School absenteeism in Karonga district, northern Malawi: Trends, influences and the impact of cleaner burning biomass-fuelled cookstoves

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I, Christine Anne Kelly, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Abstract

Although Malawi achieved rapid increases in primary school enrolment following the introduction of free primary education in 1994, the country has struggled to deliver access to quality education in a broader sense. In a context marked by high rates of grade repetition and dropout, and consistently poor scores on literacy and numeracy assessments, student absenteeism has been identified as a critical cause for concern both as a symptom of educational exclusion and as a precursor to other adverse educational outcomes. This thesis seeks to deepen understanding of the processes that underpin primary school absenteeism in Karonga district, northern Malawi, and the implications of missing school for students' future educational trajectories. It additionally capitalises on opportunities offered by a large cluster randomised trial of cleaner burning biomass-fuelled cookstoves to assess the extent to which cookstoves improve school attendance by decreasing exposure to harmful pollutants and reducing time and resource burdens associated with household fuel consumption.

The mixed methods analysis combines secondary quantitative data from a large longitudinal household survey spanning 2008-2016 and the cookstove trial implemented from 2014-2016, with in-depth interviews and focus group discussions conducted with 48 primary school students in 2016. Findings show that students attach value to daily school attendance, but are constrained by a complex interplay of individual-, household-, school-, and community-level factors, including ill health, domestic responsibilities, socioeconomic barriers, and exclusionary practices by teachers and peers. No evidence was found that cleaner burning cookstoves influenced overall school attendance, but qualitative data suggest that they may improve other dimensions of educational access such as timely arrival at school. By harnessing eight years of school attendance data, the thesis also shows that students who miss school in one survey round are consistently more likely to miss school again the following year, as well as to repeat their grade, highlighting the critical role school attendance monitoring can play in identifying students at risk of adverse educational trajectories.

Findings from this study have implications for policies and programmes designed to address absenteeism—and in particular the need for a holistic, multi-sectoral approach—as well as for the collection and interpretation of school attendance data.

Acknowledgements

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Acronyms and abbreviations

AOR   adjusted odds ratio

CI   confidence interval

CG   control group

CAPS   Cooking and Pneumonia Study

CREATE   Consortium for Research on Educational Access, Transitions and Equity

DALY   disability-adjusted life-year

DHS   Demographic and Health Survey

EFA   Education for All

EMIS   Education Management Information System

FGD   focus group discussion

FPE   free primary education

GACC   Global Alliance for Clean Cookstoves

HAP   household air pollution from solid fuels

HDSS   Health and Demographic Surveillance System

ICC   intra-cluster correlation

IDI   in-depth interview

IG   intervention group

ILO   International Labour Organization

ITT   intention-to-treat

KPS   Karonga Prevention Study

LSHTM   London School of Hygiene and Tropical Medicine

LSTM   Liverpool School of Tropical Medicine

MDG   Millennium Development Goal

MEIRU   Malawi Epidemiology and Intervention Research Unit

MICS   Multiple Indicator Cluster Survey

NGO   non-governmental organisation

NSO   National Statistical Office of Malawi

OECD   Organisation for Economic Co-operation and Development

OR   odds ratio

PCA   principal components analysis

PISA   Programme for International Student Assessment

PM$_{2.5}$	particulate matter with an aerodynamic diameter smaller than 2.5μm
PSLCE	Primary School Leaving Certificate of Education
RCT	randomised controlled trial
RESPIRE	Randomized Exposure Study of Pollution Indoors and Respiratory Effects
SACMEQ	Southern and Eastern African Consortium for Monitoring Educational Quality
SADC	Southern African Development Community
SCT	Social Cash Transfer
SD	standard deviation
SES	socioeconomic status
SGD	Sustainable Development Goal
SMS	short message service
SOFIE	Strengthening Open and Flexible learning for Increased Education access
UIS	UNESCO Institute for Statistics
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VIF	variance inflation factor
WASH	water, sanitation and hygiene
WHO	World Health Organization

Chapter 1: Introduction

It's hard when you have missed school for a long time because you can't know what your classmates learnt (Mabvuto[1], age 13)

Despite vast improvements in global school enrolment over recent decades, many children attend only sporadically. This thesis seeks to deepen understanding of the processes that underpin primary school absenteeism in Karonga district, northern Malawi, and the implications of absenteeism for students' future educational trajectories. Combining quantitative and qualitative approaches, the study contributes both empirical insights about absenteeism trends and determinants, as well as methodological reflections about the collection of school attendance data. It also assesses the extent to which cleaner burning biomass-fuelled cookstoves, which have the potential to reduce absenteeism by improving household health and lowering time spent on cooking-related activities, succeed in increasing school attendance.

1.1 Conceptualising educational access

Since the 1990 Jomtien conference on Education for All (EFA) heralded an era of international commitment to addressing educational quality and equity, global attention and resources have been devoted to expanding educational access. For the purpose of measuring progress towards EFA—and particularly the goal to achieve universal primary education, which was also enshrined as Millennium Development Goal 2—access was primarily conceived in terms of school enrolment: according to the first EFA Global Monitoring Report, 'Enrolment rates are key indicators of the extent to which the education system manages to serve all children' (UNESCO 2002, p. 44). Although efforts to expand enrolment fell short of achieving universal primary education by the target date of 2015, reductions in the number of out-of-school children and adolescents by almost half in the period since 2000 led the final EFA Global Monitoring Report to conclude: 'Improvements in access to education are one of the leading successes of the EFA movement' (UNESCO 2015, p. 76).

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[1] All participant names are pseudonyms.

While increases in global school enrolment are both critical and laudable, equating educational access with enrolment ignores other forms of marginalisation that students experience even once in school (Jere 2012; Unterhalter 2014). In particular, this narrow framing of access neglects the group identified by the Consortium for Research on Educational Access, Transitions and Equity (CREATE) as 'silently excluded' from education, including those students who are successfully enrolled but attend only intermittently (Lewin 2009). Humphreys and colleagues (2015, p. 135) similarly emphasise the importance of regular school attendance to ensure 'sustained access' to education.

The present study follows in this vein by conceiving of school attendance—as distinct from enrolment—as an important and under-researched dimension of educational access. Situated primarily within a rights-based framework, this thesis regards education as a fundamental human right predicated on the availability of safe and well-equipped schools, consistent and continuous attendance, equitable and inclusive participation, and achievement of relevant and meaningful learning (Humphreys et al. 2015; Lewin 2009; UNICEF and UNESCO 2007). Of particular concern for this thesis are those children and young people who are enrolled in school but who attend irregularly, and as such are denied sustained access to education.

1.2 Educational access in Malawi

Efforts to measure the prevalence of school absenteeism, as well as to understand the processes behind it, are particularly vital in Malawi. The country became an early adopter of the EFA goal of free primary education (FPE) when, as part of the transition to multi-party democracy, the newly-elected government eliminated primary school fees in 1994. Enrolment increased from 1.8 million to nearly three million children at the opening of the 1994/5 school year (Castro-Leal 1996) and primary school entry has been maintained at nearly universal levels in the period since the introduction of FPE: according to 2014 estimates, 93.6% of children of official primary school age were attending school (National Statistical Office 2015). Indeed, very few young people have never attended school at all— just 2.6% and 1.3% of 15-19 year-old girls and boys, respectively, according to the 2015-16 Malawi Demographic and Health Survey (DHS), compared with 30.3% and 19.5% in 1992 (National Statistical Office and ICF 2017; National Statistical Office and Macro International Inc. 1994). However, despite vast improvements in primary school enrolment, Malawi has struggled to deliver access to quality education in the broader sense (Jere 2012).

In particular, post-FPE education in Malawi has been marked by high rates of absenteeism, grade repetition and dropout, as well as students' consistently poor scores on literacy and numeracy assessments such as those conducted by the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) (Grant et al. 2013; Mulera et al. 2017; Ravishankar et al. 2016; Sunny et al. 2017; World Bank 2010). Numerous commentators have traced contemporary failings in educational delivery to the rapid implementation of FPE and the lack of appropriate supply-side investments in personnel and infrastructure to accompany the enrolment explosion (Castro-Leal 1996; Chimombo 2009; Clemens 2007). Kendall (2007) and Kendall and Silver (2014) have further highlighted the insufficiently transformative nature of the FPE reforms in terms of administrative structures and educational practices, as well as the disconnect between the social and economic benefits promised of FPE and the limited opportunities it ultimately provided.

Importantly, too, although introducing FPE eliminated an important financial barrier to school attendance, it did not make education 'free' (Kendall and Silver 2014). Household expenditure on such items as pens, notebooks, and clothes were shown in the aftermath of FPE to exceed the amount previously required for school fees (Kadzamira and Rose 2003), while schools continue to solicit community contributions of money or labour to undertake school infrastructure projects (Barnett 2013; Rose 2003). Reforms that accompanied FPE, including removing the requirement to wear a school uniform and outlawing corporal punishment, were also enforced inconsistently at school level, representing additional sources of exclusion (Pridmore and Jere 2011).

In this context, absenteeism has been identified as a critical cause for concern, both as a symptom of educational exclusion in and of itself, and as a contributing factor to adverse educational pathways involving poor academic performance, grade repetition and dropout. A Malawian government report entitled *The Main Education Challenges Facing Malawi,* cited in Nankhuni and Findeis (2004, p. 124, emphasis added), indicated that:

> [T]here is much to be done on the part of the Government and the community themselves to enhance the perception of the benefits of education, and to overcome the ***very real barriers to uninterrupted attendance*** that pupils in the most deprived circumstances face.

Despite acknowledgement of the challenges students encounter to attend school every day, understanding of the circumstances surrounding absenteeism remains somewhat limited. The need to 'identify and profile those children who fail to access school regularly' was recognised as an urgent priority by researchers affiliated with the SOFIE (Strengthening Open and Flexible learning for Increased Education access) project in Malawi, which sought to address barriers to access and achievement among vulnerable children in HIV-affected settings (Streuli and Moleni 2008, p. 32). The present study builds on a nascent literature in Malawi (Grant et al. 2013; Moleni 2008; Pridmore and Jere 2011; Psaki et al. 2017) to shed light on the processes underpinning absenteeism, and the implications of missing school on future educational outcomes.

1.3 The absence of absence data

Efforts to monitor and address school absenteeism in Malawi, and elsewhere in the Global South, are hampered by a paucity of school attendance data. Perhaps reflecting the emphasis on enrolment as an indicator of educational access in international frameworks, attendance data are missing from many high-profile education monitoring tools. National Education Management Information Systems (EMIS) typically do not include indicators for absenteeism, while cross-national survey programmes such as the DHS do not collect school attendance data beyond binary measures of any attendance over the course of the school year (UNICEF and UIS 2016). A comparison of 30 other large-scale household survey series from Africa and Asia, including the Integrated Household Survey (three countries), the Living Standard Survey (four countries), and Core Welfare Indicators Questionnaire (five countries), found that only three of the 30 surveys included questions on students' attendance frequency (Education Policy and Data Center 2009). By not accounting for regularity of attendance, these instruments not only risk overestimating the number of young people currently in school, but they also render absent students 'invisible' in research and policy dialogues (Creative Associates International 2015).

Absence of national-level data is compounded in many countries by inaccurate or incomplete recording of student attendance at the school. In Malawi, a case study of four primary schools associated with the SOFIE project observed that registers were 'poorly kept', including by some teachers who 'had not filled in information for the entire term' (Moleni 2008, p. 78). Routine data solicited from schools for scrutiny by Malawian district

education authorities also do not include measures of absenteeism (Kimura 2005), precluding analysis of attendance patterns at administrative level.

This thesis aims to increase the visibility of school absenteeism in northern Malawi by harnessing a rich combination of datasets collected under the auspices of the Malawi Epidemiology and Intervention Research Unit (MEIRU, formerly known as the Karonga Prevention Study [KPS]) (Crampin et al. 2012). I complement quantitative analysis of the factors associated with missing school with insights from in-depth interviews and focus group discussions among primary school students that shed light on the processes underlying the statistical patterns observed. This design specifically addresses two additional priorities identified by SOFIE project researchers to enhance understanding of barriers to sustained access (Streuli and Moleni 2008). Firstly, by incorporating a nested qualitative study, I look to '"unpack" the interplay between the "push" and "pull" factors that influence access to learning' and 'map the processes leading to interrupted schooling' (Streuli and Moleni 2008, pp. 31-32). Secondly, by exploiting eight years of school attendance data collected in annual household surveys, I conduct a longitudinal analysis of absenteeism patterns over the primary school cycle, and examine the implications of missing school for future educational outcomes.

1.4 Cleaner burning cookstoves: a recipe for improved school attendance?

In addition to exploring absenteeism trends and influences, this thesis also assesses the evidence for one proposed solution to irregular school attendance. Among policies and interventions designed to mitigate the barriers to educational access, particularly for girls, one that has gained recent traction is the distribution of cleaner burning cookstoves. Approximately three billion people, predominantly in Africa and South Asia, rely on solid fuels such as wood, charcoal or agricultural residues for cooking (Bonjour et al. 2013), pollution from which is responsible for nearly three million premature deaths per year (GBD 2015 Risk Factors Collaborators 2016). The process of fuel collection also poses a considerable time burden, typically borne by women and school-age children (Wodon and Beegle 2006). Cleaner burning cookstoves, which aim to reduce pollution and fuel consumption by improving ventilation or combustion efficiency relative to traditional open fire methods, have been widely championed as a policy solution to the hazards of cooking with solid fuels (Ruiz-Mercado et al. 2011). The Government of Malawi launched an

initiative in 2013 to introduce two million cleaner burning cookstoves into Malawian households by 2020 (Jagger and Perez-Heydrich 2016).

In addition to the anticipated health, economic and environmental benefits that frequently motivate cookstove distribution programmes (Ruiz-Mercado et al. 2011), cookstoves also have the potential to yield important educational payoffs, particularly for girls. The following excerpt from the Global Alliance for Clean Cookstoves Gender Fact Sheet makes this case:

> Clean cooking solutions significantly benefit girls and women. For instance, reducing the amount of time required to collect fuel with more efficient cookstoves allows girls and women to engage in other activities such as income-generating opportunities, education, or rest (Global Alliance for Clean Cookstoves n.d.).

However, while cleaner burning cookstoves have been shown to generate time and fuelwood savings in a variety of settings (Bensch and Peters 2015; Beyene et al. 2015; Cundale et al. 2017; García-Frapolli et al. 2010), their relationship with educational outcomes has not been formally assessed in sub-Saharan Africa. This thesis capitalises on unique opportunities afforded by the Cooking and Pneumonia Study (CAPS), a large cluster randomised trial of cleaner burning biomass-fuelled cookstoves conducted in Karonga district (Mortimer et al. 2016), to examine the impact of cookstove distribution on primary school attendance in northern Malawi. The analysis combines a quantitative comparison of absenteeism patterns across trial groups with insights from in-depth interviews and focus group discussions exploring the pathways through which cookstoves influenced (or did not influence) school attendance.

1.5 Research objectives

Against this backdrop, this thesis seeks to address the following primary and secondary research objectives:

1. Identify the proximal and distal determinants of primary school absenteeism in Karonga district, northern Malawi
   a. Investigate gendered patterns of absenteeism levels and determinants
   b. Unpack the relationship between household socioeconomic status and school absenteeism

2. Assess the impact of cleaner burning biomass-fuelled cookstoves on primary school attendance in the catchment area of the Cooking and Pneumonia Study

    a. Assess whether cookstoves lead to greater reductions in absenteeism for girls relative to boys

    b. Assess whether cookstoves lead to greater reductions in absenteeism as children's age increases

    c. Assess whether cookstoves lead to greater reductions in absenteeism during the rainy season

3. Determine the association between absenteeism and subsequent adverse educational pathways

    a. Assess whether the same students are absent repeatedly across school years

    b. Assess the relationship between absenteeism in one school year and grade repetition in the next

    c. Assess the relationship between cumulative absenteeism and grade attainment

    d. Establish whether the association between absenteeism and future educational outcomes is modified by students' background characteristics

4. Explore students' perceptions of the barriers to school attendance

    a. Investigate the extent to which students attach value to maintaining daily school attendance

    b. Examine if or how evaluative judgements about absenteeism influence reporting of missing school

    c. Examine whether reasons reported for missing school reflect proximal and distal determinants of absenteeism.

1.6 Thesis outline

In pursuit of these objectives, the thesis proceeds as follows:

Chapter 2: Literature review

Chapter 2 presents a narrative literature review of the individual-, household-, school-, and community-level determinants of absenteeism previously identified in sub-Saharan Africa. It also explores in more detail the mechanisms through which cleaner burning cookstoves would be expected to influence school attendance. The review informs development of the analytic framework that guides the remainder of the thesis.

Chapter 3: Research setting and methods

Chapter 3 provides a historical overview of the research context, including the unique features of educational and economic development in northern Malawi. It also establishes the study's theoretical underpinning and situates the research within the current international education agenda. It finally outlines the overarching research methodology by describing the three data sources that form the basis of the analysis, and how these data were integrated in a mixed methods design.

Chapters 4-7 are presented as standalone research papers, each containing its own literature review and conceptual underpinning as appropriate, as well as relevant conclusions and recommendations. Each paper is framed to address one of the four research objectives listed above, but is not interpreted in isolation. Rather, successive papers aim to construct a coherent narrative about school absenteeism in Karonga district, including by reinforcing, explaining or challenging findings across chapters.

Chapter 4: Determinants of absenteeism

Research Paper 1, 'Re-examining the link between socioeconomic status and school absenteeism: Evidence from primary school students in northern Malawi', uses household survey data to identify the individual- and household-level correlates of school absenteeism, with particular focus on the association between five indicators of socioeconomic status (SES) and missing school. By examining different dimensions of SES, it seeks to explore the interplay between monetary and opportunity costs of school attendance, which emerge from Chapter 2 as prominent influences of absenteeism.

Chapter 5: Cookstoves and absenteeism

Having established in Chapter 4 that both ill health and domestic labour appear to play an important role in inhibiting students' school attendance, Research Paper 2, 'From kitchen to classroom: Assessing the impact of cleaner burning biomass-fuelled cookstoves on primary school attendance in Karonga district, northern Malawi', investigates whether cleaner burning biomass-fuelled cookstoves reduced absenteeism by conferring health and time and resource benefits on recipient households.

Chapter 6: Absenteeism and future educational trajectories

Research Paper 3, 'Primary school absenteeism and future educational trajectories in

Karonga district, northern Malawi: A longitudinal analysis', harnesses eight years of longitudinal data to examine the relationship between school absenteeism in one survey round and subsequent absenteeism, grade repetition and attainment, to establish the extent to which absenteeism serves as a precursor to future adverse educational outcomes over the course of the primary cycle.

Chapter 7: Students' experiences of absenteeism

Research Paper 4, '"It is important that children should be going to school every day because in future, they can have everything they want": Exploring students' perceptions and experiences of school absenteeism in northern Malawi and the implications for absenteeism reporting in household surveys', approaches questions regarding the meaning and impact of absenteeism from the perspective of students themselves, drawing on data from in-depth interviews and focus group discussions to explore the value students place on daily school attendance and the barriers they consider to be most problematic for maintaining regular attendance. By shedding light on evaluative judgements that students attach to absenteeism, it also critically reflects on the validity of school attendance data collected in quantitative surveys, and in doing so, helps explain an apparent paradox in absenteeism reporting observed in Research Paper 1.

Chapter 8: Discussion

Chapter 8 synthesises the key empirical and methodological contributions of the thesis, reflects on its limitations, and identifies areas of future research. Findings have implications both for understanding the processes underpinning primary school absenteeism in Karonga district, as well as for the collection of school attendance data.

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Chapter 2: Literature review

This chapter begins with a narrative review of the individual-, household-, school-, and community-level factors that have been shown to be associated with school absenteeism in sub-Saharan Africa. This is followed by a specific examination of the pathways linking cooking practices with school attendance, to explore the mechanisms through which cleaner burning cookstoves would be expected to influence absenteeism. The review is used to develop an analytic model, presented in section 2.4, which guides the remainder of the thesis.

Papers for the narrative review were identified via literature searches of MEDLINE, Web of Science and Google Scholar databases, backward and forward citation tracking, and targeted searching of institutional repositories and online journals. As the exercise was designed to be exploratory rather than systematic, it cannot claim to be exhaustive, but it helps to shed light on the diverse range of factors that influence school attendance in sub-Saharan Africa. I am cognisant that the factors identified may operate across multiple levels, nor necessarily stand in isolation from each other, but for the purpose of the synthesis, available evidence was mapped onto a model of individual-, household-, school-, and community-level influences. The review combines findings from qualitative, qualitative, and mixed methods studies.

I note at the outset that the measures of absenteeism used across studies differed widely. Among quantitative studies, some analyses measured weekly school attendance in terms of hours spent in school (Adhvaryu and Nyshadham 2012; Ainsworth et al. 2005; Burke and Beegle 2004; Dillon 2013), while others measured attendance on the most recent school day (Grant et al. 2013; Psaki et al. 2017), over the past week (Orkin et al. 2014; Psaki et al. 2017), two weeks (Dreibelbis et al. 2013; Grant et al. 2013), 20 days (Pufall et al. 2014a; Pufall et al. 2014b), 30 days (Dunne et al. 2013; Siziya et al. 2007), three months (De Smedt et al. 2012; Gray et al. 2006), school semester (Belachew et al. 2011; Guarcello et al. 2005), or academic year (Ezenwosu et al. 2013; Ibekwe et al. 2007; Mustapha et al. 2013; Ogunfowora et al. 2005; Orkin 2011; Psaki et al. 2017; Thuillez et al. 2010; Wolka et al. 2013). Most conceived of absenteeism as any episode of missing school, while a minority—primarily those reporting findings from the World Health Organization's Global School-

based Student Health Survey (Dunne et al. 2013; Siziya et al. 2007)—included only unauthorised absences, or 'truancy'. Qualitative studies explored students' experiences of missing school, often as part of broader narratives about vulnerability and exclusion, without fixing temporal or definitional boundaries (Jewitt and Ryley 2014; Mason et al. 2013; McMahon et al. 2011; Mushi et al. 2012; Porter et al. 2012; Pridmore and Jere 2011; Sommer 2009).

The sources from which absenteeism data were drawn also varied across studies. Data collection methods included use of attendance registers or teacher reports (Chippaux and Larsson 1991; de Clerq et al. 1998; Ezenwosu et al. 2013; McCoy et al. 2014; Ogunfowora et al. 2005; Thuillez et al. 2010; Wolka et al. 2013), household-level surveys or interviews with parents or caregivers (Adhvaryu and Nyshadham 2012; Ainsworth et al. 2005; Amendah et al. 2014; Burke and Beegle 2004; Dreibelbis et al. 2013; Gray et al. 2006; Mushi et al. 2012; Orkin 2011), or surveys, interviews, or other participatory activities with students themselves (Belachew et al. 2011; De Smedt et al. 2012; Dillon 2013; Dunne et al. 2013; Grant et al. 2013; Grant and Hallman 2008; Guarcello et al. 2005; Jewitt and Ryley 2014; Mason et al. 2013; McMahon et al. 2011; Mushi et al. 2012; Mustapha et al. 2013; Orkin et al. 2014; Porter et al. 2012; Pridmore and Jere 2011; Psaki et al. 2017; Sommer 2009). A few studies generated their own school attendance data by performing sporadic attendance spot checks (Evans and Miguel 2007) or conducting active surveillance (Trape et al. 1993), or were not explicit about their data source (Ibekwe et al. 2007).

Differences in the scope of absenteeism, in how data were collected, and in analytical approaches mean that results across studies are not easily generalisable. Both the effect size and statistical significance of associations between risk factors and absenteeism may depend on the specific measures used (as shown in, e.g., Psaki et al. 2017), while the mode of data collection (Baird and Özler 2012) or length of recall period (Das et al. 2012; Kjellsson et al. 2014) have been shown to influence data quality in previous research. I am also mindful that the specific institutional, socio-cultural, and economic contexts in which studies were conducted limit the utility of comparison across countries (Pritchett and Sandefur 2013). The purpose of this review, however, is not to draw definitive conclusions about the relative importance of absenteeism influences, but rather to survey the research landscape in order to inform subsequent analysis.

2.1 Determinants of absenteeism

2.1.1 Individual factors

I start by examining the range of student-level characteristics that have been linked with school absenteeism. Perhaps surprisingly, given persistent gender inequality with respect to educational enrolment and experience in sub-Saharan Africa (UNESCO 2016), many studies that compared absenteeism prevalence between boys and girls did not observe significant differences, including Grant et al. (2013) in Malawi, Ainsworth et al. (2005) in Tanzania, Mensch and Lloyd (1998) in Kenya, Ezenwosu et al. (2013) in Nigeria, and Orkin et al. (2014) in South Africa. Exceptions include Dreibelbis et al. (2013) who found in western Kenya that the probability of absence for girls was slightly higher than for boys, and Siziya et al. (2007) who observed a markedly higher prevalence of truancy among boys in Swaziland. However, although overall levels of absenteeism were broadly similar between boys and girls in most studies, gendered patterns of absenteeism determinants were observed. These are noted where relevant below.

Trends by age were also evident in several studies. In their multilevel analysis of the determinants of school attendance in Tanzania, Burke and Beegle (2004) showed that weekly hours spent in school increased, plateaued, and then declined with age among 10-15 year-olds. As their measure of weekly school attendance was not conditional on current attendance status, however, their analysis may combine absenteeism and permanent school leaving. A Kenyan study observed a similar pattern for girls (but not for boys), using absence rather than attendance rates: among girls, the probability of absence declined from ages 5 to 11, before increasing sharply thereafter (Dreibelbis et al. 2013). Among boys, by contrast, the probability of absence declined steadily with age. The authors speculated that increasing absenteeism at older ages, particularly for girls, may reflect growing domestic responsibilities – I explore the contribution of household work to absenteeism in section 2.1.2.

Global estimates indicate that students in low-income countries lose the equivalent of between 200 million and 500 million school days due to ill health each year (Bundy 2011). Epidemiological research provides evidence that a wide range of health conditions are

associated with school absenteeism in African settings.[2] These include malaria (Thuillez et al. 2010; Trape et al. 1993), headache (Ofovwe and Ofili 2010), respiratory illness (Mustapha et al. 2013), epilepsy (Ibekwe et al. 2007; Mushi et al. 2012), schistosomiasis (de Clerq et al. 1998), iodine-deficiency disorders (Wolka et al. 2013), sickle cell anaemia (Ezenwosu et al. 2013; Ogunfowora et al. 2005), vernal keratoconjunctivitis (De Smedt et al. 2012), and guinea worm disease[3] (Chippaux et al. 1992; Chippaux and Larsson 1991; Ilegbodu et al. 1986). Although the prevalence of disease, magnitude of effect on absenteeism, and researchers' methodological rigour varied across condition and context (see Table A.1 in the Appendix for a summary of study features), the preponderance of evidence linking illness with school absenteeism highlights important connections between student health and educational access.

A growing literature has also explored the impact of menstruation on girls' education. Several qualitative studies have described episodes of school absence attributable to lack of sanitary towels, pain associated with menstrual cramps, expulsion from class after arriving late from washing, and difficulties associated with undertaking long journeys to school during menses (Jewitt and Ryley 2014; Mason et al. 2013; McMahon et al. 2011; Sommer 2009). However, quantitative evidence that menstruation exerts a disproportionate toll on girls' school attendance is limited, although it may affect other aspects of girls' well-being in important ways. In Malawi, Grant and colleagues (2013) found that one-third of female students aged 14-16 reported missing at least one day of school during their last period, but this represented only a small proportion of total absences. Additionally, as we saw above, they did not observe a gender difference in overall levels of absenteeism, suggesting that menstruation did not unduly disadvantage girls with respect to school attendance. Earlier research from Kenya showed similar findings (Mensch and Lloyd 1998). A mixed methods study from Ethiopia measured high levels of menstruation-related absenteeism, with more than half of 595 girls aged 10-19 missing school during their last period, but the study did not explore the extent to which girls also missed school for other reasons, nor compare with boys' attendance patterns (Tegegne and Sisay 2014).

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[2] The same factors that contribute to ill health, such as poverty, food insecurity and lack of sanitation facilities, may also influence school attendance directly (Burke and Beegle 2004) – see section 2.1.2. However, for the purpose of this review I discuss illness separately from these underlying determinants.

[3] Guinea worm disease has been the subject of a global eradication campaign since 1980, such that just 25 cases were observed in 2016 (Carter Center 2017). Evidence linking guinea worm disease comes from the period when annual incidence approached 3.5 million cases (1986 estimate).

Few studies have examined the relationship between HIV status and school attendance, as distinct from other educational outcomes, but research from Zimbabwe showed that HIV-positive children were no less likely to attend school regularly (defined as more than 80% of the last 20 days) than were HIV-negative children (Pufall et al. 2014b). The authors speculated this result could stem from the small number of HIV-positive children of school-going age in their sample (n=94), or from slower disease progression among children who had survived to primary school age.

Regardless of a student's own status, however, children in countries with advanced HIV epidemics may experience other forms of disadvantage that affect their school attendance. Increasing attention has been paid to the potential impact of orphanhood on schooling. A descriptive study using survey data from Malawi, Uganda and Botswana found that absenteeism was not consistently more common among orphans than non-orphans and, in Malawi and Uganda, that levels of absenteeism were very high among the entire primary school population (Bennell 2005). In Tanzania, Ainsworth et al. (2005) drew more nuanced conclusions by showing that weekly school attendance of students aged 7-14 was sensitive to the timing of adult death. They found that attendance substantially declined for both sexes 3-6 months *prior* to an adult death, presumably as children served as caregivers, but ultimately recovered in the aftermath of parental death. In a five-year panel study of more than 20,000 Kenyan children, Evans and Miguel (2007) observed a marked decline in school attendance following parental death, particularly for younger girls, and a smaller drop in attendance prior to the death. Proposed mechanisms through which orphanhood affects school attendance include adverse economic shocks and household caregiving responsibilities—which I will explore further in section 2.1.2—as well as intra-household discrimination and students' grief and distress that compromise schooling (Moleni 2008; Pridmore and Jere 2011).

Underlying students' decisions to attend school, particularly in the face of obstacles that may otherwise constrain school participation, are factors including cognitive ability and educational aspirations, which are likely to influence the desire to attend school regularly. Innate endowments are inherently difficult to measure, but indicators of educational motivation, attainment and achievement have been shown to be strongly associated with school attendance. One study from Malawi showed that, among girls (but not boys), late entry to primary school and previous grade repetition were significantly associated with

absenteeism in the current school year (Psaki et al. 2017), while another showed that girls who studied at home were less likely to miss school in the previous two weeks (Grant et al. 2013). Research from Ethiopia found that the highest school grade aspired to be completed by adolescents aged 13-17 was negatively associated with absenteeism during the previous semester, adjusting for other factors (Belachew et al. 2011). Additionally, in their study of Kenyan orphans described above, Evans and Miguel (2007, p. 52) showed that the impact of parental death on school attendance was significantly larger for children with poor baseline academic test scores, 'suggesting that households decide to focus their increasingly scarce resources after a parent death on more promising students'.

This passage from Evans and Miguel (2007) highlights the contribution of household investment in education as a facilitating factor for school attendance. The next section reviews household factors associated with creating an enabling or inhibiting environment for sustained educational access.

2.1.2 Household factors

Just as students' demographic characteristics were shown to influence attendance patterns in some studies, so, too, have characteristics of other household members exhibited significant relationships with children's absenteeism, although not always consistently. In Kenya, for instance, students living in female-headed households demonstrated an increased probability of missing school (Dreibelbis et al. 2013), while the sex of household head had no effect on children's attendance in Tanzania (Burke and Beegle 2004). Burke and Beegle (2004) also found that girls' weekly attendance increased with the age of the household head, perhaps reflecting the result from Grant et al. (2013) that girls in Malawi who lived with their grandmothers had lower odds of absence during their last period than those who did not.

Both quantitative and qualitative evidence from a variety of settings has highlighted the pivotal role played by household socioeconomic factors in determining attendance patterns, by affecting students' ability to meet both the direct costs of schooling as well as the opportunity costs. In Tanzania, the total value of household assets was associated with increased hours of schooling for both girls and boys, suggesting that monetary poverty constrained school attendance (Burke and Beegle 2004). Dreibelbis et al. (2013) observed a similar wealth gradient with respect to school attendance in Kenya, but it was significant

only for girls in their multilevel model. Data showed that girls from the poorest wealth group demonstrated a 71% increase in the probability of missing school compared to boys in the richest wealth group and 30% compared to boys in the poorest group.

Belachew et al. (2011) investigated the relationship between severe household food insecurity and school absenteeism in Ethiopia, and found it to be significantly associated with missing school among students aged 13-17. Although the authors speculated that food insecurity influenced school attendance through its effect on students' nutrition and cognitive development, the analysis did not adjust for measures of household wealth or income and as such may also capture the exclusionary impact of wider socioeconomic disadvantage. Examining the effect of agricultural production shocks on hours of schooling in northern Mali, Dillon (2013) showed that large crop loss increased the probability of a child aged 10-17 being withdrawn from school by 11%, but had no significant effect on hours spent in school among those who did attend.

Other studies have emphasised the underlying role of socioeconomic factors in explaining absenteeism associated with other forms of vulnerability. Psaki et al. (2017), for instance, investigated the relationship between experiences of violence and educational outcomes including absenteeism in southern Malawi. They found that boys, but not girls, who had ever experienced domestic violence were consistently more likely to miss school than those who had not, a result that remained robust to four different measures of school absenteeism.[4] Given that higher household wealth was consistently associated with lower absenteeism, and employment in the past 12 months with higher absenteeism, the authors speculated that the observed relationship with violence stemmed from underlying socioeconomic conditions:

> Boys who are at highest risk of absenteeism may be those who come from households experiencing poverty, where violence may be chronic, and where boys may be expected to contribute to financially supporting the family, in addition to— or perhaps instead of—attending school (Psaki et al. 2017, p. 376).

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[4] The four measures used were: any absence during the past school year, absence on the past school day, number of days missed during past school week, and whether the student considered he/she attended school regularly.

Elsewhere in Malawi, Pridmore and Jere (2011) drew on interview data from 14-17 year-old students and out-of-school counterparts to show that inability to afford school uniforms or soap for clothes washing contributed to absenteeism, and also led to participation in *ganyu*—short-term paid informal labour—to help meet these expenses. Other studies have highlighted aspects of students' engagement in agricultural or market work that conflict with school attendance. Anecdotal evidence provided in Awedoba et al. (2003) regarding household demand for schooling in Ghana suggested that households removed children from school during peak harvest time to provide extra labour or to look after younger siblings while their parents work. Humphreys et al. (2015) observed a similar pattern in Nigeria, where boys and girls missed school to help their families with planting and harvesting crops, or boys sought paid employment associated with harvest time. Qualitative data from Ethiopia showed that students regularly participated in both household and paid agricultural labour, but found household work to be more compatible with school attendance because jobs could be broken down into smaller pieces to fit around the school day (Orkin 2012). On the other hand, a review of survey data from the Understanding Children's Work collaboration found in Kenya that neither the type nor intensity of work carried out by school-age children influenced absenteeism, which was uniformly low, but increased engagement in non-market activities did raise the probability of late arrival to school (Guarcello et al. 2005).

Several studies have focused specifically on children's environmental resource collection work—water, firewood, and agricultural fodder—and school attendance. A descriptive study of 157 Tanzanian children found mixed evidence of a relationship between resource collection and children's schooling success: while there was some suggestion that children who collected firewood were more likely to miss school in the past week, these children also spent the most time doing homework (Levison et al. 2017). Focus group data indicated that fatigue from domestic chores—although not necessarily resource collection specifically—interfered with school performance, but that some students valued their participation in resource collection as a means of contributing to their households (Levison et al. 2017). A mixed methods study across 24 sites in Ghana, Malawi and South Africa suggested that the time and exertion associated with child porterage—carrying water, firewood, and agricultural produce—as well as the prospect of earning extra money from commercial load carrying, contributed to tardiness and absenteeism (Porter et al. 2012).

Dreibelbis and colleagues (2013) investigated the impact of household water, sanitation and hygiene (WASH) conditions on recent school absence among nearly 8000 children in Kenya. Increased probability of recent absence was observed among boys and girls living in households with a distant water source and among girls in households in which children were reported to contribute to household water collection. These results suggest a conflict between water collection and school attendance, particularly among girls, that echo findings from Levison et al. (2017) and Porter et al. (2012). The Kenyan study also found that presence of a household latrine was associated with better school attendance, although statistically significant only for boys, which may reflect either a positive wealth effect, or improved household health via reduced diarrhoea incidence from poor sanitation (Dreibelbis et al. 2013).

Other sources of household ill health have also been shown to affect students' school attendance through increased caregiving responsibilities. In open-ended interviews from a mixed methods study of educational shortfalls of young carers in South Africa, adolescents aged 10-20 described missing school to accompany ill relatives to health facilities, to provide home-based care, or due to inability to focus in lessons (Cluver et al. 2012). An earlier South African study found that children under 16 years old from households in which one or more resident adults experienced a recent illness missed significantly more school days in the past three months than did children from healthy households, although absenteeism was generally low and the analysis did not adjust for potential confounders (Gray et al. 2006). Another South African study used path analysis to assess the link between HIV/AIDS caregiving and school attendance and found no significant direct association between caregiving duties and absenteeism, but did observe an indirect relationship through poverty and internalising problems such as anxiety, depression, and post-traumatic stress disorder (Orkin et al. 2014). Robson and colleagues (2006) also highlighted the heavy emotional burden shouldered by young carers, as revealed through in-depth interviews with young people in Zimbabwe.

In a setting comparatively less affected by HIV/AIDS, a mixed methods study from Ethiopia also found a significant relationship between household illness and school attendance (Orkin 2011). Controlling for sociodemographic characteristics, high levels of absenteeism were associated with an increasing percentage of household members who were sick for more than 30 days in the previous year. A greater proportion of sick household

members also increased the probability of children's involvement in paid work, potentially to substitute for ill household members or to cover the costs of health care. Although the precise mechanism was not apparent from their analysis, results from Grant et al. (2013), which showed a significant positive relationship between girls' number of siblings and likelihood of recent absence, suggest that students may be responsible for providing care for younger siblings, regardless of health status.

Investigating other household-level determinants of absenteeism, Dreibelbis et al. (2013) observed a significant relationship between distance to school and recent school attendance in Kenya. Specifically, they found that girls, but not boys, who lived more than 20 minutes away from the nearest primary school demonstrated an increased average probability of absence relative to students who lived closer. Porter and colleagues (2011) also concluded from qualitative data in Ghana that long journeys to school, combined with heavy domestic workloads, were detrimental to daily school attendance, particularly for girls. In their multivariable model of absenteeism determinants in Malawi, Grant et al. (2013) found that girls who lived more than 30 minutes from school were significantly more likely to be absent in the past two weeks than girls who lived closer. By contrast, Burke and Beegle (2004) did not observe a significant relationship between the number of primary schools in a community—on which distance to school would at least partly be contingent—and weekly hours of school attendance in Tanzania.

Finally, just as students' own abilities and aspirations influence their desire to maintain regular attendance, so, too, does parental support for education factor in school attendance decisions. In their qualitative study from Malawi, Pridmore and Jere (2011) suggested that household encouragement for schooling—or lack thereof—exerted a strong influence on attendance and attainment. According to one student from an earlier case study in Malawi: '[Our mother] gives us advice and also encourages us, by not allowing us to be absent anyhow' (Moleni 2008, p. 53). These observations echo a statistical analysis from Swaziland, which showed, respectively, that students whose parents rarely checked homework, rarely understood their problems and worries, and rarely provided supervision were significantly more likely to report truancy in the past 30 days than were students whose parents always did so (Siziya et al. 2007). The cross-sectional nature of the analysis, however, precludes causal inference since it is also possible that parents chose not to invest time in students who skipped school regularly.

A study of 68 junior high school students in Ghana found that boys' and girls' attendance patterns were significantly associated with household gender attitudes: when students' caregivers endorsed a statement that it is better to educate boys than girls, girls' absence rates were significantly higher—and boys' significantly lower—than counterparts whose caregivers disagreed with the statement (Wolf et al. 2016). Path analysis from another Ghanaian study showed that, holding constant students' own motivation, students whose caregivers perceived that education imparted important skills were significantly more likely attend school regularly than students whose caregivers did not attach the same value to education (McCoy et al. 2014). Indeed, parents who are themselves educated may support their children's school attendance more strongly: in Burke and Beegle's (2004) multilevel analysis from Tanzania, years of maternal education was positively associated with children's weekly hours of school attendance, and more strongly so for girls than boys. Paternal education was associated with increased school attendance for boys but not for girls. On the other hand, Grant et al. (2013) did not observe a significant relationship between either maternal or paternal education and school attendance among 14-16 year-old girls in Malawi, although their binary measure of parental education (ever attended primary) may have lacked the precision necessary to capture education effects.

2.1.3 School factors

We have thus far discussed individual- and household-level factors that influence school attendance, but several studies have also explored the importance of school characteristics in shaping attendance patterns. In particular, the classroom environment—and especially the characteristics and conduct of fellow students and teachers—has been shown to be associated with absenteeism. Two multivariable analyses using data from the Global School-based Student Health Survey in Ghana and Swaziland, respectively, found that students who experienced bullying in the previous 30 days were more likely to report missing school during the same period (Dunne et al. 2013; Siziya et al. 2007), although in both cases the direction of causality is not possible to discern. With respect to teacher characteristics, an ethnographic study of junior secondary schools in Botswana and Ghana observed that student attendance and punctuality were markedly poorer in low-performing schools with lax or inconsistent management—manifested by teacher lateness or absence, failure to mark student work or erratic use of disciplinary sanctions—than in high-performing schools characterised by strong discipline (Dunne 2007). Siziya et al. (2007,

'Conclusion' para. 6) speculated in Swaziland that the increased risk of truancy observed in lower relative to upper grades possibly stemmed from 'laxity of behaviour amongst lower grades students probably as a result of lower school expectations from their teachers or themselves'.

One mechanism for instilling discipline—corporal punishment—has also received specific attention in the literature. In their study of student motivations for learning in Ghana, McCoy and colleagues (2014) showed that students who expressed a preference for extrinsic motivators (i.e. economic incentives or avoidance of punishment) attended school more often than intrinsically motivated peers, suggesting that the prospect of corporal punishment may serve as a deterrent for absenteeism. Qualitative data from elsewhere in Ghana, however, showed that students reported preferring to absent themselves from school rather than risk being subject to corporal punishment for arriving late (Porter et al. 2011). In Malawi, despite widespread experience of physical violence at school, violence was not associated with absence during the past academic year (Psaki et al. 2017).

Pridmore and Jere (2011) identified other exclusionary school policies and practices that promoted absenteeism in Malawi. They observed that some schools barred students from attending for not wearing a school uniform, despite government policies stipulating that uniforms were not required, leading to a cycle of absenteeism and potential dropout. Moreover, when students had already missed a period of school due to illness or domestic responsibilities, inflexible school policies often extended the duration of absence by preventing students' immediate return, for example by delaying readmission until the start of the next school term. Both in Malawi (Kadzamira and Rose 2003) and elsewhere (Humphreys et al. 2015; Orkin 2012), the school calendar has also been seen to exacerbate absenteeism by not accommodating seasonal demands on children's labour, or religious or cultural traditions.

Perhaps surprisingly, evidence surrounding the impact of physical infrastructure and school resources on student attendance is somewhat mixed. In Tanzania, Burke and Beegle (2004, p. 344) hypothesised that 'shortages of basic equipment such as classrooms, desks and books, not to mention other materials like charts and maps, could be a cause of poor enrolment, low attendance and under-development of cognitive skills.' However, their multilevel analysis showed that of the school-level factors included in regression models—

teachers per class, having a blackboard, students per textbook, and presence of organisations in the community providing assistance to schools—none was significantly associated with weekly hours of school attendance for girls or boys. The authors suggested that this result could stem from the overall low level of quality of schools in the study area, or from insufficient variation in the chosen indicators to detect an effect. Pufall et al. (2014a) examined the relationship between school quality and school attendance among vulnerable children in Zimbabwe, and similarly found that indices of school quality—including measures of physical infrastructure, student- teacher ratio, fee structure and support, community links, teaching methods, and extracurricular activities—were not significantly related to primary or secondary school attendance, although they were associated with other aspects of student well-being.

Focusing specifically on school WASH facilities, Dreibelbis et al. (2013) showed that sanitation quantity—that is, number of students per latrine—and having a protected water source at school were both unrelated to student absenteeism in Kenya, as were having electricity, the student-teacher ratio, and the student-classroom ratio. Although the authors speculated that limited heterogeneity of school conditions may help explain the lack of relationship observed, they noted that an indicator of latrine quality was significantly associated with increased attendance. This implies either that improved latrine cleanliness reduced transmission of diarrhoea-inducing pathogens, thus improving student health, or that students chose to absent themselves rather than use dirty latrines. With reference to menstruation-related absenteeism in Malawi, Grant et al. (2013) found no evidence for school-level variance in absence at last menses, suggesting that missing school during menstruation was not sensitive to school environment. This was consistent with the finding that school characteristics including availability and cleanliness of toilets were not significantly associated with absenteeism in their regression models, although perceived lack of privacy in school latrines was positively related with menstruation-related absenteeism.

2.1.4 Community factors

A number of community-level factors, including cultural traditions, economic relations, and infrastructural development, can also have important implications for school attendance. A qualitative investigation of how physical insecurity affected school attendance in two Nairobi slums demonstrated that perceived threats to personal safety (e.g.

dangerous routes to school) and general community insecurity (e.g. sporadic 'wars') were both responsible for absenteeism (Mudege et al. 2008). In studies from rural Ghana, Malawi and South Africa, Porter and colleagues also highlighted the contribution of treacherous walking routes to inhibiting school attendance, particularly when routes became impassable during the rainy season (Porter et al. 2011), or due to perceived risk of physical attack or rape, especially among girls travelling alone (Porter et al. 2010a; Porter et al. 2010b).

Burke and Beegle (2004) also investigated the impact of the supply of educational facilities on school attendance in their multilevel analysis of Tanzanian data. They found that although the number of primary schools in the community had no effect on hours of school attendance, presence of a secondary school within five kilometres of the community increased hours of attendance for girls. This led the authors to conclude that, given that secondary school enrolment is contingent on completion of primary school, the availability of future secondary education factored into household decisions about investment in primary, particularly for female students. They also found that the community prevalence of child farm labour was negatively associated with hours of schooling, significantly so for girls, indicating a high opportunity cost of schooling in agricultural settings.

Given the importance of ill health in inhibiting school attendance, Adhvaryu and Nyshadham (2012) investigated the effect of access to formal-sector health services on hours of school attendance among 7-19 year-old students with acute illness in Tanzania. Their analysis showed that sick children who accessed formal health care were nearly 70% more likely to attend some school in the past week and, among those who did attend, to spend roughly 3.6 more days in school than sick non-users. No significant difference was found in the number of hours per day of school attended – that is, 'speedier and more complete recovery from acute illness due to formal-sector care use induces a child to attend more days in school, but not significantly more hours in the days he attends' (Adhvaryu and Nyshadham 2012, p. 380). Importantly, this analysis used methods to control for potential self-selection into formal-sector healthcare use, for instance on the basis of disease severity, financial means, or higher preferences for health, thus demonstrating the importance of health service availability for mitigating the impact of illness on school absenteeism.

2.1.5 Summary

Drawing on research from Malawi and elsewhere in sub-Saharan Africa, this review has demonstrated that school attendance is influenced by a wide range of factors operating at the individual, household, school and community level. Although results were not always consistent across studies, which may reflect both different methodological approaches as well as different contextual features, student ill health, domestic responsibilities including work and caregiving, and socioeconomic constraints emerged as prominent barriers to attendance. Many studies found no significant differences in absence rates between girls and boys, but gendered patterns were observed with respect to absenteeism determinants, highlighting the importance of disaggregated analysis of boys' and girls' experiences.

It is against this backdrop that I now explore the mechanisms through which cooking activities would be expected to influence school attendance, and the potential for cleaner burning biomass-fuelled to address these factors. I start with an overview of the health and economic burdens of cooking with solid fuels.

2.2 Cooking with solid fuels

Approximately 2.8 billion people, or 41% (95% confidence interval [CI]: 37-44) of global households, rely on solid fuels such as wood, crop residues, dung, charcoal, and coal for cooking (Bonjour et al. 2013). Although this proportion has declined by one-third since 1980, concentrations of solid fuel use remain high in Africa and Southeast Asia. In Malawi, fully 97% (95% CI: 84-100) of households cook with solid fuels, exceeding by some margin the African regional average of 77% (95% CI: 74-81) (Bonjour et al. 2013). Persistent reliance on solid fuels to some extent reflects limited penetration of electrification, particularly in rural communities, but stems primarily from scarcity of clean and affordable alternative cooking technologies (International Energy Agency and World Bank 2017).

Burning solid fuels has well-documented environmental impacts, including deforestation, soil degradation and erosion (Foell et al. 2011), but also has important consequences for health. In particular, inefficient and incomplete combustion of solid energy sources

produces harmful pollutants including carbon monoxide as well as particulate matter[5], exposure to which yields health impacts of a magnitude between active and passive smoking (Piddock et al. 2014). Smith (2002, p. 198) summarised the processes through which households, particularly in low-income countries, are vulnerable to household air pollution from solid fuels (HAP):

- The majority of households use unprocessed solid fuels for cooking.
- Traditional cooking methods have large emission rates of a number of important health-damaging airborne pollutants.
- A large proportion of household stoves are not vented with flues or hoods to take pollutants out of the living area.
- Unprocessed fuels produce enough pollution to significantly affect 'neighbourhood' pollution levels. As cooking is done every day at times when people are present, its associated intake fraction—i.e. the percentage of emissions that reach people's breathing zones—is much higher than for outdoor pollution sources.

As a result, residents of such households, and particularly women and young children, are exposed to peak HAP levels well in excess of WHO and national air pollution guidelines (Bruce et al. 2000; Smith 2002). One study comparing rural and urban households near Blantyre, Malawi found that in 80% of households studied, particulate matter levels exceeded WHO standards by more than four times (Fullerton et al. 2009).

HAP exposure has been linked with a number of health risks, including chronic obstructive lung disease, pneumonia, ischaemic heart disease, stroke, lung cancer, and cataracts (World Health Organization 2014). According to the latest Global Burden of Disease Study, attributable deaths due to HAP[6] numbered 2.9 million (95% CI: 2.2 million-3.6 million) in 2015, while HAP accounted for 85.6 million (95% CI: 66.7 million-106.1 million) disability-adjusted life-years (DALYs) (GBD 2015 Risk Factors Collaborators 2016). Because cooking fires also contribute to outdoor, or ambient, air pollution, data from 2010 suggest that an additional 370,000 deaths and 9.9 million DALYs caused by exposure to

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[5] Inhalable particulate matter—particles less than 10 micrometres in aerodynamic diameter (PM_{10})—and especially fine particulate matter—those less than 2.5 micrometres ($PM_{2.5}$)—can penetrate deeply into the lungs and have great health-damaging potential (Bruce et al. 2000).

[6] HAP exposure was defined as annual average daily exposure to household concentrations of $PM_{2.5}$, measured in $\mu g/m^3$ from solid fuel use (GBD 2015 Risk Factors Collaborators 2016).

ambient air pollution are attributable to household cooking with solid fuels (Smith et al. 2014).

Although much of the disease burden associated with HAP falls on adult women and young children, as the groups with the highest exposure to smoke from cooking fires (Martin et al. 2013), 24-hour exposure levels can still be high among household members not directly involved in cooking (Balakrishnan et al. 2002). Among school-age populations, strong links have been drawn between use of open fire cooking and asthma prevalence in both younger (age 6-7) and older (age 13-14) school-age children in global studies (Wong et al. 2013). There is also some evidence of an association between HAP and acute respiratory infections (Gordon et al. 2014; Perez-Padilla et al. 2010).

These health impacts of HAP may have important effects on students' school attendance. Research from southern Nigeria demonstrated that 2.5% of children aged 7-14, and 5.7% in rural areas, reported missing school in the past twelve months due to symptoms of respiratory illness, although these episodes were not necessarily linked specifically to HAP exposure (Mustapha et al. 2013). Perhaps more significantly, HAP-induced morbidity of other household members may influence school attendance via increased caregiving responsibilities. Existing research has not explored the extent or distribution of household caregiving associated with HAP, but findings from previous studies of young carers in sub-Saharan Africa suggest that students frequently miss school to provide care or compensate for sick relatives by providing paid or household labour. Indeed, Orkin's findings from Ethiopia (2011), summarised in section 2.1.2, indicated that household illness increased both school absenteeism and participation in paid work.

Thus, either through direct health effects, or through increased caregiving or work responsibilities associated with illness of other household members, exposure to HAP via open fire cooking may have implications for sustained school attendance that have not been heretofore explored. Risks from open fire cooking are not, however, limited to the health impacts of HAP. Additional dangers include scalds and burns, as well as injury or violence experienced while collecting cooking fuel (Gordon et al. 2014). The process of gathering fuel, typically undertaken by women and children, also absorbs considerable time—as much as 20 hours per week in areas of diminishing environmental resources (Simon et al. 2014).

In its list of the hazards of cooking with solid fuels, the World Health Organization highlights the detrimental impact that fuel gathering exerts on children's school attendance (World Health Organization 2014). As described in section 2.1.2, some evidence exists from Porter et al. (2012) and Levison et al. (2017) that carrying firewood and agricultural produce is linked with school absenteeism, although these analyses do not explore load carrying affiliated with cooking specifically. Additional research has demonstrated apparent trade-offs between environmental resource collection and other educational outcomes. Economic studies from Malawi (Nankhuni and Findeis 2004), Kenya (Wagura Ndiritu and Nyangena 2010), and Ethiopia (Bahre and Bezu 2014) each showed that simple participation in resource collection work was compatible with current school attendance (measured as a binary outcome). However, examining the intensity of resource collection, and using statistical methods that accounted for potential endogeneity of school and work allocations, the three studies found that the number of hours spent on environmental chores was associated with a reduced likelihood of current attendance.

Nankhuni and Findeis (2004) additionally highlighted a gendered dimension: although girls were no less likely than boys to be attending school, they were more likely to be burdened with resource collection work. Similar observations were made in Kenya (Wagura Ndiritu and Nyangena 2010), while in Ethiopia, girls were more likely to engage in resource collection work but spent less time on these activities than did boys, such that the results showed no evidence of a gender difference in the impact of resource collection intensity on schooling (Bahre and Bezu 2014). Nankhuni (2004) further investigated the relationship in Malawi between time spent on resource collection work and grade attainment, as measured by attendance in senior primary school (standards 5-8). She observed that the number of hours that children spent on resource collection was associated with lower likelihood of attending senior primary school for girls but not for boys.

2.3 Cleaner burning cookstoves

Cleaner burning cookstoves have been widely championed as a solution to the health, economic, and environmental burdens associated with reliance on solid fuels, as well as a vehicle for female empowerment (Martin et al. 2013; Ruiz-Mercado et al. 2011). The Global Alliance for Clean Cookstoves (GACC), a public-private partnership hosted by the UN Foundation, was launched in 2010 'to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and

efficient household cooking solutions' (Global Alliance for Clean Cookstoves 2016). Corresponding efforts have been initiated by the government and NGO partners in Malawi to encourage cookstove development and distribution (Jagger and Perez-Heydrich 2016).

The combination of health and economic benefits from cleaner burning cookstoves has formed the basis for advocacy from the GACC and others highlighting the role clean cooking technologies can play in expanding educational access, particularly for girls (Global Alliance for Clean Cookstoves n.d.). The following sub-sections briefly review existing evidence for health and time and resource gains from cleaner burning cookstoves from randomised controlled trials (RCTs), before reflecting on potential linkages with school attendance, which have not been examined in sub-Saharan Africa.

2.3.1 Health benefits

Cleaner burning cookstoves range from rudimentary low-cost models built in situ from local materials, to state-of-the-art, mass produced, portable cookstoves that include electrically-driven fans (Wathore et al. 2017). Cookstoves aim to reduce exposure to household air pollution through one of two mechanisms: improved ventilation, typically via a built-in chimney, vent, or flue; or increased combustion efficiency. Although laboratory tests consistently show that cleaner burning cookstoves reduce HAP emissions relative to traditional cooking methods (e.g. Jetter and Kariher 2009), evidence from RCTs surrounding the effectiveness of cookstoves for mitigating the detrimental health effects of HAP is thus far limited (Thomas et al. 2015).

Before implementation of the Cooking and Pneumonia Study (CAPS), on which this thesis draws, only three RCTs—two in Latin America and one in India—had evaluated the effect of biomass smoke exposure reduction interventions on health outcomes (Jary et al. 2014). Results from a Mexican trial, which compared a locally produced wood-burning Patsari cookstove and chimney with open fire cooking, found that only half of the 338 households randomised to the intervention reported using the new stoves even some of the time (Romieu et al. 2009). However, in households that regularly used the cookstove, women's risk of cough, wheezing, eye discomfort, headache, and back pain was significantly reduced (Romieu et al. 2009), as was the duration of upper and lower respiratory infections in children under five (Schilmann et al. 2015), relative to control households.

In the Randomized Exposure Study of Pollution Indoors and Respiratory Effects (RESPIRE) trial in Guatemala, 534 households with a pregnant woman or young child were randomised to receive an improved 'plancha' woodstove with chimney or to continue as controls. Investigators observed a protective effect of the plancha on six respiratory symptoms for women, but only one result was statistically significant, and no effects on lung function were found (Smith-Sivertsen et al. 2009). In infants, the trial did not yield a significant reduction in physician-diagnosed pneumonia in intervention households, but risk of severe pneumonia declined by one-third (Smith et al. 2011).

The third RCT, conducted in eastern India, involved 2651 households across 44 villages, and showed that smoke inhalation decreased for primary cooks in the first year after receipt of a locally produced cookstove with enclosed cooking chamber and chimney, but not over a longer time horizon (Hanna et al. 2012). Unlike the Latin American trials, Hanna et al. (2012) also investigated potential health impacts of cookstove use among school-age children, but found no evidence for improvements in such outcomes as cough or fever, either in that group or in primary cooks or children under five. The authors attributed these findings to households' low valuation of the cookstoves, as reflected in their improper use, poor maintenance, and declining usage rates over the course of the four-year study.

Evidence from these trials thus paints a mixed picture of the link between cleaner burning cookstoves and improved health outcomes.[7] However, several limitations should be noted. Firstly, the absence of significant results may stem from lack of statistical power rather than absence of a true effect. The RESPIRE trial, for instance, observed a 22% reduction in pneumonia cases, but was powered to 25% (Brugha and Grigg 2014). Secondly, the cookstoves tested were designed to reduce exposure to HAP primarily through venting emissions to the outdoor environment, but cookstoves that improve combustion efficiency—such as through an in-built fan—have the potential to yield much greater reductions in HAP (Jetter and Kariher 2009). Finally, in view of substantial heterogeneity in cooking practices and preferences across regions, results from trials in Latin America and India are not necessarily transferrable to the Malawian context (Jary et al. 2014).

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[7] Preliminary findings from more recent trials, for instance in Nepal (Tielsch et al. 2016) and Rwanda (Kirby 2017), yield similarly mixed or inconclusive results.

2.3.2 Time and resource savings

A second mechanism through which cleaner burning cookstoves can improve household well-being is via time and resource savings from diminished fuelwood requirements and faster cooking times. Although neither the RESPIRE trial (Granderson et al. 2009), nor the RCT in India (Hanna et al. 2012), observed any fuel use benefits associated with the cookstove intervention, evidence from elsewhere suggests that these gains can be substantial. Evaluation of the energy performance of the Patsari stove in Mexico, for instance, showed that, even among households that continued using open fires for some tasks, average reductions of fuelwood and per capita energy consumption of 67% were observed one year after cookstove distribution (Berrueta et al. 2008), equivalent to an average saving of 840 kg of fuelwood per standard adult per year (García-Frapolli et al. 2010).

A RCT in Ethiopia comparing *injera* (flat-bread) baking cookstoves to traditional cooking methods found that average household firewood savings steadily increased over the duration of the year-long study, from an initial 5.2 kg per week to 12.4 kg per week at the endline assessment (Beyene et al. 2015). In Senegal, a RCT comparing a portable clay-metal stove with traditional cooking methods showed that, after one year of use, firewood savings in the intervention group amounted to 27 kg per week, or 30% of household consumption, when households used new and traditional cookstoves complementarily, rising to 40% if the new cookstoves were to be used exclusively (Bensch and Peters 2015). The trial also found that time spent cooking was significantly lower in the intervention group by more than 75 minutes per day (Bensch and Peters 2015).

Ultimately, time and resource savings associated with cleaner burning cookstoves are contingent on the cookstove model, the extent to which cookstoves are used exclusively or in combination with traditional methods, and the local availability of cooking fuel. Even when cookstoves do yield significant economic benefits, however, little is known about the intra-household distribution of these gains. The existence of educational payoffs of cleaner cookstoves rests on the assumption that time savings will be passed on to school-age children involved in fuel collection, but a study assessing willingness to adopt locally produced cookstoves in Malawi found that, although the time spent by the primary cook collecting firewood was an important predictor of cookstove adoption, households where people other than the cook (e.g. children) spent more time collecting fuel had *lower* odds

of choosing a cleaner burning cookstove over an in-kind payment of equivalent value (Jagger and Jumbe 2016). The authors therefore suggested that 'household decision makers prioritize the value of their time over the value of others in the household who collect fuel, including children' (Jagger and Jumbe 2016, p. 417).

2.3.3 Current research agenda

This brief review has indicated that, although some suggestive evidence of health and time and resource gains derived from cleaner burning cookstoves exists, considerable gaps remain, particularly with respect to measurement of benefits (or lack thereof) for school-age children. Indeed, only Hanna et al. (2012) included school-age children in their cookstove trial evaluation in any capacity, while evidence for changes in caregiving or fuel gathering responsibilities attributable to cookstove interventions is severely lacking in this age group. Reflecting these knowledge gaps, an international stakeholder meeting of HAP experts identified the need to '[a]ssess the potential educational and economic benefits of improved stoves or fuels that provide more free time and reduced health risks for women and girls' as an urgent research priority (Martin et al. 2013, Table 2). The present study thus contributes important evidence about the relationship between cleaner burning cookstoves and sustained educational access, by assessing the cookstoves' impact on primary school attendance in northern Malawi.

2.4 Analytic model

Figure 2.1 shows the analytic model, derived from the literature review, that guides the remainder of the thesis. By adopting an ecological approach that frames individual-, household-, school-, and community-level factors associated with school attendance as a 'nested arrangement of structures, each contained within the next' (Bronfenbrenner 1976, p. 5), I aim to portray absenteeism as the outcome of multiple influences operating both within and across levels. The model is sufficiently comprehensive to account for both immediate (proximal) as well as underlying (distal) determinants of absenteeism (Kearney 2008).[8]

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[8] I follow the WHO in using the following definitions of proximal and distal factors: 'proximal factors act directly or almost directly to cause [absenteeism], and distal causes are further back in the causal chain and act via a number of intermediary causes' (World Health Organization 2002, p. 13).

Although the full set of individual-, household-, school-, and community-level factors provide the analytic underpinning of the thesis, I focus more intensively on individual- and household-level determinants for several reasons. Firstly, because of the hypothesised link between absenteeism and cleaner burning cookstoves, I am particularly interested in investigating absenteeism pathways related to household health and division of labour. Secondly, the indicators available in the household survey which forms the basis of the quantitative analysis (described fully in Chapter 3) relate predominantly to individual and household characteristics, allowing for the most extensive analysis at these levels. Thirdly, in view of the statistical limitations associated with examining school-level effects in areas with small and/or homogeneous groups of schools (Burke and Beegle 2004; Dreibelbis et al. 2013), a decision was taken to concentrate on unpacking individual and household effects. Reflecting the shortcomings of the quantitative data, however, school- and community-level factors were explored in the nested qualitative study (see Chapter 3).

The model in Figure 2.1 also demonstrates the proposed mechanisms through which the CAPS cookstove trial would be expected to affect absenteeism. These pathways may also be influenced in important ways by underlying individual and household factors. As we saw above, for instance, students' contributions to household caregiving and fuel collection have been shown to differ widely by sex, age, number of siblings, and socioeconomic status. The analysis adopts a gendered perspective throughout, with a view to highlighting similarities and differences in girls' and boys' experiences related to school attendance.

The final component of the model examines the relationship between missing school and future educational trajectories, while recognising the direct pathway that may also link individual-, household-, school-, and community-level factors with future outcomes. This aspect of the analysis is presented in Chapter 6.

Before embarking on this research, however, Chapter 3 provides an overview of historical, economic and environmental processes that shape the contemporary educational landscape in northern Malawi, with a view to contextualising the analyses presented in subsequent chapters. It also describes in more detail the theoretical underpinning of the thesis, the three parent studies from which data were drawn, and my overarching research methods.

Figure 2.1 Analytic model
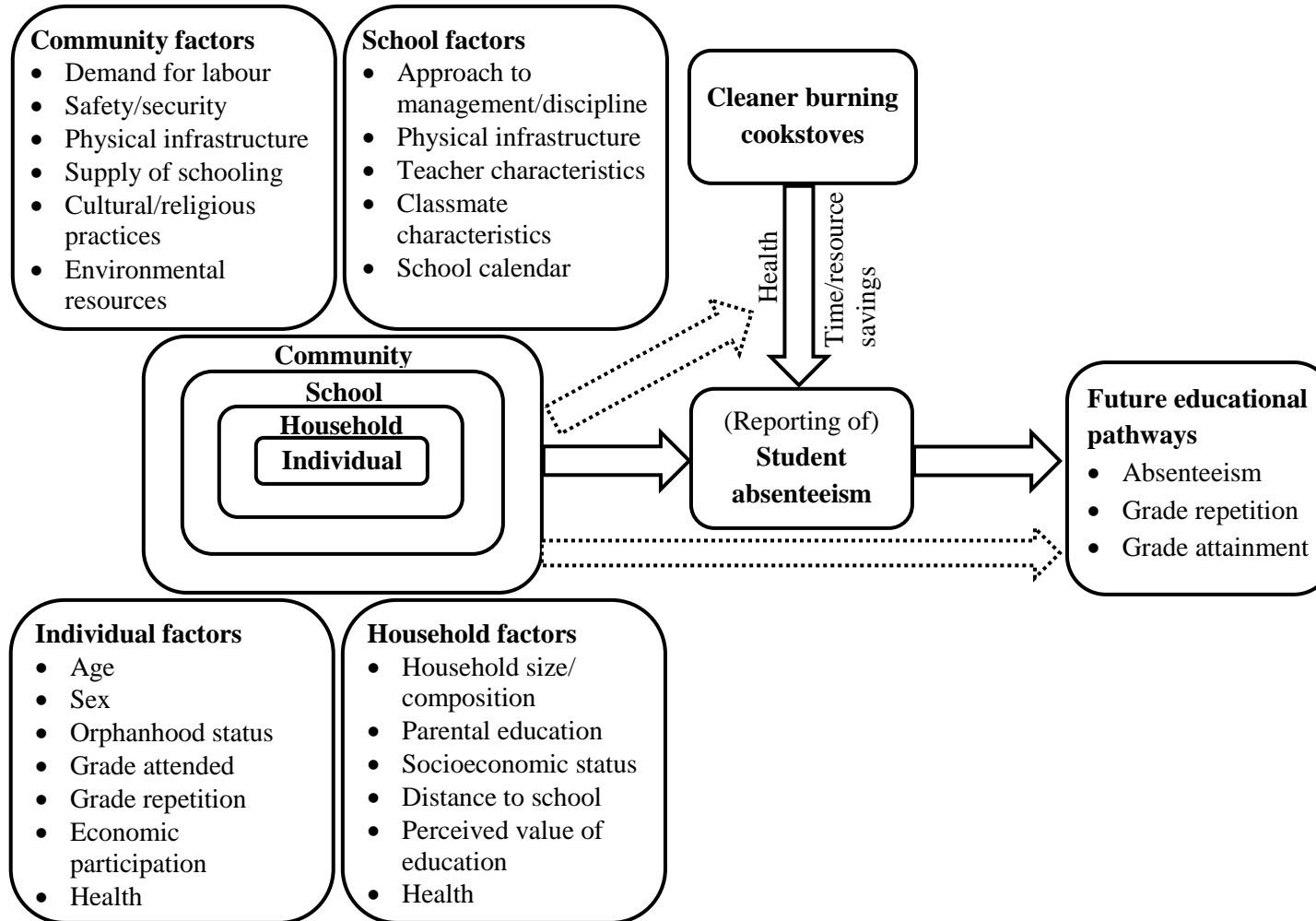
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Chapter 3: Research setting and methods

Malawi is a small, landlocked country of approximately 18 million people in south-eastern Africa, bordered by Mozambique, Zambia, and Tanzania. Known as Nyasaland during British colonial rule, it achieved independence in 1964. The country is consistently listed among the poorest in the world, with an estimated per capita income of $1,073 and a rank of 170 out of 188 countries included in the UNDP Human Development Index (United Nations Development Programme 2016). The economy is sustained in large part by agriculture, which constitutes approximately one-third of gross national product and two-thirds of workers (International Monetary Fund 2017). The country is divided administratively into three regions: Northern (comprising 6 districts); Central (comprising 9 districts and containing Lilongwe, Malawi's capital city); and Southern (comprising 12 districts and containing Blantyre, Malawi's largest city, and Zomba, the former seat of the colonial government).[9]

This chapter begins with a brief historical overview of the colonial and immediate post-colonial periods, helpful for understanding the origins of regional differences in educational, environmental, and health outcomes that characterise contemporary Malawi, and important for contextualising findings from the present study. This is followed by an elaboration of my normative position, drawing on aspects of three educational theoretical frameworks and situating the research within recent developments in the international education agenda. The chapter subsequently describes the three data sources on which this thesis draws and the overarching mixed methods strategy. It concludes with a reflection on my involvement in the research process.

3.1 Historical overview

The first primary school in Malawi was established in 1875 at the Free Church of Scotland Mission at Cape Maclear on the southern shore of Lake Malawi (Chimombo 2009). In 1884, the Mission relocated to Livingstonia in what is now the Northern region, and by 1900 had

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[9] The six Education Divisions according to which the education sector is managed in Malawi (North, Central West, Central East, South West, South East, Shire Highlands) form an additional administrative area between the level of the district and the region. Because most data for Malawi is reported at the district and region levels, I focus primarily on these in the discussion that follows unless specified otherwise. Reflecting its relatively small size, the North Education Division covers the same geographical area as the Northern region.

established a network of 123 primary schools enrolling 16,000 students (Heyneman 1972). The Free Church education system encompassed literacy, numeracy, religion, agriculture, sports and artisan skills, in contrast to schools founded by South African Dutch Reformed Church missionaries in the Central region, and French and Dutch Roman Catholics in the Southern region, which focused on purely religious and moral education, with limited emphasis on literacy (Chimombo 2009; Posner 2004). The Livingstonia Mission additionally inaugurated the country's first post-primary institution in 1894, which included a teacher training college to supply the burgeoning school system, as well as instruction in advanced technical skills (Heyneman 1972), although the relevance of technical training for the local context was questioned (see McCracken 2008 for a detailed history of this period). By 1911, Free Church of Scotland schools accounted for one-third of all primary and 45% of all post-standard-three students enrolled in colonial Nyasaland (Heyneman 1972).

Efforts to introduce western education in the Northern region were particularly well received by members of the Tumbuka tribe who, for a combination of cultural, political and economic reasons stemming from historical subjugation by other groups, actively embraced the new educational opportunities (Vail and White 1989). By contrast, the dominant Ngoni and Chewa peoples initially resisted western education (Vail and White 1989), which further heightened ethnic and regional disparities in educational outcomes. The Northern region, however, provided limited opportunities for formal employment, as the primary commercial and administrative centres of colonial Nyasaland, and accordingly the bulk of private- and public-sector infrastructure, were found in the more temperate south of the country (Kalipeni 1992). The combination of stronger educational traditions and net out-migration meant that by 1969 Tumbukas occupied more than half of the highest-ranking civil service positions in Malawi, despite comprising just 12% of the population (Vail, cited in Posner 2004).

Education and economic policies after independence in 1964 attempted to redress regional imbalances. On one hand, a number of development projects, including moving the capital from Zomba to Lilongwe, and extending road and electricity networks throughout the country, were intended to shift the geographical distribution of economic activity northwards (Kalipeni 1992). On the other hand, efforts were made to limit northern dominance in government and academic institutions, while at times actively discriminating

against Tumbuka scholars. These processes took place alongside efforts by President Kumuza Banda, the first leader of newly independent Malawi, to forge a national identity around his own Chewa culture (McNamara 2015). For instance, the 1968 convention of the ruling Malawi Congress Party stripped Chitumbuka of its status as an official language and barred its use in the media and in government documents (Kamwendo 2008). The policy also established Chichewa as the universal medium of instruction for early primary education (standards 1-4), even in non-Chichewa-speaking areas, and removed Chitumbuka from the school curriculum.[10] Places in national secondary schools were additionally awarded on the basis of ethno-regional identity (Heyneman 1972).

The introduction of free primary education (FPE) in 1994 coincided with the liberalisation of policies towards the Chitumbuka language, including the reinstatement of Chitumbuka on the national radio station (Kamwendo 2005), but medium of instruction remains hotly contested in Malawian popular discourse (see, for example, Nyondo 2016). Although FPE increased convergence in school enrolment across regions, data from the 2015-16 Demographic and Health Survey show that levels of literacy and educational attainment in the adult population, as well as current enrolment in primary and secondary school, remain highest in the Northern region – see Table 3.1 (National Statistical Office and ICF 2017). Results from the most recent Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) assessment also indicate that students in the Northern region achieved the highest average reading scores (Mulera et al. 2017).

While the legacy of historical processes remains visible with respect to educational outcomes, so, too, do regional demographic and economic imbalances persist. In particular, urban centres remain concentrated in the Central and Southern regions, such that just 12.0% of the urban population—and approximately the same proportion of the total population— resides in the Northern region (Manda 2013; National Statistical Office 2012).[11] By consequence, according to the latest census figures, population density is substantially lower in the north, at 63 people per square kilometre, compared to 155 in the Central region and 184 in the Southern region, although population growth was highest in the Northern region during the most recent intercensal period (National Statistical Office 2008). Lower

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[10] The medium of instruction was English in all schools from standard 5 onwards.
[11] Note, however, that Malawi is one of the least urbanised countries in the world, with approximately 16% of the total population living in urban areas (World Bank 2017).

population pressure in the Northern region may help to explain the lower student-teacher ratios observed there relative to other education divisions: 75:1 in government-funded primary schools compared to 105:1 in the Shire Highlands, where student-teacher ratios are highest (World Bank 2010).[12] All regions, though, fall well above the Southern African Development Community (SADC) average of 40:1 (World Bank 2010).

Pressure on land and resources is also much less acute in the Northern region than elsewhere in the country. In their analysis of household land use and energy dynamics in Malawi, Jagger and Perez-Heydrich (2016) showed that processes of deforestation and degradation were most pronounced in the Central and Southern regions over the period 2004-2010, although average fuel collection times did increase in some Northern districts, including Karonga, suggesting increasing scarcity of resources. Earlier work by Nankhuni and Findeis (2004) found that school-age children were more likely to participate in resource collection work in the Northern region relative to elsewhere in Malawi, perhaps because of the more ready availability of biomass fuels there. However, reliance on solid fuels for cooking exceeds 97% of households in all three regions (National Statistical Office 2014).

It is against this backdrop that students' educational access must be examined, and the effect of cleaner burning cookstoves on school attendance considered. Students in northern Malawi live primarily in rural settings, with limited opportunities for formal employment outside agriculture, which may affect the value they attach to education as well as its opportunity cost. At the same time, the historical legacy of educational development in Northern region means that levels of school enrolment and completion, as well as academic skills, are comparatively favourable there. In the wider context of education in sub-Saharan Africa, however, results from the Northern region still fall well below standards for Eastern and Southern Africa, according to SACMEQ assessments (Mulera et al. 2017). In his analysis of contemporary education in Malawi, Chimombo (2009, p. 309) concluded:

> [S]uccess stories come as part of a mixed bag where the overall picture suggests a system that is failing in many areas. Many schools in Malawi do not have the minimum level of resources for meaningful teaching and learning to take place, classes are often grossly overcrowded and many take place without classrooms, classroom furniture, or clean water and adequate sanitation being available. As a result the system does not provide an environment conducive to the implementation of EFA policies.

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[12] Other factors that contribute to relatively lower student-teacher in the Northern region include a disproportionate number of schools (Kalipeni 1997) and inconsistent teacher deployment (World Bank 2010).

Table 3.1 Comparison of selected sociodemographic characteristics by region

	Northern	Central	Southern
Highest level of education (women ages 15-49); %			
None	4.0	12.2	14.1
Some primary	49.5	54.8	53.9
Completed primary	15.0	7.1	7.6
Some secondary	20.8	15.2	16.2
Completed secondary	7.3	6.4	6.3
Tertiary	3.4	4.2	1.8
Highest level of education (men ages 15-49); %			
None	0.9	5.5	6.4
Some primary	44.4	51.4	49.3
Completed primary	11.2	7.5	9.1
Some secondary	26.6	17.2	20.9
Completed secondary	12.4	12.1	10.7
Tertiary	4.6	6.3	3.6
Proportion literate (ages 15-49)[1]; %			
Women	80.8	70.8	71.1
Men	88.0	80.6	83.9
Net attendance ratio[2], primary school			
Boys	96.4	93.1	92.9
Girls	96.1	94.7	93.6
Gross attendance ratio[3], primary school			
Boys	135.5	134.5	128.1
Girls	122.6	125.2	120.3
Net attendance ratio[2], secondary school			
Boys	20.4	14.0	19.1
Girls	21.6	15.0	19.2
Gross attendance ratio[3], secondary school			
Boys	52.5	32.9	42.3
Girls	38.9	28.7	36.3
Median age at first marriage			
Women (ages 20-49)	18.2	18.7	17.9
Men (ages 25-54)	23.6	23.2	22.7
Polygynous marriage (ages 15-49)[4]; %			
Women	18.1	13.5	10.9
Men	10.7	7.0	6.6
HIV prevalence (ages 15-49); %			
Women	5.6	6.7	15.7
Men	4.6	4.4	9.2
Residence and orphanhood status (ages <18); %			
Not living with biological parent	23.8	16.8	21.0
One or both parents died	10.8	9.6	13.6

Source: Malawi Demographic and Health Survey 2015-16

[1] Combines women/men who attended school beyond secondary level (whose literacy was not assessed) and those who could read a whole sentence or part of a sentence.

[2] For primary school, measures the percentage of the primary-school age population (age 6-13) that is attending primary school. For secondary school, measures the percentage of the secondary-school age population (age 14-17) that is attending secondary school.

[3] Expresses the total number of primary (secondary) school students as a percentage of the official primary- (secondary-) school-age population.

[4] Measures the percentage of currently married men who report having two or more wives or currently married women who report having one or more co-wives.

While Chimombo's critique primarily highlights failures to deliver the school inputs required to achieve Education for All, the present study investigates other aspects of educational exclusion, as manifested in students' absenteeism, that derive from a combination of individual-, household-, school-, and community-level factors.

3.2 Normative position

The underlying vision of the Education for All movement and associated calls to expand educational access can be seen to derive from multiple theoretical bases (McCowan 2011). International stakeholders including UNESCO and UNICEF have drawn heavily on rights-based approaches in advocating 'the right of access to education, the right to quality education and respect for human rights in education' (UNICEF and UNESCO 2007, p. 27). Efforts of other actors such as the World Bank have been moulded much more strongly by human capital theory, which views education as an investment in knowledge and skills that in turn generate micro- and macro-level economic returns (Rose 2003). Building on the pioneering work of Amartya Sen, advocates of the capability approach argue that education provides students with the freedom, both in the present and in the future, to 'be' and 'do' what they consider valuable (Unterhalter 2003; Walker 2005).

This thesis starts from the position that education is a fundamental human right that is both 'intrinsically reasonable and socially indispensable' (Lee 2013, p. 4). In the decades since the 1948 Universal Declaration of Human Rights asserted that 'everyone has the right to education' (United Nations 1948), international human rights discourses have emphasised the role played by education in enhancing personal development, as well as promoting peace, tolerance and understanding. The centrality of education to the realisation of human rights has been reinforced in subsequent treaties including the UNESCO Convention against Discrimination in Education (1960), the International Covenant on Economic, Social and Cultural Rights (1966), the Convention on the Rights of the Child (1989), and the ILO Convention on the Worst Forms of Child Labour (1999). These and other documents commit governments to providing free basic education to all children.[13]

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[13] Human rights discourses increasingly emphasise the right to lifelong learning. Language in this thesis referring to learners as 'children', 'adolescents' or 'young people' reflects the study's focus on primary education, but I stress that the right to education extends throughout the life course.

In an influential critique, Robeyns (2006, p. 70) described the tendency of public actors to undertake the minimum commitment required to fulfil their human rights obligations:

> [A] rights discourse can induce policy makers to being contented when they have strictly followed the rules that a limited interpretation of the rights imposes on them, even when additional efforts are necessary to meet the goal that underlies the right.

This may occur, for example, when success in achieving educational access is considered in terms of school enrolment, without attending to the range of other factors that prevent realisation of the right to education in the fullest sense. Although critiques regarding the ineffective actualisation of rights *in practice* are certainly justified (McCowan 2011), I conceive of the right to education in a way that emphasises dimensions beyond simple provision of education services. I follow Katarina Tomaševski, the first UN Special Rapporteur on the Right to Education, in defining human rights obligations that make education not only *available*, but *accessible*, *acceptable*, and *adaptable* (Tomaševski 2001). That is, in addition to being physically present and affordable, education services must be free from discrimination, achieve minimum quality standards, and respond to the needs of all children. Students who miss school due to financial constraints, competing work burdens, or unfavourable learning conditions are therefore denied their right to education conceived in this comprehensive way.

While appealing to human rights as the primary rationale for expanding educational access, I also draw on aspects of human capital theory to help frame the daily decision to attend school. Proponents of human capital theory, including Schultz (1961), Becker (1964), Mincer (1981), and Hanushek (2013), posit that the knowledge and skills acquired through education generate higher incomes, greater productivity and, at the national level, increased economic growth. As such, the expectation of private and social economic returns generated from schooling motivate investments in education made by individuals, governments and international actors including the World Bank (Rose 2003).

The daily decision to attend school can be seen to form part of this larger investment decision, modelled as a cost-benefit analysis. In this framework, students and households consider the benefits to be gained from going to school against the costs of attending in determining whether to 'invest' in a school day. Costs in this decision include direct expenses on school uniforms, notebooks or examination fees, as well as opportunity costs including foregone income or domestic labour. Costs can also extend beyond economic

considerations to, for example, distance travelled to school. These are weighed against the expected benefits of school attendance including improved learning outcomes, better exam performance, and enhanced employment prospects.

Under certain conditions, then, absenteeism could be considered a rational decision if the costs of attending school outweigh the potential gains. As Kabeer (2000, p. 94) observes: 'Education […] may not be perceived as a need by excluded groups who have no reason to believe that it is worth the sacrifice of current income or consumption.' Absenteeism thus represents a cause for concern as a signal of the failure to provide *available*, *accessible*, *acceptable* and *adaptable* education that meets students' needs. It also represents an important source of inefficiency both for individuals—who delay or forego the opportunity to reap future returns from education if absenteeism leads to exam failure and/or grade repetition or school dropout—and for school systems that must accommodate the irregular trajectories of frequently absent students. Since economic arguments often dominate funding allocation decisions, particularly in low-resource contexts (Rose 2003), and also reflect the value that households in sub-Saharan Africa have professed to place on school attendance as a route to formal employment and financial security (Grant 2008; Posti-Ahokas and Palojoki 2014), my analysis, particularly in Chapters 6 and 7, sheds light on the perceived costs and benefits of school attendance in this context.

While I highlight the critical role played by school attendance in developing knowledge and skills for future income generation, I readily acknowledge that the importance of educational access extends beyond costs and benefits, and therefore follow Sen (cited in Robeyns 2006, p. 75) in supplementing the theoretical foundation provided by human capital:

> [W]e must go *beyond* the notion of human capital, after acknowledging its relevance and reach. The broadening that is needed is additional and cumulative, rather than being an alternative to the "human capital" approach.

The capability approach espoused by Sen emphasises that reasons to value education stem from both *instrumental* and *intrinsic* rationales (Robeyns 2006)—that is, education is important both as a means to secure employment or political and social participation, and as a worthy pursuit in and of itself. I draw on these concepts in exploring the value that students in northern Malawi place on school attendance in northern Malawi in Chapter 7.

The capability approach additionally offers a lens through which to consider students' agency in navigating the competing demands on their time and resources. As capabilities are predicated on individuals 'having the freedom to choose a life they have reason to value', notions of agency are central to this approach (Walker 2005, p. 104). Indeed, while education frameworks from organisations subscribing to a rights-based approach are often silent on the issue of children's agency (Jere 2014), or regard children as the passive recipients of 'paternalistic benevolence' (Ballet et al. 2011, p. 25), a rich literature among capabilities scholars debates the complexities associated with ascribing agency to children in the context of education decisions (e.g. Ballet et al. 2011; Baraldi and Iervese 2014; Saito 2003). For the purpose of this thesis, I start from a position of 'considering children not simply as recipients of freedoms, but as active social actors and agents in their communities with their own priorities, strategies and aspirations' (Ballet et al. 2011, p. 22). At the same time, I recognise that students' educational agency is heavily shaped by social, economic and environmental circumstances, as well as by the choices of teachers, caregivers, peers, and other actors (Vaughan 2007; Walker and Unterhalter 2007). I thus explore the range of individual-, household-, school-, and community-level factors that influence students' schooling decisions in Chapters 4, 5 and 7.

3.3 Educational access in the era of the Sustainable Development Goals

This doctoral research took place alongside an important evolution in international development frameworks—namely, the transition from the Millennium Development Goals to the Sustainable Development Goals in 2015. Although the MDGs achieved important progress in many domains (Sachs 2012), they also attracted heavy criticism from researchers and practitioners for being too top-down in conception, too narrow and selective in scope, and silent in the mention of rights (Alston 2005). The SDGs, by contrast, were informed by a much wider, multi-stakeholder consultation process; ambitiously expanded both the geographic and thematic reach of the Goals; and drew explicitly on rights-based approaches to development (UNESCO 2017). With particular reference to education, whereas MGD 2 was concerned with achieving universal primary education, SDG 4 calls for ensuring 'inclusive and quality education for all and promot[ing] lifelong learning'.

Although there remains some 'conceptual confusion' among researchers and practitioners about the precise meaning of *inclusion* in education discourses (Miles and Singal 2010, p.

7), it is increasingly taken to imply a recognition of student diversity and an effort to meet the all learners' needs: 'it is about providing a framework within which all children – regardless of ability, gender, language, ethnic or cultural origin – can be valued equally, treated with respect and provided with real opportunities at school' (Thomas and Loxley, cited in Campbell 2002, p. 14). The push for inclusive education, and the SDG agenda more broadly, is founded on the conviction that education is a fundamental human right and thus central to a just society (Ainscow et al. 2006; UNESCO 2017).

Balescut and Eklindh (2006) summarise four key features in the conceptualisation of inclusion in education:

- ***Inclusion is concerned with the identification and removal of barriers.***

Ensuring inclusive education requires moving away from a model that attributes poor attendance and attainment to students' own deficiencies or lack of effort[14] rather than to external factors such as poor health, financial constraints, or discrimination that hamper students' participation. It thus necessitates careful investigation of students' social, political and economic contexts, as well as consideration of individual-, household-, school-, and community-level factors that influence inclusion and exclusion (Sayed and Soudien 2003). Consequently, it involves collecting a wide range of data to monitor and inform improvements in policy and practice (Balescut and Eklindh 2006).

- ***Inclusion is about the presence, participation and achievement of all students***.

'Presence' is concerned both with where children are educated and how reliably and punctually they attend; as such, daily school attendance represents an important dimension of inclusion in education. 'Participation' relates to the quality of students' educational experiences and 'achievement' to learning across the curriculum, not merely results from formal assessments (Balescut and Eklindh 2006). Inclusion thus extends crucially beyond a concern for provision of educational services to processes that ensure meaningful learning experiences. As Sayed and Soudien (2003, p.14) highlight:

> [I]nstitutional access alone – the creation of physical space – does not answer the call for educational inclusion. Besides issues of affordability, cultural and political environments and practices, both within and outside of educational institutions, may perpetuate exclusion even after students have technically been 'placed'.

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[14] The SACMEQ head teacher survey that treats student absenteeism as a 'behavioural problem' (Hungi 2011) is one example of this kind of approach.

- *Inclusion involves a particular emphasis on those groups of learners who may be at risk of marginalisation, exclusion or underachievement.*

Although inclusion in education concerns all children, particular consideration should be given to those who have been traditionally marginalised. Hard to reach constituencies include girls, especially in patriarchal societies; rural children, for whom distance to school or transport costs may be prohibitive; ethnic minorities or indigenous groups who do not speak the common language taught at school; children with disabilities; children with no fixed residence; and children caught in armed conflict (Lee 2013). Education researchers and practitioners thus assume a moral responsibility to ensure that 'at risk' groups are carefully monitored, and that, when needed, appropriate steps are taken to enhance their presence, participation and achievement in education (Balescut and Eklindh 2006).

- *Inclusion is a process.*

Inclusion is not a fixed state to be achieved, but rather a constantly unfolding process contingent on social, economic and political contexts (Kabeer 2000). Importantly, too, 'inclusion' is not simply the opposite of 'exclusion', but rather both are two sides of the same coin. As Sayed, Soudien and Carrim (2003, p. 234) describe:

> [A]ny attempt at inclusion will entail a form of exclusion, and in order to understand the intent and effects of inclusionary measures, one needs to be aware of their inherent exclusionary influences and potential outcomes. Inclusion and exclusion need to be viewed as being conjoined, and not as diametrically opposing forces.

Responding to students' diversity of learning needs, and reducing exclusion from and within education, thus involve continuous evolution of policy and practice.

By embracing inclusive education, the SDGs advance meaningfully on the narrow framing of educational access in the MDGs that prioritised school enrolment over other aspects of the educational experience. As King (2017) has pointed out, however, the emphasis on equity, inclusivity and quality so carefully included in SDG 4 was somewhat 'lost in translation' when generating the global indicators that serve to monitor progress towards the Goal. In particular, the indicators focus less on 'learning needs' and more on 'learning outcomes' and limit the scope of education to reading and mathematics skills rather than broader notions of quality. Moreover, although the indicators for SDG 4 draw attention to some aspects of students' presence and participation, for instance by monitoring the extent to which students progress through school at appropriate ages, they stop short of addressing

the 'silent exclusion' of students who are enrolled in school but attend irregularly (Gilmour and Soudien 2009; Lewin 2009).

I draw on the theoretical framework designed by researchers at the CREATE consortium (Lewin 2009), to shine light on students in Zone 3 of CREATE's six 'zones of exclusion', which identify students at risk of adverse educational outcomes including permanent dropout (Figure 3.1). In examining sources of exclusion, I am concerned with both *active* and *passive* forms (Sen 2000). The former results from deliberate policies or actions that prevent students from attending school, for example when teachers enforce strict uniform policies or require students to wait until the start of the next school term to return after a period of absence (Pridmore and Jere 2011). Passive exclusion, by contrast, stems from phenomena including poverty or food shortages that result in exclusion through no deliberate action on the part of schools or communities, but nevertheless inhibit students' educational access.

Figure 3.1 CREATE zones of exclusion
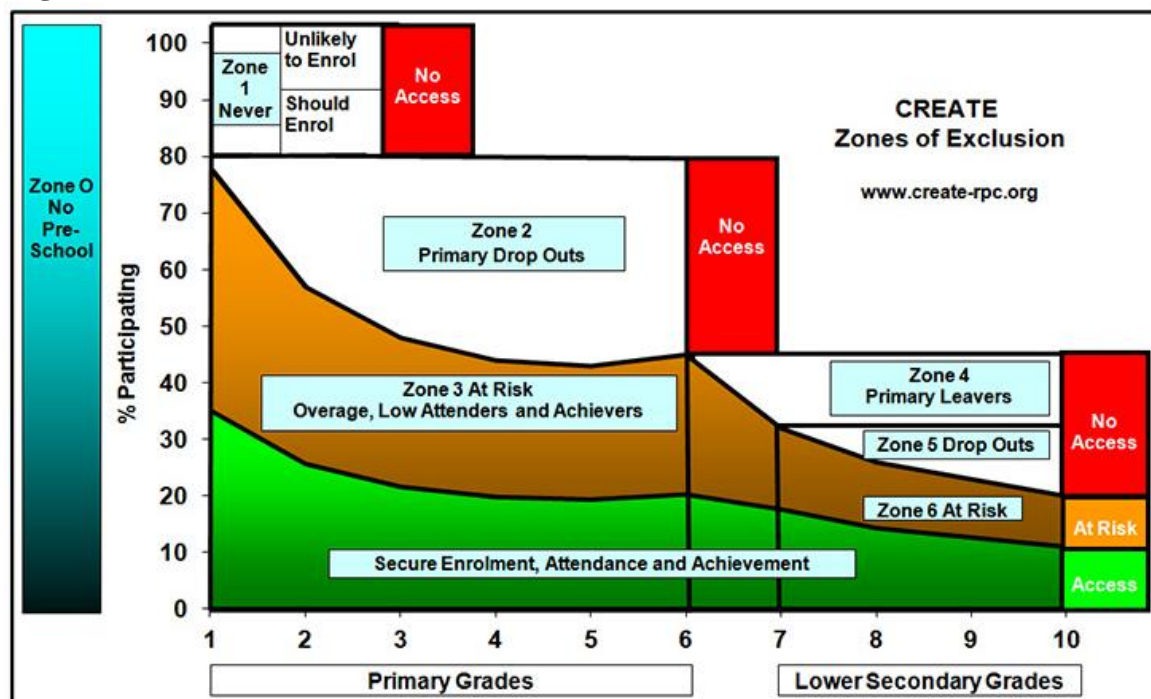
Source: CREATE Model of Zones of Exclusion (http://www.create-rpc.org/about/exclusion/)

3.4 Data sources

My analysis of the trends and influences of school absenteeism is guided by the socio-ecological model developed in Chapter 2 and conducted using a combination of quantitative

and qualitative data from primary school students in Karonga district, northern Malawi. Key features of each of the three parent studies from which the data were derived, as well as my overarching research design, are described in detail below.

3.4.1 Karonga Health and Demographic Surveillance System

The study was carried out in the catchment area of the Karonga Health and Demographic Surveillance System (HDSS) in Karonga district, northern Malawi. The HDSS forms part of a suite of data collection activities administered under the auspices of the Malawi Epidemiology and Intervention Research Unit (MEIRU, previously known as the Karonga Prevention Study [KPS]) in Karonga district, northern Malawi. The MEIRU research site has supported epidemiological, clinical, and immunological studies in various guises since 1979. The project began with a total population cohort study designed to identify the risk factors for leprosy, but subsequently shifted orientation to focus on tuberculosis and HIV, and, more recently, non-communicable diseases. Crampin et al. (2012) provides an overview of research activities associated with KPS/MEIRU.

The HDSS surveillance area comprises approximately 135 km^2 at the southern end of Karonga district, bounded by the shore of Lake Malawi on the eastern side, and surrounding the port village of Chilumba (see Figure 3.2). The area is predominantly rural, with an economy based primarily upon subsistence agriculture, petty trading and fishing. HIV prevalence in the HDSS catchment area was estimated at 7.1% among men and 9.2% among women in 2008/2009 (Floyd et al. 2013). The resident population is mainly Christian and Chitumbuka-speaking (Floyd et al. 2007).

Study design

The HDSS, established in 2002, operates as a continuous registration system using village informants for vital events, combined with an annual census covering the population of more than 35,000 currently residing in the catchment area. As of 2007, the HDSS also included an annual household survey capturing sociodemographic information about each household member. Questions about school attendance were added to the survey in 2008. During the 2007 and 2010 rounds, an additional survey module collected detailed information about household socioeconomic indicators, including land and productive assets, consumer durables, dwelling quality, and access to credit or other financial safety nets. Each survey round spanned a 12-month period, from approximately September-

August. Surveys were administered by field staff using paper questionnaires with data double entered in Microsoft Access and imported into Stata for secondary analysis. Sample survey instruments are provided in Appendix A3.4 and A3.5.

Figure 3.2 Location of Karonga HDSS catchment area
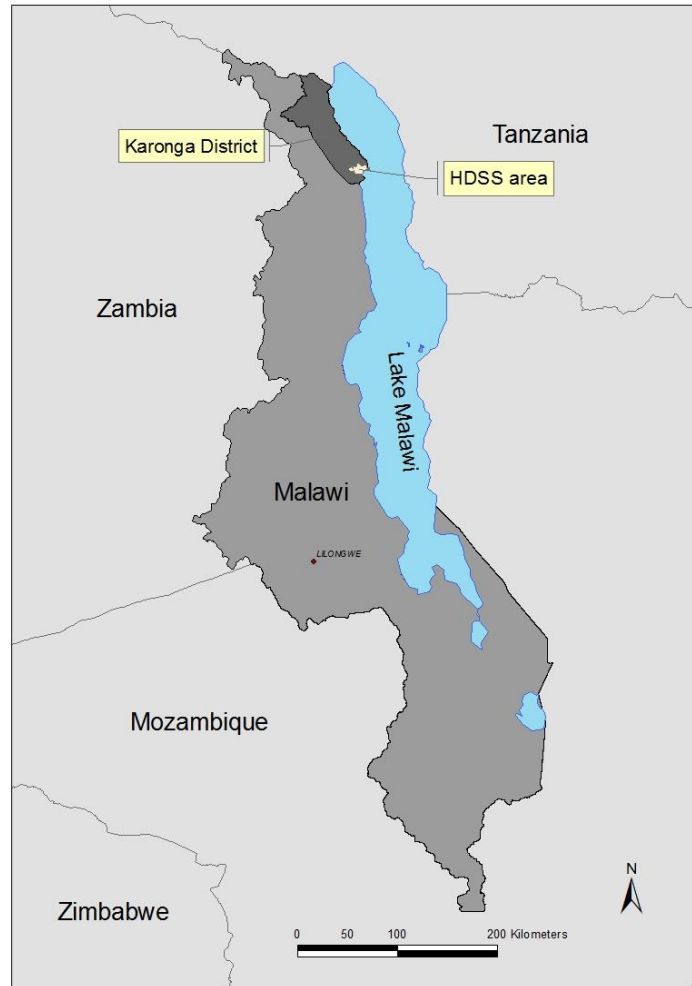
Ethics statement

Data collection associated with the HDSS was reviewed and approved by the LSHTM Research Ethics Committee (Ref #5081) and the National Health Sciences Research Committee (NHSRC) in Malawi (Protocol #419). Before initial enumeration, meetings were held with the *Wasambo* (traditional authority with responsibility for the area), group village headmen (each representing several villages), and village headmen and *ndunas* (village elders) to gain consent for conducting the baseline survey. Response rates are traditionally very high for HDSS activities, with approximately 1% of households—typically spiritualists or other objecting religions—refusing to participate (Crampin et al. 2012).

Analytic sample

The analyses presented here focus on the subset of HDSS residents attending primary school in one or more of the eight HDSS survey rounds conducted from 2008-2016 in which school attendance data were collected. Research Paper 1 (Chapter 4) additionally draws on the household socioeconomic module collected in 2010-11.

Surveys were administered to household residents aged 15 or older who were at home during the field team's visit. As such, most school attendance data were provided by an adult household member, usually a parent, on behalf of resident children. Because of the household-based reporting of school attendance, I exclude from all analyses the small proportion of permanent residents of the HDSS catchment area who were attending school outside Karonga district and as such likely lived elsewhere during term time.[15] In cases where students were captured more than once within a single survey round, for example by changing households, one observation per student-round is included in analyses.

Although school attendance information is available for students enrolled at both primary and secondary levels, I restrict analyses to primary school absenteeism for several reasons. Firstly, reflecting the very competitive nature of secondary school entry in Malawi, the proportion of young people attending secondary school in the HDSS population is both relatively small and highly selective. Places at government schools are rationed according to performance on the high-stakes Primary School Leaving Certificate of Education examination, so students who progress to secondary comprise the highest achievers at primarily level and come disproportionately from the highest-income households (Zeitlyn et al. 2015).[16] Identifying and addressing the barriers to sustained primary school attendance are thus of critical policy importance in order to facilitate more equitable and inclusive access to higher levels of education.

Additionally, secondary students are more likely to live outside Karonga district during term time than primary students, either via acceptance to prestigious national boarding schools, limited local availability of secondary school places, or perceived higher school

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[15] The HDSS instrument does not capture information about students' residence during term time (if different).

[16] Students who fail to meet the standard to government secondary schools can attend private schools, which often have more lax entrance requirements, but many private schools in Malawi are unregulated and the quality of education offered is highly variable (Zeitlyn et al. 2015).

quality elsewhere. According to HDSS data, whereas on average ~1% of primary school students attended school outside Karonga district in a given survey round, ~15% of secondary school students did the same.[17] Recognising the critical role of the primary school performance in determining secondary school entry, as well as concerns about the validity of household-based reporting of school attendance for more mobile secondary school students, the analysis therefore focuses on barriers to primary school access.

Outcome measures

The schooling section of the HDSS instrument asked respondents about the current school enrolment status of each household resident. For residents who were currently enrolled in school, respondents were asked if these students had attended school during the past four weeks that school was in session, and if so, how many days or weeks they had missed during this period. Respondents were asked to provide up to two reasons for absence for residents who had missed school.

The survey also included two indicators of extended absenteeism: any absence of two consecutive weeks during the previous twelve months, asked of all currently-enrolled students; and any school interruption of one year or more from which the student subsequently returned, asked of all household members. Although these forms of school withdrawal are common in other contexts (e.g. Chalasani et al. 2013 in southern Malawi and Grant and Hallman 2008 in South Africa), prevalence was too low in my primary school sample (~1% for each outcome) to conduct a meaningful analysis. I thus derive absence outcomes from school attendance in the past four weeks: Paper 1 (Chapter 4) uses a binary measure of any absence during that period, Paper 2 (Chapter 5) models the number of days a student missed during the past four weeks, and Paper 3 (Chapter 6) uses both binary and count outcomes.

The analysis in Chapter 6 also explores the relationship between absenteeism and two additional educational outcomes: 1) grade repetition and 2) grade attainment. The former was derived from a combination of two survey questions, the first asking a student's current standard attended and the second whether he/she had repeated the standard, from which a longitudinal schooling history was constructed by combining data across rounds. I

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[17] School names or locations are not collected for students attending school outside Karonga district, so the ultimate destination of these students is unknown.

recognise, as previous research has noted (Jere 2012), that grade promotion in Malawi is a subjective process, not based on standardised assessments or other transparent criteria. However, in the absence of data on examination scores or academic skills, I consider grade repetition to represent the best available proxy for school performance.

Figure 3.3 Summary of HDSS study design and data

Implementation period: 9/2007-10/2016 (school attendance data added 9/2008)

Study design: Continuous registration system + annual household survey

Inclusion criteria: Residence within geographical boundaries of HDSS (see Figure 3.2)

Data collection instruments: Household survey covering individuals (2007-2016) and households (2007 and 2010; see Appendix A3.4 and A3.5)

Analytic sample: Young people attending primary school in Karonga district in ≥1 survey round, 2008-2016

3.4.2 The Cooking and Pneumonia Study

The Cooking and Pneumonia Study (CAPS), a collaboration between the Liverpool School of Tropical Medicine and the London School of Hygiene and Tropical Medicine, was a large cluster randomised trial of cleaner burning biomass-fuelled cookstoves on health outcomes implemented from 2014-2016. CAPS was nested within the Karonga HDSS site in order to capitalise on existing research infrastructure as well the option to link CAPS trial data with broader sociodemographic indicators collected in HDSS surveys. The trial was also conducted in a second site in southern Malawi, which I do not analyse here.

CAPS' primary objective was to assess the effect of cleaner burning cookstoves on incidence of pneumonia in children under five years old. The trial was designed to address shortcomings of previous cookstove trials, discussed in Chapter 2. Firstly, as the largest study of the effects of a biomass-fuelled cookstove intervention on health outcomes to date—involving a total of 150 community-level clusters and more than 8000 households randomly allocated to intervention and control groups—CAPS had greater statistical power to detect an effect on pneumonia incidence than existing trials such as RESPIRE. Specifically, the trial was designed to provide 21,200 child-years of follow-up over the duration of the study period and 90.3% power to detect a 20% percent reduction in the rate of pneumonia, from five per 100 child-years in the control group to four per 100 child-years

in the intervention group (Mortimer et al. 2016). Secondly, reduced exposure to HAP in the CAPS cookstove was generated through increased combustion efficiency rather than improved ventilation, and as such was expected to yield greater declines in smoke emissions than previous cookstove models (Jetter and Kariher 2009).

Study design

One hundred and fifty village-level clusters, of which 100 were in the Karonga district research site and thus form the basis of the present study, were randomised to intervention and control groups. Starting in July 2014, intervention households received two Philips HD4012LS cookstoves (shown in Figure 3.4), manufactured in Lesotho at a cost of approximately 90 USD. The stove included a battery-powered fan, charged via a solar panel. As the surface area of each cookstove accommodated one pot at a time, participants were given two cookstoves to minimise combined use with traditional cooking methods associated with device 'stacking' (Ruiz-Mercado and Masera 2015). Given the trial's primary focus on children under five, only households with at least one child aged up to 4.5 years at baseline were invited to participate. Households that subsequently became eligible for inclusion through new births, adoptions, or in-migration were recruited on a continuous basis until six months before trial end.

Figure 3.4 Philips fan-assisted cookstove and solar panel

Photo: the author

Households were visited approximately every three months over the 24-month study period, during which time fieldworkers collected data about cookstove usage and functionality, as well as outcomes related to child health and adult lung function not analysed here. The visit at month 21 was omitted as the follow-up schedule was sufficiently behind to proceed directly to the 24 month exit visit. Data were collected electronically using smartphones and Open Data Kit software and imported into Stata for secondary analysis (see Appendix A3.6 and A3.7 for extracts from baseline and follow-up survey forms). Throughout the trial period, a free repair, maintenance and replacement service was provided for damaged cookstoves. Control households received their own cookstoves at the end of the trial. Full details of the CAPS design, procedures, and impact on incidence of pneumonia in children under five can be found in Mortimer et al. (2016).

Ethics statement

The CAPS protocol was reviewed and approved by the Malawi College of Medicine Research Ethics Committee (Ref P.11/12/1308) and the Liverpool School of Tropical Medicine Research Ethics Committee (Ref 12.40). A summary of the peer-reviewed protocol was published in *The Lancet*.[18] Prior to implementation, community engagement activities were conducted with village leaders and communities, and written informed consent (or witnessed thumbprint in lieu of signature) obtained at both cluster and household level.

Analytic sample

As the CAPS target population comprised children under five years old, trial data were limited to characteristics of these children and the households in which they resided. In order to examine the cookstoves' impact on school attendance in Chapter 5, I merged the CAPS dataset with the HDSS population register to identify young people of primary school age resident in households enrolled in the CAPS trial. I then used data from HDSS annual sociodemographic surveys to isolate the young people in CAPS households currently attending primary school in Karonga district. Reflecting the inclusion criteria of both CAPS and my study, statistical findings are therefore representative only of households in the catchment area with both young and school-age children.

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[18] Available from: http://www.thelancet.com/protocol-reviews/13PRT-4689

Figure 3.5 Summary of CAPS study design and data

Implementation period: 7/2014-9/2016

Study design: Cluster randomised trial

Intervention: Two Philips HD4012LS cleaner burning biomass-fuelled cookstoves (see Figure 3.4)

Inclusion criteria: Households with children under 4.5 years old resident in HDSS catchment area

Data collection instruments: Household survey (baseline and follow-up; see Appendix A3.6 and A3.7 for extracts)

Analytic sample: Young people aged 5-18 years resident in CAPS households attending primary school in Karonga district (identified using HDSS population register and household surveys)

3.4.3 Nested qualitative study

To supplement the existing quantitative data, I designed and conducted a nested qualitative study in the HDSS catchment area over the period April-May 2016, consisting of semi-structured in-depth interviews (IDIs) and focus group discussions (FGDs) with primary school students aged 12-18 resident in CAPS intervention or control households. The decision to collect qualitative data stemmed primarily from three motivations:

1. Explain relationships observed in quantitative analysis, particularly with respect to mechanisms/processes
2. Interrogate the validity of proxy-reported attendance data by exploring incentives to misreport school attendance in household surveys
3. Include children's perspectives in analyses of absenteeism trends and influences.

These rationales were rooted in both pragmatic and political concerns—pragmatic, as methods were chosen to best address the research objectives presented in Chapter 1 with the time and resources available, and political, as I explicitly sought to include under-represented voices in the research (Brannen 2005).

Although the HDSS and CAPS facilitated a rich analysis of school attendance trends, cookstove uptake, and factors associated with missing school, they provided less insight into the mechanisms through which observed relationships operate. With reference to the

hypothesised links between cleaner burning cookstoves and improved school attendance, qualitative data were required to interpret the eventual quantitative comparison of school attendance levels between CAPS intervention and control groups, in order to explore *why* changes in attendance were or were not found (Lewin et al. 2009). As Stanistreet and colleagues (2015) have highlighted, qualitative data are particularly valuable in the context of cookstove trials to understand the processes of behaviour change. As such, the nested qualitative study was designed to explore students' perceptions of the extent to which household cooking practices, and their own participation in cooking-related activities, changed as a result of cookstove distribution, as well as to examine students' assessments of household health, fuel consumption and school attendance across trial groups.

More generally, qualitative data enhance 'understanding of the intra-household dynamics and/or social processes behind the numbers' produced in quantitative research (Jones and Sumner 2009, p. 41). The qualitative study was thus intended to 'unpack' the statistical analysis of proximal and distal factors associated with school absenteeism, by providing deeper understanding of household decision-making regarding education, how students negotiated trade-offs between school attendance and other household responsibilities, and the 'push' and 'pull' factors that influenced schooling decisions (Streuli and Moleni 2008).

The second motivation for pursuing a mixed methods strategy arose in response to an apparent paradox between the reasons reported for missing school in the HDSS survey and the statistical correlates of absenteeism, described fully in Chapter 4. The qualitative study was therefore additionally conceived as an opportunity to assess the validity of self- or proxy-reported school attendance data. In particular, by exploring normative judgements surrounding absenteeism and punishments associated with missing school, the qualitative data sought to assess the extent to which reports of absenteeism could be influenced by social desirability bias (Kelly et al. 2013), which would yield under- or misreporting of absenteeism trends and influences. Previous research has also suggested that proxy reporters in household surveys may not be adequately informed about the characteristics or behaviour of other household members, or wish to portray them in a particular light, such that their accounts provide an inaccurate or incomplete picture of the outcome under study (Bardasi et al. 2011; Dammert and Galdo 2013). The qualitative module thus served to supplement adults' reports of children's school attendance and provide a limited means of triangulating students' attendance patterns.

Most importantly, however, the qualitative component sought to highlight young people's own perspectives as voices under-represented in household research (Jones and Sumner 2009). Consistent with a view of children as social and economic agents, and 'experts in their own lives' (Langsted, cited in Orkin 2011, p. 789), IDIs and FGDs sought to explore the value they placed on maintaining regular school attendance and the barriers to schooling they considered to be most problematic. As the primary beneficiaries of policies or interventions designed to improve schooling outcomes, I considered it critical to include students' voices in identifying both problems and solutions associated with expanding educational access.

Study design

The qualitative study comprised 16 in-depth interviews with primary school students and four focus group discussions with eight students per group, each with embedded participatory activities. The design and implementation of each component is described below.

In-depth interviews

Using the Karonga HDSS dataset as a sampling frame, IDI participants were purposively sampled to vary by sex (8 male, 8 female), age (12-18 years); standard attended (grades 3-8); CAPS trial group (intervention and control); and by three community types prevalent in the HDSS catchment area (lakeside, semi-urban and rural), based on the hypothesis that practices associated with fishing, trading, or farming, respectively, might influence school attendance in different ways. Community types were classified on the basis of location within the study site: those on the shore of Lake Malawi were grouped as lakeside; semi-urban designated proximity to a large trading centre and the tarmac road connecting Malawi and Tanzania; and rural comprised communities found in the more remote interior regions of the HDSS catchment area (see Figure A.1 in the Appendix for a map of IDI and FGD interview locations within the study site).

The semi-structured IDI guide (provided in Appendix A3.8) explored students' perceptions of the barriers to regular school attendance, their educational motivations and aspirations, household health status, economic and domestic responsibilities, and the effect of missing school on educational engagement. Among cookstove recipients, interviews also explored the perceived impact of cleaner burning cookstoves on health, schooling and time

allocation. A gendered perspective was adopted throughout, with a view to highlighting parallels and differences between girls' and boys' experiences. The guides were iteratively updated based on feedback from eight pilot interviews, as well as from preliminary analysis of early IDIs.

In order to gain insights of students' time use, each IDI also included an exercise in which participants were asked to identify the activities in which they had engaged on the most recent school day, from among a selection of ten activity cards: attending school, doing homework, going to the market, collecting firewood, drawing water, cooking, fishing, farming, caregiving, and playing. Participants then placed these activities on an illustrated timeline from morning to night and estimated the time spent engaged in each (see Figure 3.6 and Appendix A3.9). The exercise was conceived primarily as a recall tool and formed the basis for follow-up discussion regarding potential work-school trade-offs and intra-household labour allocation.

Figure 3.6 Example of IDI timeline activity
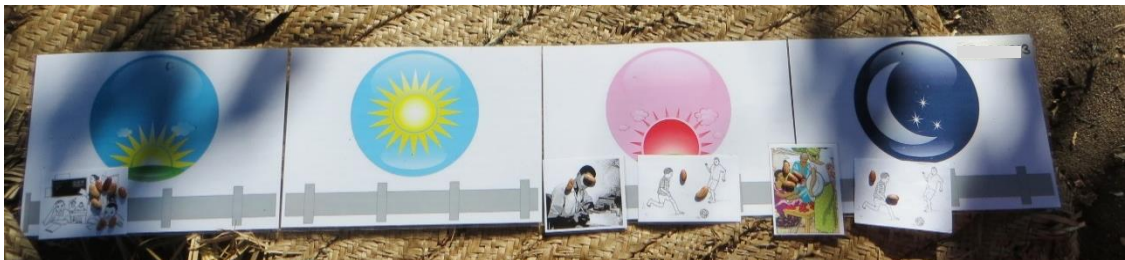
Photo: Aaron Ndovi

Focus group discussions

Participants for four FGDs were drawn from communities contiguous to those from which IDI participants were selected to ensure comparability of community characteristics while avoiding potential overlap of participants (see Figure A.1). Four FGDs were conducted—one each among boys and girls in CAPS intervention and control clusters. Upon arrival in a target cluster, 'natural groups' of eight participants were identified for participation in FGDs (Green and Thorogood 2014). That is, eligible students who were already acquainted—by virtue of living close to each other, sharing a local water source, or attending the same school—were recruited at the household. Natural groups were selected in preference to purposive sampling in order to facilitate greater interaction between FGD members and gain insight into school or community norms.

For each FGD, a trained facilitator, assisted by an additional note-taker, directed the conversation according to a topic guide developed based on findings from the IDIs as well as from two FGD pilot sessions (see Appendix A3.10). Discussions solicited participants' views on the value of schooling, community norms surrounding education, the primary challenges to regular school attendance and proposed measures to reduce absenteeism. In CAPS intervention groups, discussions also explored the perceived benefits and drawbacks of cleaner burning cookstoves. Separate male and female FGDs were conducted to allow for discussion of gender-specific or sensitive topics.

Perceived barriers to school attendance were explored via a 'draw and tell' exercise embedded within each FGD (Driessnack 2006), when participants were asked to draw the activities in which they, or other children they knew, engaged on days when they did not attend school. Variants of draw and tell exercises have previously been conducted among children in sub-Saharan African studies, including in Ethiopia to elicit views on things/people/places they liked and disliked in their schools and neighbourhoods (Tekola et al. 2009), in Zimbabwe on how HIV affected boys' and girls' schooling (Campbell et al. 2015), and in Kenya on children's concepts of health and illness (Onyango-Ouma et al. 2004).

Approximately 10 minutes was allocated for participants to complete their pictures, during which time participants dispersed throughout the FGD venue so as not to be influenced by others' drawings. Upon reconvening, participants described their drawings and the practices they represented, with the help of probing questions from the FGD facilitator, while other members were encouraged to share their own observations related to the activity their colleague had depicted.

Some critics have questioned the quality of data that drawings generate—for instance that children depict ideas or practices that are easy to draw rather than those which hold personal salience—and highlighted the analytical complexity of interpreting the images produced (Backett-Milburn and McKie 1999). In my study, the drawing exercise was intended not as a standalone data gathering exercise, but rather as a means to facilitate the exchange of ideas in an interactive and inclusive way (Driessnack 2006; Noonan et al. 2016). Facilitators stressed that students should not be concerned about the artistic complexity of their drawing. I am, however, cognisant that, as others have argued (Backett-Milburn and

McKie 1999), drawing is not necessarily interesting or enjoyable to all young people, and that, particularly in the context of a group activity, participants may have felt uncomfortable taking part. While the informed consent process made clear that participants were free to withdraw at any time, observations from pilot sessions suggested that students were receptive to the activity, and many indeed took pride in their work. Sharing drawings also appeared to provide a vehicle for more equitable participation in FGDs otherwise dominated by a minority of voices. I did not observe a gender difference in the ability to draw, as was reported in Ethiopia (Tekola et al. 2009).

Interviews and FGDs were conducted in participants' local language, Chitumbuka, by a skilled team of HDSS field staff. Data collection activities were audio-recorded with participants' consent and transcribed and translated into English by the same research team. Four transcripts—one per interviewer—were sent for external auditing by a MEIRU researcher based in Lilongwe. Since the errors identified during this process were minimal and minor, no further review of transcripts was undertaken.

Training and piloting

Prior to implementing the qualitative study, I designed and facilitated a comprehensive training programme comprising an overview of the research objectives, familiarisation with topic guides, mock interviews, transcription practice, and ethical considerations regarding consent and confidentiality. During this time, the team collectively agreed on substantive changes to the topic guides based on their local knowledge and expertise, as well as on appropriate Chitumbuka translations. Eight pilot IDIs and two pilot FGDs were conducted, after which topic guides were further revised to reflect emerging themes.

Ethics statement

The protocol for the nested qualitative study was reviewed and approved by the LSHTM Research Ethics Committee (Ref 10401) and the NHSRC in Malawi (Protocol 15/1/1509). The research was additionally authorised by the Karonga District Education Office. Written consent was received from a parent or guardian of each study participant by way of a signature or thumbprint, in addition to written assent from participants themselves.

Changes to fieldwork plans

My original proposal for the nested qualitative study included a set of focus group

discussions with parents or guardians of primary school students as well as another set with primary school teachers. Although these FGDs would have shed valuable light on school and community norms surrounding absenteeism, practices that support or hinder school attendance, procedures for monitoring attendance at school and in the community, and the decision-making process regarding attending or missing school, delays in obtaining local ethics approval meant that the time and resources available to carry out the study were significantly less than anticipated. I therefore took the decision to focus efforts on conducting the student IDIs and FGDs, with the consequence that school- and community-level perspectives are comparatively under-represented in my analysis. Conversations with teachers and district education officials during my time in Malawi, students' perceptions of school and community norms, as well as personal observations of local learning environments, nevertheless provided important context—see section 3.5.

Figure 3.7 Summary of nested qualitative study design and data

<div style="border:1px solid black; padding:10px;">

Implementation period: 4/2016-5/2016

Inclusion criteria: Young people aged 12-18 years in CAPS households and attending primary school in Karonga district

Data collection methods: In-depth interviews with timeline activity; focus group discussions with draw and tell exercise (see Appendix A3.8, A3.9 and A3.10)

Participant selection: Purposive sampling (IDIs), natural groups (FGDs)

Topics covered:

    IDIs: perceived barriers to school attendance; educational motivations and aspirations; household health status; economic and domestic responsibilities; missing school and educational engagement; perceived impact of CAPS cookstoves on health, schooling and time allocation (intervention group only).

    FGDs: perceived value of schooling; community norms surrounding education; challenges to regular school attendance; proposed measures to reduce absenteeism; perceived benefits and drawbacks of CAPS cookstoves (intervention group only).

</div>

3.5 Mixed methods design

Data collection and analysis were conducted in a sequential and iterative manner, whereby findings from preliminary analysis of the quantitative data informed design of the qualitative component, which in turn served to corroborate, explain, expand, or challenge

patterns observed in the quantitative data. Figure 3.8, adapted from Teddlie and Tashakkori (2009, p. 277), illustrates this approach diagrammatically. Although only one of the four research papers (Chapter 5) combines quantitative and qualitative data within a single analysis, taken collectively, this mixed methods thesis produces a more 'coherent, rational and rigorous whole' (Gorard and Taylor 2004, p. 4) than would each method achieve in isolation.

A key feature of mixed methods research involves combining the quantitative and qualitative components to draw 'meta-inferences', where 'inferences' comprise 'the researcher's interpretations and constructions of what their participants have expressed' (Teddlie and Tashakkori 2009, p. 288) and 'meta-inferences' provide an 'overall conclusion, explanation, or understanding developed through an integration of the inferences obtained from the qualitative and quantitative strands of a mixed methods study' (Tashakkori and Teddlie 2008, p. 101). The strength of meta-inferences depends on the quality of the constituent research components as well as the effectiveness with which they are combined (Onwuegbuzie and Johnson 2006).

I undertook several specific measures across each phase of the research process to enhance the validity of study findings. With respect to study design, by purposively sampling qualitative participants from the larger quantitative sample, I ensured that data generated from both sources were directly comparable (Cresswell and Plano Clark 2011). I also subjected both quantitative and qualitative data sources to quality checks, which resolved inconsistencies, reduced information loss due to missing values, and validated interview transcription and translation output. Importantly, I deliberately used each research strand to assess the validity of the other component, such as when I explored in the qualitative study incentives respondents may face to misreport absenteeism in the context of a household survey. Thirdly, I grounded the processes of analysis and interpretation in findings from previous literature (Teddlie and Tashakkori 2009). By integrating findings from previous quantitative, qualitative and mixed methods research in the narrative review presented in Chapter 2, I developed an analytic model that guided my subsequent research. In particular, I used the model to identify the strengths and weaknesses of available quantitative datasets and highlight gaps that could be addressed with qualitative data. I also continuously reflected on the extent to which my findings corresponded with research from elsewhere in Malawi and sub-Saharan Africa.

Finally, I familiarised myself as deeply as possible with the research context, both through the historical overview summarised in section 3.1 and through personal experiences and observations during two months in Karonga district in 2016. Although I am fully cognisant of my cultural and linguistic distance from the data (Liamputtong 2010; Temple et al. 2006)—as a non-Chitumbuka speaker, I relied on Malawian collaborators to facilitate entry into the study community (under the auspices of MEIRU), to conduct the IDIs and FGDs, and to translate and transcribe the qualitative data produced—I undertook several measures to enhance my understanding of the data. I accompanied field staff from the HDSS, CAPS, and qualitative study teams on data collection activities, and therefore gained valuable insight into the research process and setting. I also held weekly debriefing meetings with the field team (Temple et al. 2006), with which to address specific queries raised by preliminary data analysis as well gain more general understanding of the local education system, including grading, assessment and disciplinary procedures, and practices surrounding cooking, firewood and charcoal production. In this way, I viewed the research team as 'key informants' rather than neutral transmitters of messages (Edwards, cited in Temple and Young 2004). I additionally arranged visits to two primary schools in the study area as well as to the Karonga District Education Office to gain further insight into students' learning environments, the monitoring of student absenteeism at school and administrative levels, and perceptions of teachers and education officials about children's attendance. I kept detailed field notes of conversations and observations made during these encounters, which, although I did not analyse separately in the course of the study, proved valuable in helping to interpret my findings (Teddlie and Tashakkori 2009)

Despite these efforts, I nevertheless acknowledge a number of study features that potentially hinder validity. Because linguistic barriers precluded my direct involvement in qualitative data collection, I was unable to react to the data in real time, and thus unable to pursue new themes as they emerged. I was also unable to engage with the data in its original language, which may have resulted in loss of 'cultural meaning' (Temple and Young 2004), although in-depth debriefing sessions with the research team attempted to mitigate this. Perhaps most critically, limitations with respect to the range of variables included in the quantitative data, as well as time and resource constraints that restricted the scope of the nested qualitative study, mean that school- and community-level voices are under-represented. I further reflect on the implications of these omissions in Chapter 8.

Ultimately, by choosing to combine both quantitative and qualitative data in a single study, I have sought to create a 'whole' that is 'greater than the sum of its parts' (Onwuegbuzie and Johnson 2006, p. 59). While the large and representative sample from the quantitative component provides keys insights into the individual and household level determinants of absenteeism, the rich and nuanced data from the qualitative strand provide the detail necessary to understand and contextualise the patterns observed, as well as fill some important information gaps (Teddlie and Tashakkori 2009).

Figure 3.8 Sequential mixed methods design
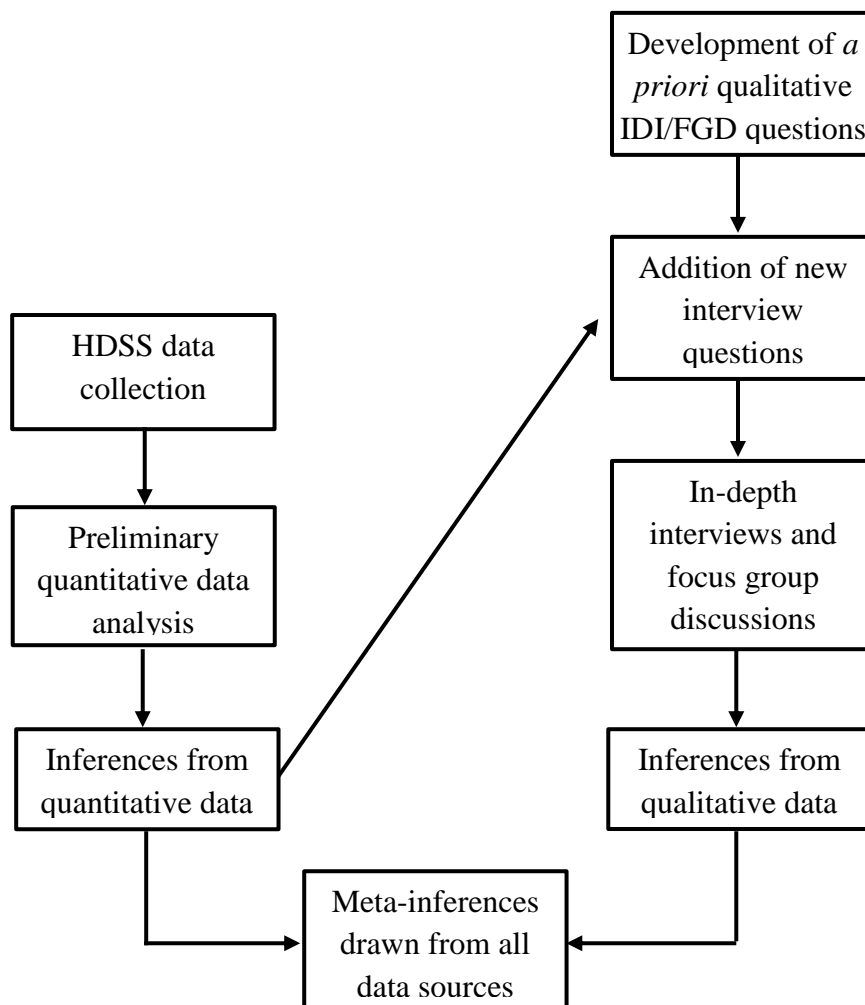
Source: Adapted from Teddlie & Tashakkori 2009, p.277, citing Carwile 2005, p.63

3.6 A note on interdisciplinarity

This thesis follows calls to think 'beyond sectors' for sustainable development (Waage and Yap 2015). As such, it makes a concerted attempt to move beyond traditional sectoral

'silos' to explore potential synergies between different fields (Waage et al. 2010). Situated primarily within the 'gender-education-health-poverty' thematic nexus identified within the coverage areas of the Sustainable Development Goals (Waage et al. 2010), it seeks to highlight reciprocal linkages between these sectors. By exploring additional linkages with clean energy—typically part of a separate 'climate-land-energy-water' cluster (Boas et al. 2016)—I thus explore new connections across these thematic areas, which have received less policy attention (Vladimirova and Le Blanc 2016).

In addition to examining synergies between sectors, I also combine research approaches from different disciplines within sectors. Although the analysis is rooted in epidemiological methods, it draws heavily on concepts, theories and techniques from a range of social science disciplines, including economics, education, demography and sociology, to address the set of research objectives outlined in Chapter 1. This interdisciplinary approach lends itself to 'analysing the complexity of the world' (Mollinga 2014), and specifically to identifying the diverse range of processes that influence school attendance in northern Malawi. By extending the scope of inquiry beyond the boundaries of one discipline, I aim to reach a more holistic understanding of the drivers and implications of school absenteeism in Karonga district than could be achieved from a single perspective (Nissani 1997). The thesis thus follows the approach advocated by Jones and Sumner (2009, p. 45), by combining mixed methods with an interdisciplinary outlook:

> [T]he multi-dimensionality of childhood well-being suggests the importance of a cross-disciplinary, mixed methods approach that combines quantitative and qualitative social sciences with insights from natural sciences.

3.7 Role of investigators

As described in section 3.4, this thesis is the product of multiple research programmes, some of which preceded my PhD. Before presenting my findings, I briefly describe my involvement with respect to these parent studies, as well as the contributions of other investigators who appear as co-authors on one or more of the enclosed research papers.

Judith Glynn (LSHTM), Kevin Mortimer (LSTM) and Mia Crampin (MEIRU/LSHTM) conceived of the thesis topic, and in particular the linkage between cleaner burning cookstoves and school absenteeism using data from HDSS and CAPS, based on an existing collaboration between the London School of Hygiene and Tropical Medicine and the

Liverpool School of Tropical Medicine. Prof Glynn, Deborah Johnston (SOAS), and Elaine Unterhalter (UCL Institute of Education) secured funding for the research under the auspices of a Bloomsbury Colleges PhD studentship, to which I successfully applied in 2014. They also served as primary and secondary supervisors, respectively, throughout my doctoral studies. In Malawi, Albert Dube assumed responsibility for overseeing data collection associated with the HDSS, Jullita Malava coordinated CAPS, and I managed data collection associated with the nested qualitative study. Four members of MEIRU staff—Levie Gondwe, Green Kapila, Aaron Ndovi and Cecilia Nyirenda—conducted the IDIs and FGDs with primary school students.

I had no role in the either the design or evaluation of the CAPS trial, nor did I contribute content to HDSS surveys that preceded my tenure at LSHTM, but I benefitted from unfettered access to data from both parent studies. In compiling this thesis, I established the overarching research objectives described in Chapter 1 as well as the analysis plan for each individual paper. I undertook all data coding and analysis and wrote all thesis content, under the guidance of my supervisors. In research papers, use of the pronoun 'we' reflects work conducted by me with the input of co-authors.

Figure 3.9 shows the timeline of research activities vis-à-vis my doctoral research.

This chapter has set the scene for the forthcoming set of research papers by exploring the historical, economic and environmental features of the study area that inform contemporary trends, and describing the combination of data sources that will be employed to address the research objectives. In recognition of the complexity of the processes driving educational exclusion, as well as the contribution of both quantitative and qualitative approaches in producing a nuanced understanding of absenteeism trends and influences, the thesis adopts an interdisciplinary, mixed methods approach. The analysis begins with a statistical analysis of the individual- and household-level determinants of primary school absenteeism, with particular focus on unpacking the interplay between different dimensions of socioeconomic status.

Figure 3.9 Timeline of research activities
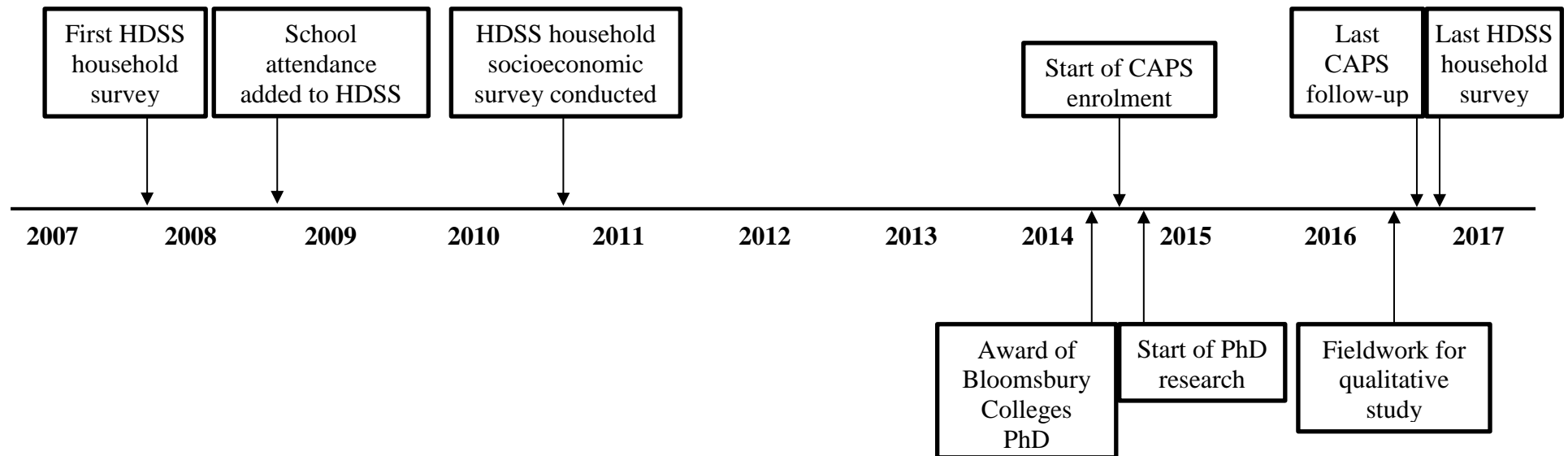
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SECTION A – Student Details

Student	Christine Kelly
Principal Supervisor	Judith Glynn
Thesis Title	School absenteeism in Karonga district, northern Malawi: Trends, influences and the impact of cleaner burning biomass-fuelled cookstoves

If the Research Paper has previously been published please complete Section B, if not please move to Section C

SECTION B – Paper already published

Where was the work published?			
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SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	International Journal of Educational Development
Please list the paper's authors in the intended authorship order:	Christine A. Kelly, Deborah Johnston, Elaine Unterhalter, Amelia C. Crampin, Albert Dube, Judith R. Glynn
Stage of publication	**Submitted**

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	With input from co-authors, I designed the study, managed the data, conducted the analysis and wrote the manuscript

Student Signature: _____ Date: 16/10/2017

Supervisor Signature: _____ Date: 16.10.17

Re-examining the link between socioeconomic status and school absenteeism: Evidence from primary school students in northern Malawi

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Abstract

This paper explores the ways that five dimensions of socioeconomic status—agricultural wealth, non-agricultural household wealth, credit access, parental education and household occupation—influence children's primary school attendance in both complementary and opposing ways. Drawing on data from 9,851 students in Karonga district, northern Malawi over the 2010-2011 school year, we find that absenteeism for both girls and boys was associated with increasing levels of agricultural wealth but with decreasing levels of other socioeconomic indicators. We highlight that primary school absenteeism is not restricted to children from the poorest households if multiple dimensions of socioeconomic status are considered.

Highlights

- Socioeconomic status is conceptualised in five dimensions.
- 16% of primary school students missed one or more days of school in the past four weeks.
- Absenteeism was associated with increasing levels of agricultural wealth but with decreasing levels of other socioeconomic indicators.
- Primary school absenteeism in Malawi is not restricted to the poorest children if multiple dimensions of SES are considered.

4.1 Introduction

Links between poverty and school enrolment, attendance and attainment are well attested in the education literature (e.g. Filmer 2005; Lewin 2009; Lewin and Sabates 2012; UNESCO 2016). Both within and across countries, children living in the poorest households are more likely to have never attended school and to drop out early (UNESCO 2016). Poverty prevents students from meeting the direct or indirect costs of schooling, and encourages their participation in activities for which the social and economic returns are higher (Kendall 2007). However, macro-level models that show an inverse relationship between income and school attendance or attainment (e.g. UNESCO 2016) obscure complex household-level processes that help determine children's educational outcomes. Indeed, previous research has recognised that 'loss of schooling cannot be accounted for solely by poverty' (Pridmore and Jere 2011, p. 520), while studies of rural households in low-income countries have shown that adverse educational pathways are not necessarily restricted to the most deprived (Bhalotra and Heady 2003; Hazarika and Sarangi 2008; Shimamura and Lastarria-Cornhiel 2010).

Analyses of the relationship between poverty and school attendance, particularly in agricultural contexts, requires a nuanced approach. Exclusive reliance on a single indicator of monetary poverty—such as household income—may not provide a comprehensive picture of the socioeconomic mechanisms behind educational exclusion. This paper explores the relationship between five dimensions of socioeconomic status (SES) and school absenteeism among primary school students in northern Malawi. As described further below, it specifically acknowledges the independent, and potentially opposing, ways that agricultural wealth, non-agricultural household wealth, credit access, parental education and household occupation influence children's school attendance.

The analysis focuses specifically on school absenteeism, as opposed to non-enrolment, grade repetition, or dropout, which have received considerably more attention in policy discourse and international education targets including the Sustainable Development Goals. Absenteeism, however, represents an important precursor to these adverse educational outcomes. Students who miss school regularly are likely to be less exposed to curriculum content (Abadzi 2004), and vulnerable to exclusionary practices from teachers and peers (Lockheed and Harris 2005) or to disengagement from education (Kearney 2008), all of which may increase risk of poor performance, grade repetition and dropout. Identifying

students most at risk of irregular school attendance is therefore critical to arrest adverse educational trajectories, but where school absences have been formally evaluated—for example during assessments conducted by the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) (e.g. Milner et al. 2011)—analyses typically document simple levels and reported reasons for absenteeism, without exploring the wider set of proximal and distal determinants of missing school.

In examining the relationship between different dimensions of SES and school attendance, this paper aims to highlight the role of household-level influences of absenteeism, and in particular, the multiple socioeconomic processes associated with missing school. The analysis harnesses a large dataset of primary school students in a rural area of Karonga district, northern Malawi. Malawi became an early adopter of the Education for All goal of fee-free primary education in 1994, but its education system remains characterised by poor rates of retention, completion and skills acquisition (Taylor and Spaull 2015; World Bank 2010). In light of these continued challenges, detailed investigation of the extent of and reasons for absenteeism in Malawi is opportune.

4.1.1 Conceptual framework

Previous research has established both conceptual and empirical links between different dimensions of SES and children's school attendance, although they are rarely examined collectively, as is our aim here. Drawing on previous literature, we start by building a conceptual model of the expected relationships between five indicators of SES—household wealth, agricultural wealth, credit access, parental education and household occupation— and school attendance, with which to inform the subsequent analysis.

Common measures of household wealth, such as income, consumption, or asset ownership, reflect a household's ability to meet the direct or indirect costs of schooling, which have been identified as key barriers to daily school attendance across sub-Saharan Africa. Monetary poverty has prevented children from attending school regularly due to lack of soap to wash clothes (Pridmore and Jere 2011), inability to pay school fees on time (Mukudi 2004), lack of money for transport (Porter et al. 2011), or food insecurity (Belachew et al. 2011). Poverty also raises the opportunity cost of schooling, causing students miss school in order to perform household chores, work in the family business, or earn additional income through paid labour (Huisman and Smits 2009). We would therefore expect to

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observe a negative relationship between household wealth and school absenteeism, such that children from wealthier households are less likely to miss school than their poorer counterparts.

Land and livestock ownership is typically strongly associated with household income (Basu et al. 2010) so could be predicted to demonstrate the same negative relationship with school absenteeism as household wealth. However, in the absence of functioning labour markets, access to these productive assets may in fact increase students' propensity to miss school via increased demand for child labour (Cockburn and Dostie 2007). Large landowners who cannot hire sufficient workers to meet labour demand may instead be forced to employ their children (Bhalotra and Heady 2003)—at least until the household is so well-off it will not want resident children to work (Basu et al. 2010)—with adverse consequences for students' school attendance. Using data from Ghana and Pakistan, Bhalotra and Heady (2003) identified a 'wealth paradox' in school attendance among students in Pakistan (but not in Ghana), in which girls from households with larger farms were more likely to spend fewer hours in class, relative to girls from households with smaller land endowments.

Even in the absence of market failures, there may be additional incentives for children to gain experience working on family farms if they stand to inherit the land in their adult years (Bhalotra and Heady 2003), or if the expected returns to education are low (Rolleston 2009). Children in agricultural households may also increase their share of household chores if farm work absorbs all available adult effort (Webbink et al. 2012), with negative implications for school attendance. The nature of the relationship between agricultural wealth and school absenteeism is therefore ambiguous, and may not simply align with that of household wealth.

Previous research suggests that access to credit plays a greater role than household income per se in determining children's school enrolment, since income constraints can be compensated for by borrowing (Ersado 2005). In the same way, households with access to credit may be able to better weather temporary economic shocks that could otherwise result in children's absenteeism than those with no means of smoothing income fluctuations (Amendah et al. 2014). Hazarika and Sarangi (2008) showed in Malawi, however, that improved access to microcredit increased children's involvement in domestic work as compensation for parents' participation in credit-stimulated household enterprises.

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Although the authors did not find a significant impact of credit access on children's school attendance, they posited that reduced leisure time and work-induced fatigue would lead to adverse educational outcomes. A subsequent Malawian study showed that agricultural credit uptake delayed school enrolment among young female children, but found limited evidence of a trade-off between school attendance and domestic chores (Shimamura and Lastarria-Cornhiel 2010). Thus, as with agricultural wealth, the observed relationship between credit access and school absenteeism cannot necessarily be predicted a priori.

Education status is frequently used as an indicator of human capital to capture knowledge or skills-related assets (Galobardes et al. 2007), and is also typically correlated with income and earning potential (Burke and Beegle 2004). Parental education may thus yield a direct income effect on children's school attendance, as well as reflect a general preference for education. We would therefore expect to observe lower absenteeism levels among children with comparatively highly educated parents.

Like education, occupation is strongly related to income, so household occupation has potentially important implications for children's education through its impact on material resources (Galobardes et al. 2007). Household heads engaged in occupations where education is valued may also make greater effort to ensure that resident children attend school regularly. On the other hand, household occupation may adversely affect school attendance via demand for child labour. The opportunity cost of school attendance will likely be higher for children in households engaged in labour-intensive livelihoods, such as farming, relative to those in non-manual occupations (Huisman and Smits 2009). This has been reflected in seasonal patterns of absence that correspond with demanding periods in the agricultural calendar (Hadley 2010). The association between parental occupation and children's absenteeism thus depends on the relative importance of income, preferences and labour demand in household schooling decisions.

Figure 4.1 summarises the expected relationships between each dimension of household socioeconomic status and school absenteeism diagrammatically.

Figure 4.1 Expected direction of relationship between five dimensions of household socioeconomic status and school absenteeism
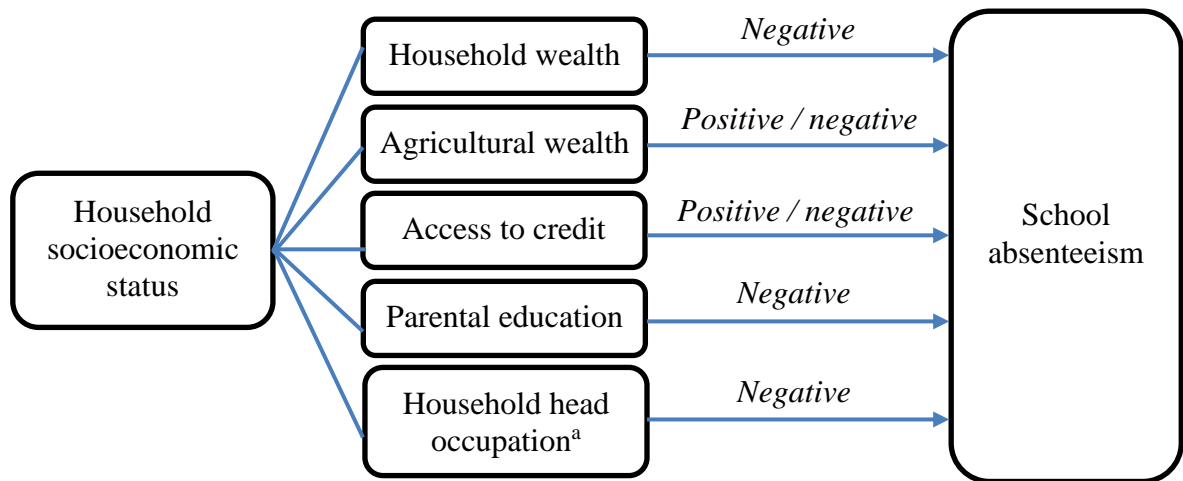
ᵃ Expected relationship when moving from more manual to less manual occupation

Analyses of the relationship between SES and absenteeism must equally consider other factors that influence students' school attendance, or confound the relationship between SES and absenteeism. Gender relationships play a role in the value that households attach to education for different members (Kazeem et al. 2010), or to the type or intensity of work allocated to boys and girls (Lyon et al. 2013), which may affect the regularity with which they attend school. Studies from Ghana, Malawi and South Africa have also shown that male and female students face different challenges with respect to school journeys, with parents more reluctant to allow daughters than sons to walk long distances, cross rivers, or use busy roads to get to school (Avotri et al., cited in Porter et al. 2011). The perceived risk of physical attack or rape, particularly when travelling alone, disproportionately affects girls (Porter et al. 2010a; Porter et al. 2010b).

Students' age and birth order may similarly affect their ability to attend school daily, especially when domestic and economic responsibilities are distributed unequally among household members. Evidence from Nepal suggests that older siblings, particularly girls, assume a greater burden of domestic work than do younger children, increasingly so with each additional younger sibling (Edmonds 2006). Older students have also been shown in Mali to substitute for adult labour in the event of parental illness or other labour shortage (Dillon 2013), or in Malawi to sacrifice their own educational needs to facilitate their younger siblings' attendance (Pridmore and Jere 2011).

Household size and composition influence children's school attendance in a number of potentially opposing ways. Large households may have greater difficulty meeting the costs of schooling for all resident children, but may equally have more incomes on which to draw. Similarly, child labour demands, and resulting absenteeism, may be greater in large households due to having more members to support, but if work responsibilities are allocated between more members, this may increase time available for schooling (Webbink et al. 2012). The sex of the household head has also been shown to influence the school attendance of resident children through varying levels of investment in education. Research from seven sub-Saharan African countries suggests that, for a given level of socioeconomic resources, students living in female-headed households experience better schooling outcomes than those living in male-headed households, although absenteeism was not measured specifically (Lloyd and Blanc 1996). Conversely, Dreibelbis et al. (2013) found that boys and girls living in female-headed households in Kenya demonstrated increased probabilities of missing school relative to peers in male-headed households.

The value households place on educating resident children may also depend on the relationship of these children to the household head. Child fostering in low-income countries is common both as a means of facilitating better access to education through extended kinship networks and to help meet labour demands in recipient households (Grant and Yeatman 2014), so can either enhance or reduce students' school attendance. Particularly in HIV-affected areas of sub-Saharan Africa, orphanhood also results in children living with caregivers other than their biological parents. While the actual event of parental death has been linked with periods of school absence (Ainsworth et al. 2005; Evans and Miguel 2007), intra-household discrimination against orphans who live with caregivers can also prevent them from attending school regularly (Pridmore and Jere 2011).

Finally, households' investment in children's education—and indeed students' own desire to attend school daily—is likely to be influenced by children's motivation and aptitude, or perceptions thereof. Data from Kenya has suggested that caregivers choose to direct scarce household resources towards the most promising students (Evans and Miguel 2007), while a study of Ethiopian adolescents has shown that absenteeism was inversely related to students' educational aspirations (Belachew et al. 2011). In the context of Malawi, where school dropout is high and progression to secondary school is determined on the basis of high stakes entrance exams (de Hoop 2011), we would thus expect school absenteeism to

decrease with grade attained as the composition of students remaining in school becomes more selective, and as proximity to exams approaches.

Combining the five socioeconomic dimensions of interest, as well as other individual- and household-level factors that may influence absenteeism, Figure 4.2 shows the model used to guide the empirical analysis.

Figure 4.2 Individual- and household-level determinants of school absenteeism

Household factors
- **Household wealth**
- **Agricultural wealth**
- **Access to credit**
- **Primary occupation**
- Number of household members
- Younger household members
- Sex of household head
- Distance to school
- Season of interview

Individual factors
- Sex
- Age
- **Parental education**
- Orphanhood status
- Relationship to household head
- Recent economic participation
- Grade attended
- Grade repetition
- School attended

Household

Individual

(Reporting of)
School absenteeism

Note: Socioeconomic factors highlighted in bold; individuals nested within households

4.1.2 Education in Malawi

Discussion of school attendance and absence in Malawi must be understood in the context of expanding education provision over the past twenty years. Malawi became one of sub-Saharan Africa's first adopters of free primary education (FPE) when the government abolished primary school fees in 1994. Within six months of the announcement the number of enrolled primary school students nearly doubled (Chisamya et al. 2012), but the limited planning and rapid implementation of FPE placed considerable strain on personnel and infrastructure (Chimombo 2009). Despite maintaining nearly universal enrolment in the

early years of primary school, which consists of eight grades ('standards'), high rates of grade repetition and dropout characterise the system: according to UNESCO's estimates, the primary school completion rate stands at 54% (UNESCO 2016). Malawian students also perform consistently poorly on standardised assessments relative to counterparts in regional neighbours. For example, in the latest set of SACMEQ tests in 2007, just 63% of Malawian students in standard 6 demonstrated functional literacy and 40% functional numeracy, compared to figures approaching 90% in both subjects among counterparts in Kenya, Tanzania and Swaziland (Taylor and Spaull 2015).

Among studies that have examined absenteeism in Malawi, all have found relatively high levels. The 2007 SACMEQ assessment found that standard 6 students missed an average of 1.7 school days in the past month (Milner et al. 2011), while a cross-country comparison of weekly absence rates using data from the 2005-6 Multiple Indicator Cluster Surveys (MICS) showed that 15% of Malawian students aged 10-19 missed two or more school days in the preceding week, second only to Guinea-Bissau among the twelve sub-Saharan African countries studied (Loiaza and Lloyd 2008).[19] According to a school-based survey of 1,675 adolescents from Malawi's southern region, 20% of primary school students aged 14-16 were absent on the most recent school day and more than half missed at least one school day in the previous two weeks (Grant et al. 2013). Thus, despite sustained efforts to expand education provision, irregular school attendance poses an issue of concern.

4.2 Data and methods

4.2.1 Research site

This paper uses data from the Karonga Health and Demographic Surveillance System (HDSS), which has collected annual sociodemographic data about a population of more than 30,000 people since 2002, and school attendance information since 2008. Data for the present analysis are drawn from the 2010-2011 survey, when the most comprehensive set of economic indicators was collected. The survey was conducted in ~7,250 households in the catchment area over the 12-month period from September-August, mirroring the school calendar. Respondents were household members aged 15 years or older who were at home at the time of the field team's visit; as such, most school attendance data was provided by

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[19] Absenteeism was lowest in Cote d'Ivoire, with fewer than 2% of students reportedly missing two or more days in the previous week.

an adult household member, usually a parent, on behalf of resident children.

The study site, which covers approximately 135 km^2 in Karonga district, northern Malawi (see Figure 3.2), is predominantly rural, with an economy based upon subsistence agriculture, petty trading and fishing (Crampin et al. 2012). The climate is hot and dry from September to November, followed by the rainy season December-April, and a cool and dry period May-August (National Statistical Office 2012). The farming season begins with planting in November; the peak harvest period typically occurs between February and April (Hazarika and Sarangi 2008).

The area is populated mainly by members of the Tumbuka tribe, who are patrilineal, predominantly Christian, and represent approximately 9% of the Malawian population (Floyd et al. 2007; National Statistical Office 2008). HIV prevalence in the HDSS catchment area was estimated at 7.1% among men and 9.2% among women in 2008/2009 (Floyd et al. 2013).

4.2.2 Study population

The analytic sample comprises 5,231 boys and 4,620 girls aged 5-20 years, enrolled in Karonga district primary schools at the time of the 2010-2011 survey and for whom relevant data were available. Thirty-seven boys and 45 girls who attended schools outside Karonga district were excluded from the analysis, as were 22 boys aged older than 20 years who were reported to attend primary school.[20] To avoid the problem of perfect correlation with absenteeism in regression models (i.e. where no absenteeism was reported among students in the same school), 68 boys and 90 girls from schools with fewer than 15 male or female observations, respectively, were additionally omitted. Where possible, missing values for students' background characteristics were recovered based on observations from previous survey rounds, but the analytic sample excludes 172 boys and 162 girls missing one or more covariates (see Figure 4.3). Sixty boys and 52 girls for whom the number of absence days was missing, but for whom no reason for absenteeism was provided, were coded as not having missed school.

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[20] As a result of delayed entry, temporary withdrawal from school, and grade repetition, it is common for Malawian students to remain in primary school beyond age 14 (World Bank 2010). One survey question (about recent economic participation) was asked only of students aged 5-20 so the analysis is restricted to these ages.

Figure 4.3 Flow diagram of school attendance and data availability of boys (left) and girls (right) aged 5-20 years in the Karonga Health and Demographic Surveillance System (HDSS) survey population, 2010-11
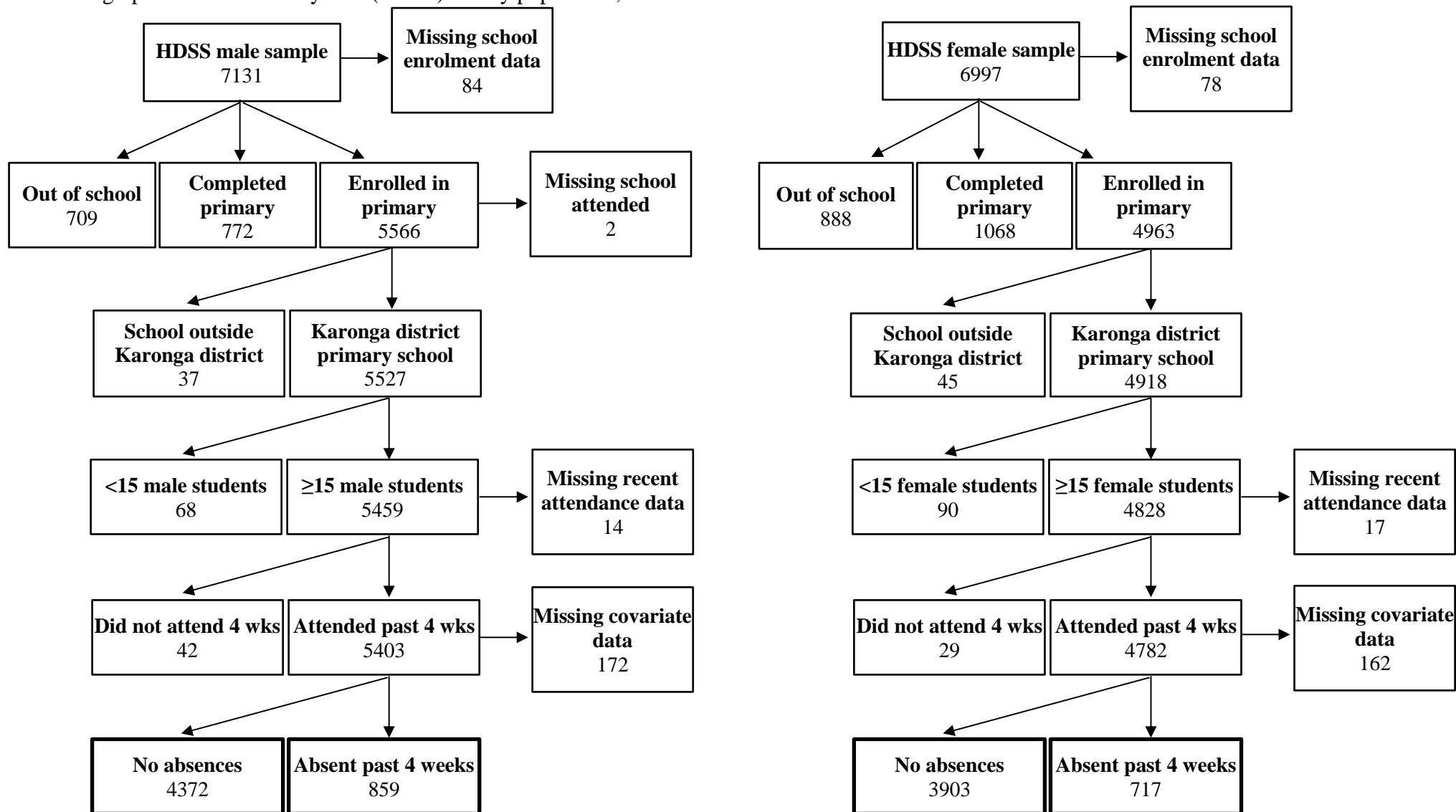
4.2.3 Statistical methods

Analyses were conducted in Stata 14.2 (College Station, TX). A binary measure of any absence from school in the past four weeks, among those who had attended at least one day, served as the primary outcome variable. The indicator excludes the small proportion of boys and girls who were enrolled in school but did not attend at all in the past four weeks (see Figure 4.3). These individuals would be more appropriately considered 'temporary dropouts' (Ananga 2011), whose reasons for non-attendance may differ from those students whose absences were more short-term in nature.

Independent variables included the five socioeconomic dimensions shown in Figure 4.1: agricultural wealth, non-agricultural wealth, household credit access, parental education, and household head occupation. Two asset indices were generated using principal components analysis (PCA) (Howe et al. 2008; Vyas and Kumaranayake 2006) to capture household and agricultural wealth, respectively. The household wealth index included ownership of 15 durable goods,[21] a variable indicating the household's ability to buy bathing soap in the past four weeks, and eight measures of housing quality, based on classifications used in the 2010 Malawi Demographic and Health Survey (National Statistical Office and ICF Macro 2011).[22] Continuous variables, such as the number of rooms per household member, were normalised between 0 and 1 and combined with the remaining binary variables in the PCA. The resultant asset score was divided into quintiles representing increasing household wealth.

The second index captured agricultural wealth by combining the number of land plots owned and cultivated by the student's household; the number of plots cultivated but not owned; sales of maize, rice and groundnut crops; ownership of cattle, chicken, goats, pigs, ducks, and doves; and ownership of a hoe, plough, panga, axe, wheelbarrow, fishing net, canoe and oxcart. An index score was generated using PCA, from which agricultural wealth quintiles were created.

Households with access to credit were defined as those that received a loan from a bank,

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[21] These 15 goods were: table, chairs, clock, bed, mattress, radio, bicycle, sewing machine, mobile phone, tape/CD player, electric fan, iron, television, refrigerator and clay water pot.

[22] The eight measures of housing quality were: dwelling ownership, number of rooms per household member, finished walls, concrete floor, iron roof, VIP latrine or flush toilet, improved water source, and access to electricity.

microcredit institution or employer in the past year, or those in which one or more members belonged to a savings group. We recognise that this indicator is neither an exhaustive measure of a household's borrowing options, nor entirely exogenous, since households who are most concerned with ensuring that their children do not miss school may also be most likely to take measures to mitigate against income-related absences (Hazarika and Sarangi 2008). However, by extending our measure of credit access beyond just those households that have received a bank loan, we attempt to include households with the potential to borrow, and not only those who have exercised the possibility.

Finally, binary measures of maternal and paternal education (less than primary/completed primary) were generated, and the principal occupation of the household head grouped to compare farming and fishing households with other skilled and unskilled occupations.

Table A.2 in the Appendix shows the distribution of students according to each dimension of SES, as well as tests for potential multicollinearity between the indicators. Although each of the SES measures was significantly associated with household wealth, the pairwise correlation coefficients, as well values of the variance inflation factor (VIF) for the six indicators in combination, suggest that sufficient variation exists to allow all six measures to be included simultaneously in multivariable regression models without encountering multicollinearity (Chen et al., n.d.).

Additional covariates comprised the range of characteristics listed in Figure 4.2. Individual-level variables reflected students' demographic characteristics, educational attainment, orphanhood and residence status, as well as participation in economic activities in the past four weeks. The survey defined economic activities as farming, fishing, gathering natural products, piece work, preparing and selling food or beverages, selling goods manufactured by the household, or providing a service. Household-level variables included the number of household members, the number of household members younger than the index student and the sex of the household head. Distance to school was calculated from the GPS coordinates of each student's household and school using the *geodist* command in Stata.[23] Finally, we also investigate temporal patterns in absenteeism, by generating a variable indicating the season of interview (hot, wet or cool). The relationship of the survey respondent to the

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[23] Note that this variable measures the straight-line distance between the household and school and not necessarily the actual distance students travel.

index student (informant type) was also recorded, but was not ultimately included in regression models due to overlap with the relationship to household head.

Following a descriptive exploration of absenteeism prevalence and reported reasons for missing school, two-level logistic regression models estimate the individual- and household-level correlates of absenteeism in the past four weeks. Models were conducted in a stepped fashion to investigate the relationship between the six socioeconomic indicators and absenteeism 1) in isolation, 2) in combination and 3) upon conditioning for other background characteristics. Covariates were measured contemporaneously with absenteeism. Correlation of observations within households was accounted for in regression models by including household random effects, which also allows for examination of heterogeneity among households. In order to assess gendered patterns of absenteeism, separate male and female regression models were estimated.

4.3 Results

4.3.1 Descriptive findings

Table 4.1 compares the characteristics of boys and girls in the analytic sample. Female students were significantly younger than their male counterparts, attended earlier standards, and were less likely to have repeated their current standard. A slightly but significantly higher proportion of boys than girls undertook economic activities in the previous four weeks (17.8% vs. 15.8%, p=0.007), and the activities in which students engaged also significantly differed along gendered lines. The majority of both boys and girls who participated in economic activities engaged in farming, but a higher proportion of boys did so than girls (85.6% vs 79.0%). Boys were also more likely to take part in piece work and fishing, while girls were more likely to provide a service, gather natural products, and prepare or sell food or beverages.

At the household level, most household heads were male and engaged in subsistence farming, but girls were slightly more likely than boys to live in households with heads in skilled occupations. With respect to interview characteristics, most surveys were administered during the wet season (December-April), with comparatively few occurring during the hot season at the start of the school year. The vast majority of survey responses were provided by household proxy respondents, as opposed to students themselves.

Table 4.1 Characteristics of primary school students aged 5-20 who attended at least one school day in the past 4 weeks

	Boys (N=5231)		Girls (N=4620)		
Socioeconomic characteristics	**n**	**%**	**n**	**%**	
Household wealth quintile					
Lowest	1,069	20.4	903	19.5	
2	1,079	20.6	912	19.7	
3	1,047	20.0	926	20.0	
4	1,043	19.9	929	20.1	
Highest	993	19.0	950	20.6	
Agricultural wealth quintile					†
Lowest	995	19.0	964	20.9	
2	1,029	19.7	934	20.2	
3	1,048	20.0	931	20.2	
4	1,079	20.6	904	19.6	
Highest	1,080	20.6	887	19.2	
Household access to credit (bank loan or savings group)					
No	4,149	79.3	3,630	78.6	
Yes	1,082	20.7	990	21.4	
Father's education					
None/primary	3,221	61.6	2,801	60.6	
Post-primary	2,010	38.4	1,819	39.4	
Mother's education					
None/primary	4,418	84.5	3,864	83.6	
Post-primary	813	15.5	756	16.4	
Occupation of household head					**
Subsistence farmer/herder	3,553	67.9	3,058	66.2	
Fisherman	266	5.1	215	4.7	
Other non-skilled	726	13.9	636	13.8	
Skilled	557	10.6	610	13.2	
Not working	129	2.5	101	2.2	
Individual characteristics					
Age (years)					***
5-11	3,116	59.6	2,997	64.9	
12-14	1,216	23.2	1,132	24.5	
≥15	899	17.2	491	10.6	
Standard					*
1-4	3,205	61.3	2,807	60.8	
5-7	1,520	29.1	1,427	30.9	
8	506	9.7	386	8.4	
Repeated current standard					***
No	3,507	67.0	3,355	72.6	
Yes	1,724	33.0	1,265	27.4	
Father died					
No	4,598	87.9	4,099	88.7	
Yes	633	12.1	521	11.3	
Mother died					
No	4,977	95.1	4,418	95.6	
Yes	254	4.9	202	4.4	

Table 4.1 continued Characteristics of primary school students aged 5-20 who attended at least one school day in the past 4 weeks

	Boys (N=5231)		Girls (N=4620)		
	n	%	n	%	
Relationship to household head					***
Child	3,890	74.4	3,297	71.4	
Step-child	133	2.5	162	3.5	
Grandchild	862	16.5	769	16.6	
Other	345	6.6	392	8.5	
Economic participation past 4 weeks					**
None	4,300	82.2	3,892	84.2	
Yes	931	17.8	728	15.8	
Primary economic activity, among those with economic participation					***
Farming	797	85.6	575	79.0	
Providing a service	35	3.8	57	7.8	
Buying/selling other people's products	28	3.0	33	4.5	
Fishing	16	1.7	0	0.0	
Piece work	14	1.5	4	0.5	
Gathering natural products	6	0.6	11	1.5	
Preparing/selling food/beverages	17	1.8	31	4.3	
Selling own goods	7	0.8	8	1.1	
Other	3	0.3	1	0.1	
Unknown/missing	8	0.9	8	1.1	
<u>**Household characteristics**</u>					
Number of household members					
1-4	763	14.6	694	15.0	
5-8	3,598	68.8	3,189	69.0	
≥9	870	16.6	737	16.0	
Number of younger residents					*
0-1	2011	38.4	1,818	39.4	
2-3	2,327	44.5	2,102	45.5	
≥4	893	17.1	700	15.2	
Sex of household head					
Male	4,305	82.3	3,778	81.8	
Female	926	17.7	842	18.2	
Distance to school					†
<1 km	2,887	55.2	2,567	55.6	
1-2 km	1,745	33.4	1,590	34.4	
>2 km	599	11.5	463	10.0	
Season of interview					
Hot (Sept-Nov)	848	16.2	696	15.1	
Wet (Dec-Apr)	2,779	53.1	2,478	53.6	
Cool (May-Aug)	1,604	30.7	1,446	31.3	
Survey Informant type					*
Self	87	1.7	106	2.3	
Parent	3,781	72.3	3,248	70.3	
Other	1,363	26.1	1,266	27.4	

† $p<0.1$ * $p<0.05$ ** $p<0.01$ *** $p<0.001$

Notes: Excludes 37 boys and 45 girls were enrolled in schools outside Karonga district; 68 boys and 90 girls were attending schools with fewer than 15 male and female observations, respectively, in the catchment area; and 172 boys and 162 girls missing one or more characteristic. P-values refer to chi-squared tests for independence of the distributions across categories between boys and girls.

Table 4.2 shows the prevalence of school absenteeism among male and female students enrolled in primary school in Karonga district. Among those who had attended school in the four weeks preceding the survey, 16.0% (16.4% of boys, 15.5% of girls) missed one or more days during this period. Most of these students missed four days or fewer, but approximately one-fifth missed five or more. No significant gender differences were observed in either the prevalence of absenteeism or the number of school days missed.

The reasons reported for missing school were also very similar for boys and girls. The majority of absences for both sexes were attributed to illness (72.3% for boys, 75.7% for girls), while considerably smaller proportions were ascribed to lack of money for transport, meals or school supplies and to lack of interest in school. Absences attributed to household chores were consistently low, as were those attributed to participation in economic activities, although a significantly higher proportion of boys than girls were absent for the latter reason (1.9% versus 0.7%, p=0.04).

Table 4.2 Prevalence of and primary reason for primary school absenteeism in the past 4 weeks; n(%)

	Boys (N=5231)	Girls (N=4620)
Missed ≥1 day	859 (16.4)	717 (15.5)
Number of days missed (among absentees)		
1	169 (19.7)	164 (22.9)
2-4	505 (58.8)	405 (56.5)
≥5	185 (21.5)	148 (20.6)
Primary reason for missing school		
Illness (own)	621 (72.3)	543 (75.7)
No money transport/meals/supplies	59 (6.9)	44 (6.1)
No interest in school	43 (5.0)	35 (4.9)
Parental illness/death	32 (3.7)	24 (3.4)
Economic activities	16 (1.9)	5 (0.7)
Household chores	10 (1.2)	12 (1.7)
Caregiving, household child	12 (1.4)	7 (1.0)
Caregiving, household adult	7 (0.8)	3 (0.4)
Other	42 (4.9)	36 (5.0)
Reason missing	17 (2.0)	8 (1.1)

† p<0.1 * p<0.05 ** p<0.01 *** p<0.001

Notes: Respondents could list up to two reasons for absence but multiple reasons were provided for only 14 (1.6%) boys and 16 girls (2.2%). The table includes only the first, or most important, reason listed. The 'other' category includes no money for fees, distance to school, suspension from school, poor school quality, household instability, and other unspecified responses. No significant differences were found in chi-squared tests for independence of absence days or reasons by sex.

Figure 4.4 explores temporal patterns in school attendance reporting by presenting absenteeism prevalence for boys and girls, as well as corresponding reasons reported for missing school, according to month of interview. The superimposed seasonal boundaries indicate that absenteeism was highest among households interviewed during the hot season at the start of the school year, as well as those interviewed in the middle of the rainy season. The figure also investigates the extent to which reporting of absenteeism may be influenced by the timing of survey administration relative to school holidays. Although the survey question explicitly specified absences during the most recent four weeks that school was in session, there is some evidence—particularly around the December break—that reporting of absenteeism was lower during or closely following a school holiday. This could reflect a genuine improvement in attendance in the weeks surrounding a school break, that respondents included school holidays in the four-week absenteeism reporting period thus reducing the window of risk, or that respondents forgot about episodes of absenteeism when it was longer ago.

4.3.2 Regression results

Table 4.3 presents unadjusted (Model 1) and adjusted (Models 2 and 3) odds ratios for absenteeism in the past four weeks among girls and boys who attended at least one day of school during that period. Several of the SES indicators demonstrated strong and significant associations with student absenteeism across all three model specifications, but in opposite directions. After adjusting for all other covariates, absenteeism decreased with household wealth quintile for both boys and girls (boys adjusted odds ratio (AOR) 0.86 [95% confidence interval (CI) 0.75-0.98]; girls AOR 0.84 [0.72-0.96]). Household credit access, too, was consistently associated with lower absenteeism for both boys and girls (boys AOR 0.53 [0.35-0.80]; girls AOR 0.60 [0.39-0.93]), although the relationship was slightly attenuated relative to the unadjusted model. By contrast, absenteeism increased with agricultural wealth quintile (boys AOR 1.24 [1.09-1.41]; girls AOR 1.34 [1.17-1.54]). Absenteeism was also higher in unadjusted models among students living in households in which the primary occupation of the household head was in agriculture, and among boys with less educated fathers, but these effects did not persist once other socioeconomic indicators were included in Model 2.

Figure 4.4 Prevalence of and principal reason reported for missing school in the past four weeks, by sex and interview month
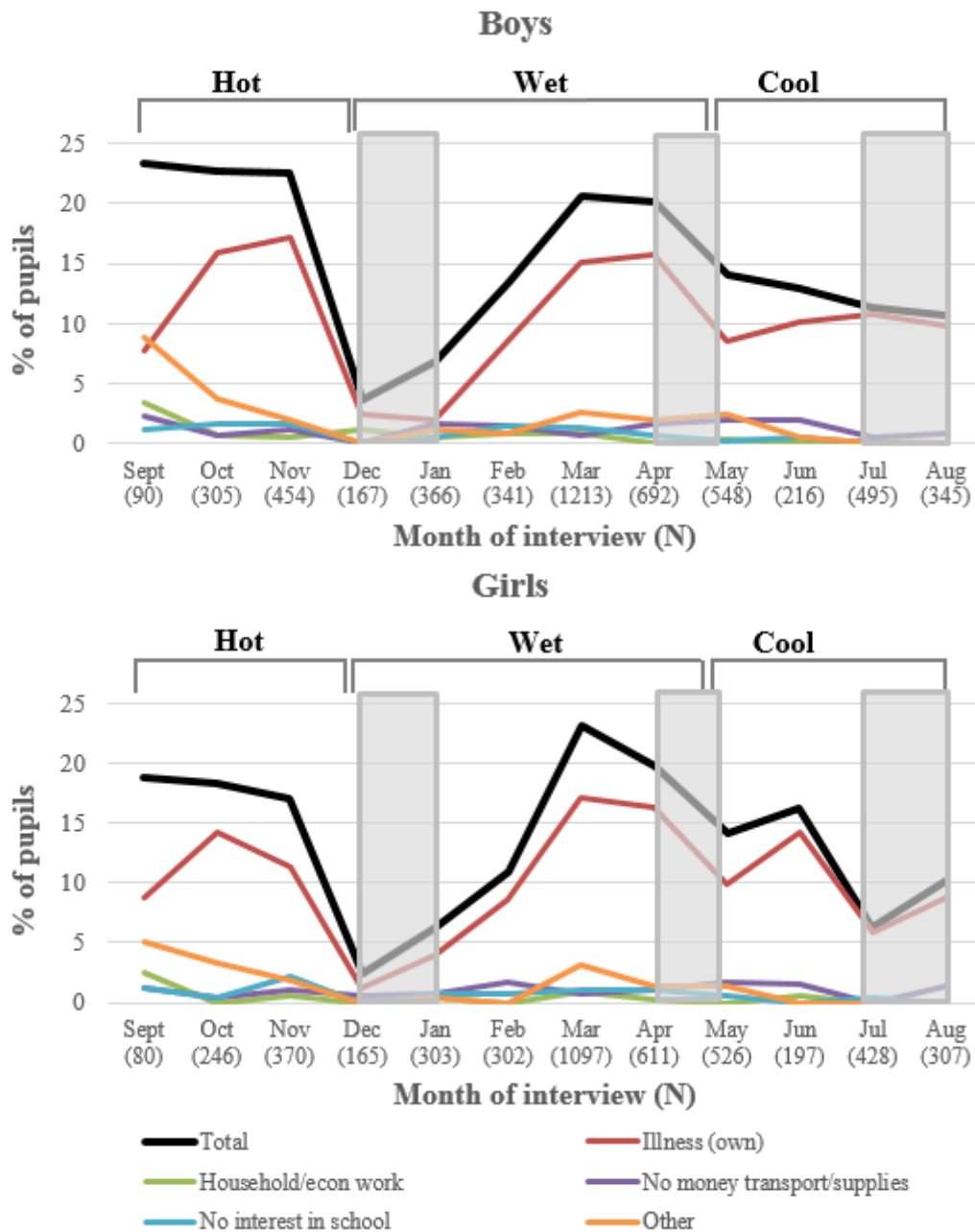
Notes: Grey boxes indicate periods of school holiday: 11 December 2010-2 January 2011, 9 April 2011-24 April 2011, 9 July 2011-4 September 2011. Brackets designate approximate seasonal boundaries: hot (September-November), wet (December-April), and cool (May-August). Reasons for absence were not provided for 17 boys and 8 girls.

A number of relationships with other individual- and household-level characteristics are also notable. Firstly, boys—but not girls—who were attending standard 8 were signficantly less likely to miss school relative to students in the four earliest standards (AOR 0.38 [0.20-0.74]), but students of both sexes who had repeated their current standard were more likely

to be absent (boys AOR 1.28 [0.98-1.66]; girls AOR 1.31 [0.96-1.76]). Boys who had participated in economic activities in the previous two weeks were considerably more likely to miss school than those who had not (AOR 1.83 [1.29-2.60]), but there was no association for girls in the multivariable model.

At the household level, girls and boys in households with nine or more members were significantly less likely to miss school than students from the smallest households. The number of younger household members was additionally associated with absenteeism for girls: female students living with four or more younger children were significantly more likely to be absent than those with one or none (AOR 1.73 [1.02-2.94]). For girls, but not boys, living more than 1 km from school was associated with increased absenteeism. Echoing the descriptive findings, some seasonal patterns in absenteeism were also observed, with students from households interviewed during the wet season (boys only) and the cool season (girls and boys) significantly less likely to miss school than those interviewed during the hot season. The values of *rho* from Model 3 show that household-level variance contributed 65% and 67% of the total variance in absenteeism by boys and girls, respectively, thus demonstrating the importance of accounting for household effects even after adjusting for all covariates.

In light of the finding from Figure 4.4 that reporting of absenteeism may differ according to proximity to school holidays, we performed a sensitivity analysis to compare levels and determinants of absenteeism in the full sample with those in the subset of students interviewed four or more weeks after a school break. The overall prevalence of absenteeism increased for boys from 16.4% in the full sample to 18.9% in the subsample and for girls from 15.5% to 18.4%. Indeed, combining both sexes, the difference in absenteeism prevalence between those interviewed during or within four weeks after a school holiday (11.9%) and those interviewed four or more weeks after a school break (18.7%) was striking and highly significant ($p<0.001$). Decreasing the analytic sample to include only the latter group altered the seasonal distribution of interviews and reduced the precision of estimates, but yielded few substantive differences compared to the full models (see Appendix Table A.3). The positive relationship between absenteeism and agricultural wealth and the negative relationship with household credit access remained strong and robust for both sexes. The negative association between absenteeism and household wealth also persisted, but lost statistical significance in Models 1 and 3.

Table 4.3 Results from two-level logistic regression models estimating primary school absenteeism in the past four weeks, by sex

	Boys (N=5231)			
	Absent past 4 weeks; n(%)	**Model 1: Unadjusted OR (95% CI)**	**Model 2: Adjusted SES only AOR (95% CI)**	**Model 3: Adjusted all factors AOR (95% CI)**
Socioeconomic factors				
Household wealth quintile		0.86 (0.77-0.95) **	0.83 (0.73-0.94) **	0.86 (0.75-0.98) *
Lowest	184 (17.2)			
2	196 (18.2)			
3	191 (18.2)			
4	153 (14.7)			
Highest	135 (13.6)			
Agricultural wealth quintile		1.29 (1.16-1.44) ***	1.34 (1.19-1.51) ***	1.24 (1.09-1.41) **
Lowest	119 (12.0)			
2	158 (15.4)			
3	165 (15.7)			
4	193 (17.9)			
Highest	224 (20.7)			
Household credit access				
No	738 (17.8)	1	1	1
Yes	121 (11.2)	0.41 (0.28-0.61) ***	0.49 (0.32-0.73) **	0.53 (0.35-0.80) **
Father's education				
None/primary	563 (17.5)	1	1	1
Post-primary	296 (14.7)	0.72 (0.54-0.96) *	0.89 (0.65-1.22)	0.97 (0.70-1.34)
Mother's education				
None/primary	724 (16.4)	1	1	1
Post-primary	135 (16.6)	0.97 (0.66-1.41)	1.36 (0.91-2.04)	1.43 (0.95-2.17) †
Occupation of household head				
Subsistence farmer/herder	631 (17.8)	1	1	1
Fisherman	39 (14.7)	0.64 (0.32-1.28)	0.82 (0.41-1.64)	1.49 (0.70-3.18)
Other non-skilled	108 (14.9)	0.63 (0.41-0.99) *	0.89 (0.56-1.41)	1.00 (0.62-1.62)
Skilled	67 (11.8)	0.46 (0.27-0.77) **	0.82 (0.47-1.44)	0.92 (0.52-1.62)
Not working	15 (11.6)	0.50 (0.18-1.35)	0.57 (0.21-1.53)	0.70 (0.25-1.97)
Individual factors				
Age group (years)				
5-11	502 (16.1)	1		1
12-14	223 (18.3)	1.24 (0.94-1.63)		1.26 (0.85-1.85)
≥15	134 (14.9)	1.00 (0.72-1.39)		1.29 (0.75-2.22)
Current standard				
1-4	546 (17.0)	1		1
5-7	257 (16.9)	1.13 (0.87-1.46)		0.88 (0.59-1.30)
8	56 (11.1)	0.54 (0.34-0.85) **		0.39 (0.20-0.74) **
Repeated current standard				
No	546 (15.6)	1		1
Yes	313 (18.2)	1.37 (1.06-1.77) *		1.28 (0.98-1.66) †
Father died				
No	761 (16.6)	1		1
Yes	98 (15.5)	0.89 (0.60-1.32)		1.13 (0.71-1.79)

Table 4.3 continued Results from two-level logistic regression models estimating primary school absenteeism in the past four weeks, by sex

	Boys (N=5231)			
	Absent past 4 weeks; n(%)	Model 1: Unadjusted OR (95% CI)	Model 2: Adjusted SES only AOR (95% CI)	Model 3: Adjusted All factors AOR (95% CI)
Mother died				
No	822 (16.5)	1		1
Yes	37 (14.6)	0.67 (0.36-1.24)		0.73 (0.38-1.39)
Relationship to household head				
Child	661 (17.0)	1		1
Step-child	23 (17.3)	0.91 (0.41-2.04)		0.96 (0.42-2.17)
Grandchild	126 (14.6)	0.79 (0.54-1.15)		0.96 (0.63-1.48)
Other	49 (14.2)	0.68 (0.40-1.14)		0.77 (0.44-1.35)
Economic participation in past 4 weeks				
No	652 (15.2)	1		1
Yes	207 (22.2)	1.99 (1.44-2.74) ***		1.83 (1.29-2.60) **
Household factors				
Number of household members				
1-4	133 (17.4)	1		1
5-8	619 (17.2)	0.94 (0.64-1.37)		0.86 (0.55-1.36)
≥9	107 (12.3)	0.47 (0.27-0.81) **		0.42 (0.22-0.81) *
Number of younger residents				
0-1	334 (16.6)			1
2-3	378 (16.2)	0.93 (0.72-1.21)		0.91 (0.67-1.23)
≥4	147 (16.5)	1.09 (0.76-1.57)		1.01 (0.63-1.62)
Sex of household head				
Male	730 (17.0)	1		1
Female	129 (13.9)	0.66 (0.44-0.98) *		0.74 (0.46-1.18)
Distance to school (km)				
<1 km	470 (16.3)	1		1
1-2 km	271 (15.5)	1.02 (0.75-1.40)		0.81 (0.58-1.14)
>2 km	118 (19.7)	1.40 (0.91-2.14)		1.20 (0.74-1.94)
Season of interview				
Hot (Sept-Nov)	193 (22.8)	1		1
Wet (Dec-Apr)	468 (16.8)	0.48 (0.32-0.72) ***		0.42 (0.25-0.71) **
Cool (May-Aug)	198 (12.3)	0.25 (0.16-0.39) ***		0.18 (0.08-0.39) ***
School fixed effects		No	No	Yes
sigma_u			2.55 (2.21-2.93)	2.47 (2.14-2.86)
rho			0.66 (0.60-0.72) ***	0.65 (0.58-0.71) ***

† p<0.1 * p<0.05 ** p<0.01 *** p<0.001

Notes: All models include household random effects. Model 3 additionally includes a dummy School ID variable. Sigma_u and rho not shown for unadjusted models.

Table 4.3 continued Results from two-level unadjusted and adjusted regression models estimating primary school absenteeism in the past four weeks, by sex

	Absent past 4 weeks; n(%)	Model 1: Unadjusted OR (95% CI)	Model 2: Adjusted SES only AOR (95% CI)	Model 3: Adjusted All factors AOR (95% CI)
Girls (N=4620)				
Socioeconomic factors				
Household wealth quintile		0.84 (0.75-0.95) **	0.80 (0.70-0.92) **	0.84 (0.72-0.96) *
Lowest	152 (16.8)			
2	154 (16.9)			
3	160 (17.3)			
4	146 (15.7)			
Highest	105 (11.1)			
Agricultural wealth quintile		1.35 (1.20-1.52) ***	1.39 (1.23-1.59) ***	1.34 (1.17-1.54) ***
Lowest	109 (11.3)			
2	125 (13.4)			
3	149 (16.0)			
4	151 (16.7)			
Highest	183 (20.6)			
Household credit access				
No	610 (16.8)	1	1	1
Yes	107 (10.8)	0.47 (0.31-0.72) ***	0.55 (0.36-0.84) **	0.60 (0.39-0.93) *
Father's education				
None/primary	448 (16.0)	1	1	1
Post-primary	269 (14.8)	0.93 (0.68-1.27)	1.31 (0.93-1.84)	1.33 (0.94-1.89)
Mother's education				
None/primary	614 (15.9)	1	1	1
Post-primary	103 (13.6)	0.79 (0.52-1.20)	0.99 (0.63-1.54)	1.08 (0.68-1.71)
Occupation of household head				
Subsistence farmer/herder	527 (17.2)	1	1	1
Fisherman	20 (9.3)	0.29 (0.12-0.69) **	0.39 (0.17-0.93) *	0.57 (0.23-1.42)
Other non-skilled	87 (13.7)	0.65 (0.40-1.06) †	0.93 (0.57-1.54)	1.22 (0.72-2.06)
Skilled	68 (11.1)	0.40 (0.23-0.67) **	0.70 (0.40-1.23)	0.95 (0.53-1.69)
Not working	15 (14.9)	0.56 (0.18-1.74)	0.69 (0.23-2.11)	0.77 (0.24-2.42)
Individual variables				
Age group (years)				
5-11	444 (14.8)	1		1
12-14	190 (16.8)	1.32 (0.97-1.79) †		1.44 (0.93-2.23)
≥15	83 (16.9)	1.38 (0.90-2.11)		1.34 (0.71-2.53)
Current standard				
1-4	441 (15.7)	1		1
5-7	217 (15.2)	1.00 (0.75-1.34)		0.80 (0.53-1.22)
8	59 (15.3)	1.26 (0.77-2.05)		1.00 (0.50-1.99)
Repeated current standard				
No	496 (14.8)	1		1
Yes	221 (17.5)	1.44 (1.07-1.93) *		1.30 (0.96-1.76) †
Father died				
No	641 (15.6)	1		1
Yes	76 (14.6)	0.89 (0.56-1.43)		1.05 (0.62-1.77)

Table 4.3 continued Results from two-level logistic regression models estimating primary school absenteeism in the past four weeks, by sex

	Absent past 4 weeks; n(%)	Model 1: Unadjusted OR (95% CI)	Model 2: Adjusted SES only AOR (95% CI)	Model 3: Adjusted All factors AOR (95% CI)
Girls (N=4620)				
Mother died				
No	689 (15.6)	1		1
Yes	28 (13.9)	0.69 (0.35-1.40)		0.84 (0.41-1.74)
Relationship to household head				
Child	537 (16.3)	1		1
Step-child	28 (17.3)	1.13 (0.53-2.40)		1.03 (0.47-2.23)
Grandchild	116 (15.1)	0.84 (0.56-1.27)		1.00 (0.63-1.59)
Other	36 (9.2)	0.38 (0.21-0.67) **		0.44 (0.24-0.80) **
Economic participation in past 4 weeks				
No	585 (15.0)	1		1
Yes	132 (18.1)	1.40 (0.96-2.04) [†]		1.01 (0.67-1.51)
Household variables				
Number of household members				
1-4	100 (14.4)	1		1
5-8	530 (16.6)	1.32 (0.86-2.05)		0.92 (0.55-1.52)
≥9	87 (11.8)	0.66 (0.36-1.22)		0.40 (0.19-0.83) *
Number of younger residents				
0-1	263 (14.5)	1		1
2-3	326 (15.5)	1.20 (0.89-1.61)		1.14 (0.82-1.61)
≥4	128 (18.3)	1.70 (1.13-2.57) *		1.73 (1.02-2.94) *
Sex of household head				
Male	592 (15.7)	1		1
Female	125 (14.9)	0.89 (0.58-1.35)		1.13 (0.68-1.87)
Distance to school (km)				
<1 km	343 (13.4)	1		1
1-2 km	295 (18.6)	1.83 (1.30-2.58) **		1.87 (1.29-2.69) **
>2 km	79 (17.1)	1.62 (0.96-2.72) [†]		1.64 (0.93-2.89) [†]
Interview variable				
Season of interview				
Hot (Sept-Nov)	123 (17.7)	1		1
Wet (Dec-Apr)	431 (17.4)	0.92 (0.58-1.44)		1.11 (0.60-2.05)
Cool (May-Aug)	163 (11.3)	0.38 (0.23-0.64) ***		0.27 (0.12-0.62) **
School fixed effects		No	No	Yes
sigma_u			2.66 (2.26-3.14)	2.60 (2.20-3.08)
rho			0.68 (0.61-0.75) ***	0.67 (0.59-0.74) ***

[†] p<0.1 * p<0.05 ** p<0.01 *** p<0.001
Notes: All models include household random effects. Model 3 additionally includes a dummy School ID variable. Sigma_u and rho not shown for unadjusted models.

4.4 Discussion

Data from the 2010-11 Karonga HDSS household survey in northern Malawi show that 16% of primary school students missed school in the previous four weeks, and nearly one-fifth of those who were absent missed five days or more. Echoing previous studies in Malawi and elsewhere in sub-Saharan Africa (Ainsworth et al. 2005; Ezenwosu et al. 2013; Grant et al. 2013; Mensch and Lloyd 1998; Orkin et al. 2014), no significant differences in absenteeism prevalence between boys and girls were observed. The reported causes of absenteeism were also very similar by sex, with the majority of absences attributed to student illness and much smaller proportions related to financial constraints or lack of interest in school. A slightly higher proportion of boys' absenteeism was attributed to economic participation than for girls, but prevalence of such absences was very low overall.

Multivariable regression analysis suggested, by contrast, a central role for socioeconomic factors as determinants of missing school, as well as some important sex-specific differences in the proximal and distal correlates of primary school absence. Consistent with the 'wealth paradox' previously observed in rural communities (Bhalotra and Heady 2003), absenteeism for both boys and girls was associated with increasing levels of agricultural wealth—measured in terms of land ownership, crop sales, and productive assets—but with decreasing levels of other socioeconomic indicators, including non-agricultural household wealth and credit access.[24] These findings demonstrate how different measures of SES act in opposing ways, and how analysis of multiple SES dimensions produces a more complete picture of the socioeconomic processes behind educational exclusion.

That missing school was associated with increasing levels of agricultural wealth suggests that children engage in farm work, or domestic activities that compensate for others' farm work, which compete with school attendance. Several other results support this narrative. Peaks in absenteeism reporting, particularly in the hot season and mid-rainy season, correspond to periods of high agricultural labour demand associated with planting and harvest. Moreover, participation in economic activities such as farming, fishing and gathering of natural products, was significantly associated with missing school for boys

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[24] The theoretical model subsequently developed by Basu et al. (2010) suggests that there exists a threshold above which increased land ownership will not lead to greater child labour, even in the market conditions described by Bhalotra and Heady (2003). Such threshold effects were not observed with respect to agricultural wealth index score and school absenteeism.

(but not for girls). Overall, a slightly higher proportion of boys than girls was reported to participate in economic activities, which is perhaps surprising given that time use research in Malawi has shown that women and girls undertake more hours of work than do men and boys (Webbink et al. 2012; Wodon and Beegle 2006). However, a substantial proportion of female labour, particularly at younger ages, is devoted to tasks including cooking, laundry and cleaning, which were not included in the economic activities solicited by the HDSS survey question. This could thus explain why no relationship between economic participation and school attendance was observed among female students.

On the other hand, girls in households with four or more younger residents were significantly more likely to miss school than were counterparts living with one or no younger children, suggesting that older girls may be tasked with caring for younger siblings, to the detriment of their school attendance. It may also indicate that older girls contribute a greater share of other household tasks (Edmonds 2006), or sacrifice their own schooling needs to help support younger children (Pridmore and Jere 2011). Grant et al. (2013) similarly found a significant positive association between a student's number of siblings and absenteeism among girls in southern Malawi. For both boys and girls, absenteeism was significantly lower in households with nine or more members, relative to those with 1-4 members, perhaps reflecting more thinly distributed work burdens in larger households, which result in less disruption to children's school attendance (Johnston et al. 2015; Wittenberg 2005).

The significant relationship between decreasing household wealth and missing school suggests that monetary poverty additionally plays a role in preventing children's school attendance. While the higher opportunity cost of schooling among poor households may further explain students' participation in household work and income-generating activities, monetary poverty constrains households' ability to meet the financial costs associated with schooling. Lack of school uniform (Pridmore and Jere 2011), expenses on pens and notebooks (Kadzamira and Rose 2003) or transport costs (Porter et al. 2011) have all been linked with school absenteeism in other Malawian studies.

That household credit access was associated with lower propensity to miss school implies that credit helps households weather the financial burden attached to school attendance, including unexpected income shocks that have been shown to result in students'

absenteeism or permanent withdrawal (Amendah et al. 2014; Dillon 2013). However, we cannot rule out that savings group membership or receipt of loans simply reflect improved access to financial institutions among some households, or else unmeasured household characteristics, including diligence and foresight, which contribute to favourable educational outcomes.

Although the regression results provide compelling evidence of a relationship between absenteeism and household SES, only 6.5% of absences were attributed by HDSS survey respondents to lack of funds for schooling expenses and just 2.7% to household chores or economic work. By contrast, 73.8% were reportedly caused by student illness. There can be no doubt that poor health represents an important barrier to school attendance, given the range of epidemiological studies that have linked illness to absenteeism in sub-Saharan Africa (Brooker et al. 2000; de Clerq et al. 1998; Ezenwosu et al. 2013; Ibekwe et al. 2007; Mushi et al. 2012; Mustapha et al. 2013; Ofovwe and Ofili 2010; Ogunfowora et al. 2005; Thuillez et al. 2010; Trape et al. 1993; Wolka et al. 2013). Without data about students' health status we can cannot corroborate episodes of illness-related absence, but the observed discrepancy between reported reasons for missing school and the statistical correlates of absenteeism may reflect relative over-reporting of illness-related absences and under-reporting of economically-driven absences, particularly those associated with child labour. In particular, survey respondents may have adjusted their reporting to conform to societal expectations about what constitutes an 'acceptable' reason for missing school (Kelly et al. 2013). Although child labour is not itself socially proscribed in many parts of sub-Saharan Africa (Dillon et al. 2012), missing school in order to work would generally be looked upon less favourably: in schools visited by the first author in the HDSS catchment area, absences related to illness were much less likely to be met with sanctions than were absences for other reasons, which may also encourage survey participants to attribute recent absences to ill health.

Given that the reasons for absenteeism were typically provided by an adult informant as opposed to the student him/herself, the reliance on proxy reporters—who may lack knowledge about the daily activities of all household children, or wish to portray them in a particular light—could represent an additional source of reporting bias. A recent study from Peru that compared child and proxy reporting of child labour found a discrepancy of 17 percentage points in nationally-representative child labour statistics, with parents

systematically underreporting child labour relative to children (Dammert and Galdo 2013). However, a similar interview experiment from Tanzania did not find any significant differences between self and proxy reports in either the amount or type of child labour (Dillon et al. 2012).

This study's reliance on survey data may have affected prevalence estimates of absenteeism as well. A methodological analysis by Baird and Özler (2012) found that adolescent girls in Malawi overstated their school enrolment and attendance relative to administrative data from a cash transfer experiment and attendance registers maintained by schools. Equally, Barrera-Osorio et al. (2011) showed in a Colombian cash transfer experiment that self-reported attendance and enrolment figures were consistently higher than in monitored attendance and administrative enrolment data. Although incentives to inflate attendance reporting are likely to be higher in the context of a programme or intervention than in household-based survey research, it remains possible that survey participants under-reported absenteeism.

As the absenteeism survey question covered the previous four weeks that school was in session, participant recall may have proved additionally problematic. We saw, for instance, that reporting of absenteeism was lower in interviews conducted during school holidays, particularly in December. Although excluding interviews from within four weeks of holiday periods did not change the nature of regression results, the discrepancy in the prevalence of absenteeism suggests that respondents may have failed to remember or report episodes of absenteeism from weeks prior to a school break. Ultimately, without an objective measure of attendance—such as physical spot checks or well-kept school registers—it is difficult to assess the extent or direction of reporting bias. If misreporting did occur, however, it is more likely to produce underestimates of absenteeism, so the results presented here can perhaps best be considered a lower bound.

This study would have benefited from detailed time use data with which to examine the relative burdens posed by household responsibilities or economic activities, and particularly agricultural work. We were also missing measures of student aptitude or aspirations, as well as community characteristics including value of schooling or labour market conditions, which influence decision-making surrounding school attendance and time allocation (Burke and Beegle 2004). However, factors such as grade repetition,

parental education and occupation, which were included in regression models, may proxy for some of these unmeasured characteristics. Notably, girls and boys who had repeated their current standard were significantly more likely to miss school, suggesting that absenteeism is indeed related to poor school performance. Conversely, boys in standard 8 were much less likely to miss school than their counterparts in lower grades, presumably because of the importance of the Primary School Leaving Certificate of Education exam for determining secondary school entry. This same pattern, though, was not observed for female students, which could reflect selectivity in the female sample: given that dropout is higher among girls than boys in late adolescence (Sabates et al. 2010), it is possible that girls who faced barriers to regular school attendance—or were less motivated to attend school—had already dropped out in earlier standards. Indeed, Table 4.1 indicates that female students in the HDSS were younger, less likely to attend standard 8, and less likely to have repeated their current standard.

It should finally be noted that, given the cross-sectional nature of the analysis, and acknowledged limitations with respect to variable range, the potential endogeneity of SES and school attendance is not accounted for here. Our results provide an indication of the relationship between socioeconomic factors and students' absenteeism, but causal inferences should be drawn with caution.

4.5 Conclusion

While this paper confirms the oft-cited link between monetary poverty and school absenteeism, it highlights that primary school absenteeism in Malawi is not restricted to children from the poorest households if multiple dimensions of SES are considered. Students who scored poorly on the household wealth index were more likely to miss school, but so too were students in households with high levels of agricultural wealth.

These findings have a number of implications. Firstly, when conceptualising the link between SES and school attendance, nuanced analysis is required. Exclusive reliance on a single indicator of SES produces a limited picture of the multiple socioeconomic mechanisms that drive educational exclusion. By extension, when designing interventions such as cash transfer schemes that aim to reduce the opportunity cost of schooling, careful attention should be paid both to appropriately targeting recipient households and to the potential (and unintended) impact on child labour when cash transfers increase investments

in agricultural assets (Covarrubias et al. 2012). Even when increased work demands do not reduce school attendance, they may nevertheless negatively affect students' educational performance through injury, fatigue, or lack of time to study (Hazarika and Sarangi 2008; Heady 2003).

This analysis has also highlighted the importance of individual- and household-level factors as barriers to school attendance. While schools remain effective sites for delivery of programmes to reduce absenteeism, school-based interventions should acknowledge the constraints students face at home. Adjusting the school calendar so that it does not conflict with periods of high labour demand, or designing more flexible means of curriculum delivery, represent possible options for accommodating the needs of children living in agricultural communities (Kadzamira and Rose 2003; Orkin 2012; Pridmore and Jere 2011).

Finally, this research has demonstrated the need for critical reflection regarding the potential omissions and biases inherent in household survey data. Better collection and monitoring of administrative attendance data would help not only to keep track of absenteeism levels in a more systematic way, but could be used to identify students at risk of subsequent adverse schooling outcomes, allowing for targeted interventions.

Acknowledgements

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RESEARCH PAPER COVER SHEET

PLEASE NOTE THAT A COVER SHEET MUST BE COMPLETED FOR EACH RESEARCH PAPER INCLUDED IN A THESIS.

SECTION A – Student Details

Student	Christine Kelly
Principal Supervisor	Judith Glynn
Thesis Title	School absenteeism in Karonga district, northern Malawi: Trends, influences and the impact of cleaner burning biomass-fuelled cookstoves

If the Research Paper has previously been published please complete Section B, if not please move to Section C

SECTION B – Paper already published

Where was the work published?			
When was the work published?			
If the work was published prior to registration for your research degree, give a brief rationale for its inclusion			
Have you retained the copyright for the work?*	Choose an item.	Was the work subject to academic peer review?	Choose an item.

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SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	PLOS ONE
Please list the paper's authors in the intended authorship order:	Christine A. Kelly, Amelia C. Crampin, Kevin Mortimer, Albert Dube, Jullita Malava, Deborah Johnston, Elaine Unterhalter, Judith R. Glynn
Stage of publication	**Submitted**

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	With input from co-authors, I designed and coordinated the qualitative study, managed the data, conducted the analysis and wrote the manuscript

Student Signature: _____ Date: 16/10/2017

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Chapter 5: Cookstoves and absenteeism

From kitchen to classroom: Assessing the impact of cleaner burning biomass-fuelled cookstoves on primary school attendance in Karonga district, northern Malawi

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Abstract

Household air pollution from burning solid fuels is responsible for an estimated 2.9 million premature deaths worldwide each year and 4.5% of disability-adjusted life years, while cooking and fuel collection pose a considerable time burden, particularly for women and children. Cleaner burning biomass-fuelled cookstoves have the potential to lower exposure to household air pollution as well as reduce fuelwood demand by increasing the combustion efficiency of cooking fires, which may in turn yield ancillary benefits in other domains. The present paper capitalises on opportunities offered by the Cooking and Pneumonia Study (CAPS), the largest randomised trial of biomass-fuelled cookstoves on health outcomes conducted to date, the design of which allows for the evaluation of additional outcomes at scale. This mixed methods study assesses the impact of cookstoves on primary school absenteeism in Karonga district, northern Malawi, in particular by conferring health and time and resource gains on young people aged 5-18. The analysis combines quantitative data from 6168 primary school students with 16 in-depth interviews and four focus group discussions carried out in the same catchment area in 2016. Negative binomial regression models find no evidence that the cookstoves affected primary school absenteeism overall (IRR 0.92 [95% CI 0.71-1.18], p=0.51). Qualitative analysis suggests that the cookstoves did not sufficiently improve household health to influence school attendance, while the time and resource burdens associated with cooking activities—although reduced in intervention households—were considered to be compatible with school attendance in both trial arms. More research is needed to assess whether the cookstoves influenced educational outcomes not captured by the attendance measure available, such as timely arrival to school or hours spent on homework.

Keywords

5.1 Introduction

Ninety-five percent of households in Malawi rely on biomass fuels such as wood, charcoal or crop residues for cooking (Jary et al. 2014), often in poorly ventilated environments. Household air pollution from solid cookfuels (HAP) is responsible for an estimated 2.9 million premature deaths worldwide each year from causes including pneumonia, stroke, ischaemic heart disease, chronic obstructive pulmonary disease, and lung cancer (GBD 2015 Risk Factors Collaborators 2016; World Health Organization 2014), and contributes 4.5% of global disability-adjusted life years (Lim et al. 2012). Among school-age children specifically, there is some evidence of an association between HAP and acute respiratory infections as well as asthma (Gordon et al. 2014; Perez-Padilla et al. 2010; Wong et al. 2013).

Cleaner burning biomass-fuelled cookstoves, which have better fuel efficiency than traditional open fire cooking methods and reduce harmful emissions, have been advocated as a means to reduce morbidity and mortality associated with cooking with solid fuels. Outcomes of existing randomised controlled trials, however, have principally targeted women and young children, as the groups with the highest exposure to solid fuel emissions, and have typically not explored the cookstoves' impact on other household members, particularly adolescents. Moreover, less is known about the potential ancillary benefits of cookstoves in domains beyond health (Martin et al. 2013; Ruiz-Mercado et al. 2011). The present study fills an important research gap by assessing the effect of cleaner burning biomass-fuelled cookstoves on school attendance of young people in northern Malawi.

Two possible mechanisms are explored: 1) reduced household air pollution leading to improved health and associated reductions in caregiving responsibilities, and 2) reduced fuel consumption leading to lower time and resource costs associated with acquiring fuel, both yielding increased school attendance (Figure 5.1). Although the impact of cooking-related activities on school attendance has not been formally assessed in sub-Saharan Africa, the contributions of ill health and caregiving to absenteeism are well established. Research from southern Nigeria has specifically highlighted respiratory illness as a reason for absenteeism (Mustapha et al. 2013). The authors found that 2.5% of children aged 7-14 years, including 5.7% of children in rural areas, reported missing school in the past twelve months due to symptoms of respiratory illness, although episodes were not necessarily linked to HAP exposure.

Figure 5.1 Proposed causal pathways linking cleaner burning cookstoves with increased school attendance
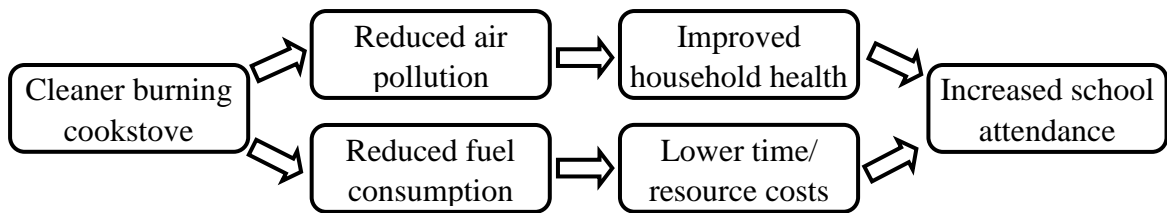
Cleaner burning cookstoves may also reduce school absenteeism by improving the health of other household members. Several studies from sub-Saharan Africa have highlighted the responsibility schoolchildren bear for providing care or performing household or economic labour in the event of a family illness, to the detriment of their school attendance. Research from Ethiopia showed that, controlling for sociodemographic factors, high levels of absenteeism were significantly associated with the percentage of household members who were sick for more than 30 days in the previous year (Orkin 2011). Analyses of orphanhood in Kenya and Tanzania found that children's school attendance declined not only in the wake of a parental death, but also in the months leading up to it, presumably as students served as caregivers (Ainsworth et al. 2005; Evans and Miguel 2007). Interviews from a mixed methods study in South Africa indicated that adolescents missed school to accompany ill relatives to health facilities or provide home-based care (Cluver et al. 2012). Thus, potential health improvements for both school-age children and other household members through reduced exposure to cooking-related pollutants could yield significant payoffs with respect to school attendance.

The second pathway focuses on time and resource savings linking cleaner burning cookstoves with reduced absenteeism. Even in healthy households, students regularly participate in domestic or market activities that can compete with school attendance. Data from UNICEF Multiple Indicator Cluster Surveys in Malawi show that boys and girls spend an average of 9 and 12 hours per week, respectively, on household work, and an additional 3 and 4 hours on family business work (Webbink et al. 2012). Water and fuelwood collection have been identified as particularly burdensome for school-going children (Nankhuni and Findeis 2004). A mixed methods study across 24 sites in Ghana, Malawi and South Africa suggested that the time and exertion associated with child porterage—carrying water, firewood, and agricultural produce—as well as the prospect of earning extra

money from commercial load carrying, contributed to tardiness and absenteeism (Porter et al. 2012). By reducing the duration and/or frequency of domestic fuelwood collection, as well as speeding up cooking times of household meals, cleaner burning cookstoves may thus play an important role in improving school attendance. Moreover, although the vast majority (94.8%) of households in Karonga district, Malawi, collect their own firewood for cooking, 4.6% purchase their wood supplies (Jagger and Perez-Heydrich 2016). Reduced expenditure on firewood associated with cleaner burning cookstoves may enable households to better meet schooling costs, including exercise books, pens and clothes, which have been shown to amount to approximately 6% per child of the total financial resources of the poorest Malawian households (Kadzamira and Rose 2003).

5.2 Methods

5.2.1 Trial design

This paper harnesses opportunities offered by the Cooking and Pneumonia Study (CAPS), a large cluster randomised trial of cleaner burning biomass-fuelled cookstoves conducted in Karonga district, northern Malawi, in which one hundred community-level clusters were randomised to intervention or control groups.[25] A full description of the study design and randomisation procedures is available in Mortimer et al. (2016). Starting in July 2014, intervention households received two Philips HD4012LS cookstoves with cooking pots and a solar panel with which to charge the in-built battery-powered fan, as well as user training. As the trial's primary outcome of interest was incidence of pneumonia in children under five years old (Mortimer et al. 2016), cookstoves were distributed only to households with children below 4.5 years at baseline, as well as on a continuous basis to eligible in-migrating households or those into which children under five were born, adopted or fostered over the course of the two-year follow-up period. The CAPS team visited households approximately every three months to collect information about cookstove usage and functionality. A free repair, maintenance and replacement service was provided for damaged cookstoves and solar panels. Control households received their own cookstoves at the end of the trial.

5.2.2 Study population

To examine the impact of cookstoves on primary school attendance, we identified young

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[25] An additional 50 clusters were randomised in a second site in southern Malawi (see Mortimer et al. 2016), but these are not included here.

people of primary school age resident in households enrolled in the CAPS trial. Primary school in Malawi comprises eight grades but, in light of the frequency of late entry and grade repetition among Malawian students (Sunny et al. 2017), we included children aged 5-18. The total number of absence days in the past four weeks that school was in session was collected as part of the annual household survey of the Karonga Health and Demographic Surveillance System (HDSS) (Crampin et al. 2012), which formed the catchment area of the CAPS trial. School attendance reports were drawn from the first HDSS interview that took place at least 60 days after the household was enrolled in CAPS. A threshold of 60 days was chosen to allow for a short cookstove adjustment period—for instance, to deplete existing stocks of firewood—and in light of the HDSS survey design in which absenteeism over the past four weeks was retrospectively reported. Schooling information was provided by household members aged 15 years or older who were at home at the time of the field team's visit; as such, most respondents were parents or other adult relatives reporting on behalf of resident children.

The primary analysis followed intention-to-treat (ITT) principles, where the ITT population consisted of primary school students aged 5-18 living in CAPS intervention or control households at the time of enrolment, and who had at least one follow-up CAPS and HDSS survey. A per-protocol analysis was also conducted for comparison, excluding students who changed cookstove exposure status between CAPS enrolment and the first eligible HDSS survey by: 1) moving from an intervention household to a new household in a control cluster, 2) moving from a control household to a new intervention household, or 3) moving from a cookstove to a non-cookstove household within an intervention cluster. It also excluded students living in households that reported not using the cookstove exclusively in the CAPS visit closest to the HDSS schooling interview—that is, households that did not use the cookstove as a result of breakage, mechanical failure, or personal preference, or that continued to use open fire cooking methods alongside the cookstove for at least some household meals. Finally, the per-protocol analysis excluded students from households for whom data from a CAPS follow-up visit were not available within three months of the HDSS survey.

5.2.3 Statistical methods

Negative binomial regression modelling was used to compare absenteeism across trial groups to reflect overdispersion in the distribution of absence days. All regression models

included cluster robust standard errors to account for the clustered trial design. Multivariable models adjusted for the following pre-specified covariates, informed by the analyses presented in Mortimer et al. (2016) and in Chapter 4 of this thesis: age, sex, current grade attended, repetition of current grade, maternal death, paternal death, maternal education, paternal education, total number of household members, number of younger household members, relationship to household head, sex of household head, household socioeconomic status, co-residence with a regular smoker, and exposure to sources of household smoke other than cooking. Socioeconomic status was constructed by using principal components analysis (Howe et al. 2008; Vyas and Kumaranayake 2006) to generate a wealth index combining ownership of ten durable goods, two variables indicating a shortage of food or bathing soap in the past year, and two variables indicating a household's access to an improved water source or improved toilet facility. A variable indicating the HDSS survey round was also included in regression models to control for survey-specific differences in absenteeism reporting, as was the month of interview to account for seasonal differences in absenteeism. A further variable indicating whether HDSS survey took place during term time or school holiday was additionally included, alongside a variable specifying the number of months between CAPS enrolment and the HDSS survey to adjust for potential changes in cookstove usage over time.

By adding appropriate interaction terms to each regression model, subgroup analyses were also conducted to investigate the following secondary hypotheses:

1. Cookstoves will lead to greater reductions in absenteeism for girls relative to boys, due to diminished cooking, fuel collection and caregiving responsibilities, which are predominantly carried out by girls.
2. Cookstoves will lead to greater reductions in absenteeism as children's age increases, as older children assume more responsibility for caregiving and household chores. This analysis is guided by the age thresholds stipulated by ILO Convention No. 138 for child work burdens, namely <12, 12-14, and 15+ (International Labour Organization).
3. Greater reductions in absenteeism will be observed among children interviewed in the rainy season (December-April) relative to in the dry season, due to the increased propensity to cook indoors during the rainy season and the larger anticipated health

benefit of using cookstoves rather than open fires in a poorly ventilated environment.

5.2.4 Nested qualitative study

To corroborate the quantitative comparisons and elucidate the proposed mechanisms at play (Stanistreet et al. 2015), a nested qualitative study was conducted in April-May 2016 involving 16 in-depth interviews (IDIs) and four focus group discussions (FGDs) among male and female primary school students aged 12-18. The qualitative sample was purposively selected using the HDSS and CAPS datasets to ensure distribution across trial arms, variation by age and school grade attended, as well as representation from the three community types present in the study area: lakeshore, roadside, and rural agricultural. Interviews and FGDs solicited students' perceptions of the barriers to regular school attendance, household and community support for schooling, intra-household allocation of domestic responsibilities and household health status. To gain particular insight into the time students spent on cooking and fuelwood collection, IDIs additionally included an exercise whereby participants were asked to fill a timeline with the activities in which they had engaged on the previous school day, choosing from a selection of ten illustrated activity cards.[26] Among cookstove recipients, IDIs also explored the perceived impact of cleaner burning cookstoves on health, schooling and time allocation. In-depth interview and FGD topic guides were iteratively updated to reflect emerging themes from the pilot phase and from preliminary data analysis.

Qualitative activities were conducted by a team of four trained interviewers/facilitators in the participants' local language, Chitumbuka, and subsequently transcribed and translated into English by the same research team. As a validity check, four IDI transcripts—one per interviewer—were externally audited for completeness and accuracy by a bilingual consultant. Since errors identified during this process were minimal and minor, no additional review of the remaining transcripts was undertaken. The final transcripts were uploaded into *NVivo* software for coding and thematic analysis (Guest et al. 2012), with particular focus on aspects of students' narratives that supported or undermined the pathways linking cookstoves and school attendance shown in Figure 5.1.

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[26] The activity cards were: attending school, doing homework, going to the market, collecting firewood, drawing water, cooking, fishing, farming, caregiving, and playing.

5.2.5 Ethics statement

Ethical approval for the qualitative study was obtained from the National Health Sciences Research Committee (NHSRC) in Malawi (Protocol #15/11/1509) and the London School of Hygiene and Tropical Medicine Research Ethics Committee (Ref #10401). Written consent was received from a parent/guardian of each study participant, in addition to written assent from participants themselves. Data collection associated with the Karonga HDSS and CAPS underwent separate review processes (NHSRC Protocol #419 and LSHTM Ref #5081; and Malawi College of Medicine Research and Ethics Committee P.11/12/1308 and Liverpool School of Tropical Medicine Research Ethics Committee Ref #12.40, respectively).

5.3 Results

5.3.1 Analytic sample

Of the 4848 households enrolled in the CAPS trial in Karonga district, 59 (30 intervention, 29 control) withdrew from the study, became ineligible, left the study area or were lost to follow-up before completing a CAPS follow-up visit. An additional 1442 (756 intervention, 686 control) had no resident school-age children. In the remaining 3347 households, 8129 young people aged 5-18 were identified (4194 intervention, 3935 control). Of these, 750 (431 intervention, 319 control) were excluded as they had no post-CAPS schooling survey before or within 30 days after the conclusion of the trial, and a further 930 (492 intervention, 438 control) were not currently attending primary school in Karonga district. Among eligible students, 281 (103 intervention, 178 control) were missing outcome or covariate data, leaving an ITT sample of 3168 and 3000 in the intervention and control groups, respectively (Figure 5.2). The per-protocol sample further excluded 57 children (50 intervention, 7 control) who changed cookstove status before the first schooling interview; 1150 from intervention households that reported not using the cookstove exclusively during the closest CAPS follow-up period to the schooling survey, including 92 in households that did not use the cookstove at all; and 177 (69 intervention, 108 control) for whom CAPS data within three months of the HDSS schooling survey were not available. Thus, the per-protocol sample consisted of 1899 children in intervention households and 2885 in control households (Figure 5.2).

Figure 5.2 Flowchart of control and intervention participants included in analysis

Control group

Intervention group

144
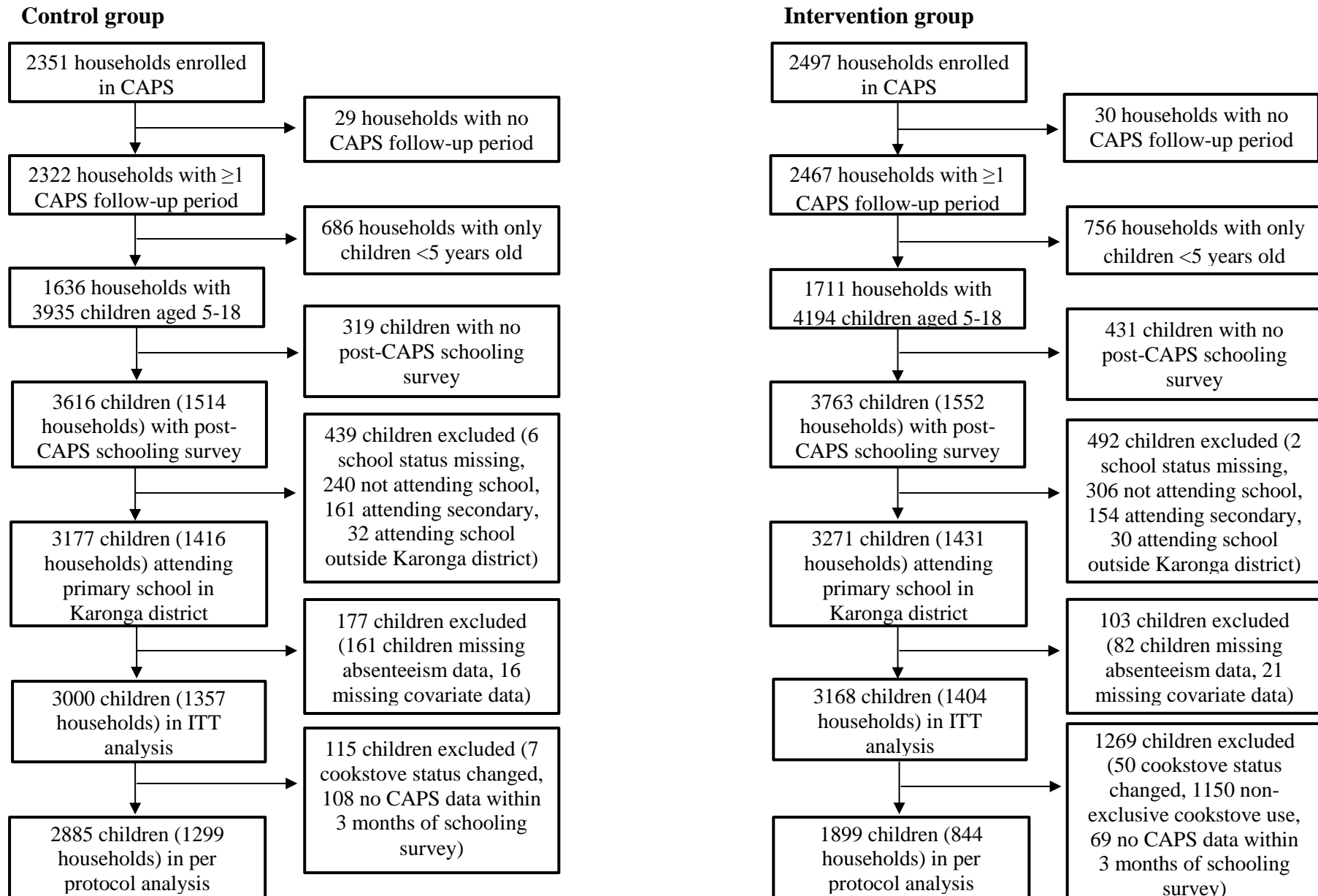
5.3.2 Baseline characteristics

Table 5.1 shows individual- and household-level baseline characteristics of the ITT sample. Household data were drawn from the CAPS baseline survey, but this did not include individual-level information about household members aged 5 or over. Hence, individual data were taken from the nearest available HDSS survey before CAPS enrolment, or up to 30 days afterward. Data were not available for 97 children who were not interviewed prior to CAPS enrolment. Additionally, since the HDSS survey and CAPS enrolment occurred on average 168 days apart (180 days intervention, 156 control), time-varying characteristics such as school enrolment and parental survival may not reflect children's status at the start of the CAPS trial. Nevertheless, the table demonstrates that both individual- and household-level characteristics were reasonably balanced between intervention and control groups.

Table 5.1 Baseline characteristics of intention-to-treat population, by trial group

Household characteristics	Control (N=1357)		Intervention (N=1404)	
	n	**%**	**n**	**%**
Sources of cooking fuel[a]				
Firewood	1329	97.9	1383	98.5
Crop residues	804	59.2	802	57.1
Charcoal	378	27.9	307	21.9
Other	20	1.5	11	0.8
Cooking location, dry season				
Outside, roof only	314	23.1	345	24.6
Outside, walls and roof	706	52.0	725	51.6
Outside, open air	281	20.7	271	19.3
Outside veranda	26	1.9	20	1.4
Inside, kitchen	20	1.5	31	2.2
Inside, living space	10	0.7	12	0.9
Cooking location, rainy season				
Outside, roof only	294	21.7	331	23.6
Outside, walls and roof	782	57.6	781	55.6
Outside, open air	11	0.8	16	1.1
Outside veranda	117	8.6	113	8.0
Inside, kitchen	93	6.9	101	7.2
Inside, living space	60	4.4	62	4.4
Sources of household smoke exposure[a]				
Resident smoker	186	13.7	229	16.3
Burning rubbish	941	69.3	967	68.9
Cooking business	295	21.7	343	24.4
Burning bricks	137	10.1	103	7.3
Kerosene lamp	64	4.7	61	4.3
Socioeconomic quintile				
Lowest	277	20.4	322	22.9
2	259	19.1	299	21.3
3	254	18.7	275	19.6
4	266	19.6	258	18.4
Highest	301	22.2	250	17.8

Table 5.1 continued Baseline characteristics of intention-to-treat population, by trial group

Individual characteristics	Control (N=3000)		Intervention (N=3168)	
	n	**%**	**n**	**%**
Age				
5-11	2000	66.7	2155	68.0
12-14	641	21.4	669	21.1
≥15	359	12.0	344	10.9
Mean (years)		9.94		9.93
Sex				
Male	1515	50.5	1642	51.8
Female	1485	49.5	1526	48.2
Among students with baseline interview:	(N=2947)		(N=3124)	
School status				
Not attending	360	12.2	375	12.0
Attending standard 1-4	1856	63.0	2003	64.1
Attending standard 5-7	665	22.6	694	22.2
Attending standard 8	66	2.2	52	1.7
Repeated current standard (if attending school)				
Yes	672	26.0	789	28.7
No	1915	74.0	1960	71.3
Days of absence in past 4 weeks (if attending school)				
0	1952	75.5	2021	73.5
1	258	10.0	303	11.0
2-4	258	10.0	313	11.4
≥5	90	3.5	99	3.6
Missing	29	1.1	13	0.5
Mean days, all students		0.67		0.70
Mean days, conditional on absence		2.81		2.67
Mother died				
Yes	77	2.6	57	1.8
No	2870	97.4	3067	98.2
Father died				
Yes	193	6.5	187	6.0
No	2754	93.5	2937	94.0
Mother's education				
None/primary	2362	80.1	2524	80.8
More than primary	585	19.9	600	19.2
Father's education				
None/primary	1750	59.4	1945	62.3
More than primary	1197	40.6	1179	37.7
Relationship to household head				
Child	2422	82.2	2624	84.0
Step-child	116	3.9	116	3.7
Grandchild	261	8.9	250	8.0
Niece/nephew	53	1.8	60	1.9
Other	95	3.2	74	2.4
Mean days between baseline and CAPS enrolment[b]		156.4		180.6

[a] Multiple responses possible.

[b] Each participant's baseline interview was assigned as the closest before CAPS enrolment or up to 30 days afterward.

5.3.3 Absenteeism in the past four weeks

Figure 5.3 shows the distribution of absence days in the past four weeks among students in the ITT sample, by cookstove status. Overall, students in the intervention group missed an average of 0.81 days in the past four weeks, relative to 0.88 days in the control group. Similar proportions of students in each arm—26.9% intervention, 27.8% control—missed one or more days of school, and among those who were absent, the mean number of days missed was also very similar across groups: 3.0 among intervention students, 3.1 among controls. Figure 5.4 charts the mean days of absence by month of interview among intervention and control students, as well as the total number of students interviewed in each month. With the exception of a sharp peak in September when very few students were interviewed, rates of absenteeism were fairly flat across the school year, and consistently higher in the control group over the period January-June. As a result of the clustered nature of data collection, the distribution of interviews across the school year varied across trial groups; as such, multivariable regression models adjust both for a student's month of interview, as well as whether he/she was interviewed outside of term time.

Figure 5.3 Distribution of primary school absenteeism in past four weeks, by trial group
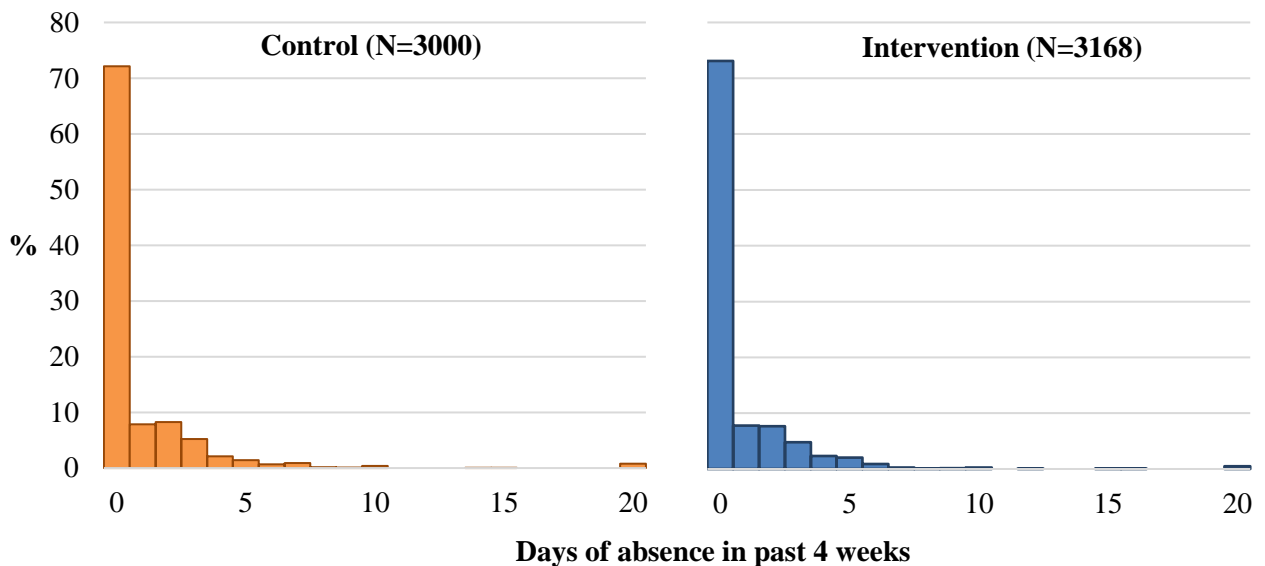
Figure 5.4 Number of students interviewed and mean days of absence, by month and trial group
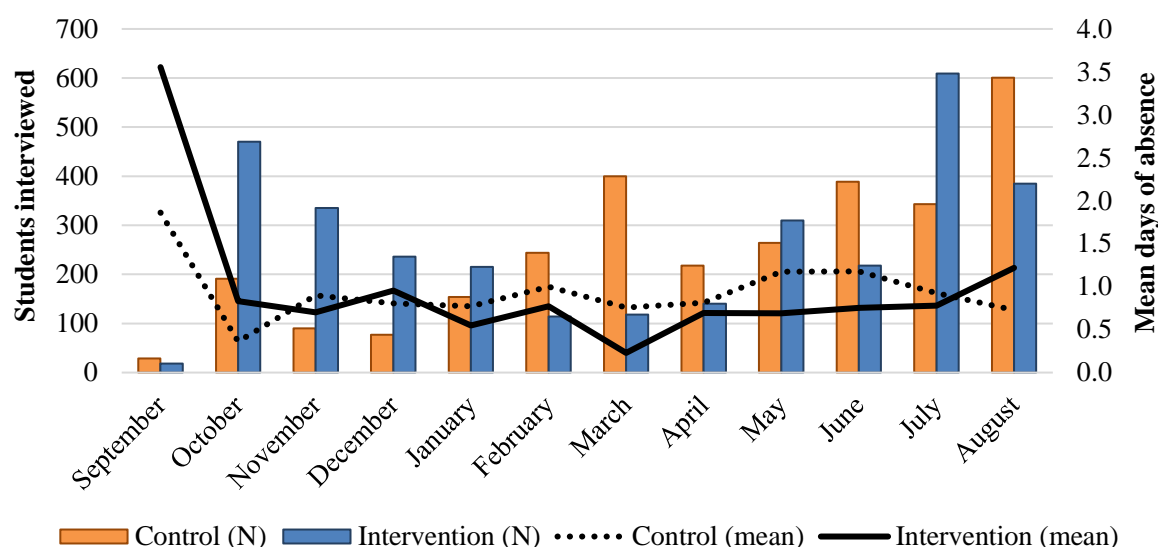
Results from negative binomial regression models suggest that, although the rate of absenteeism was slightly lower among cookstove recipients, there was no evidence that the CAPS trial yielded measurable improvements in school attendance in either the crude or adjusted analysis (adjusted incidence rate ratio (IRR) 0.92 [95% confidence interval (CI) 0.71-1.18]; Table 5.2). The per-protocol analysis gave similar results (adjusted IRR 0.93 [0.71-1.23]). Alternative specifications of the per-protocol sample—such as excluding only households that reported not using the cookstove at all, or only those that reported continuing to use open fire cooking methods for every, rather than any, household meal— did not change the nature of these findings.

Table 5.2 Incidence rate ratios of absenteeism in the past four weeks, comparing intervention to control group

	Unadjusted			Adjusted		
	IRR	95% CI	p-value	IRR	95% CI	p-value
ITT sample (N=6168)	0.92	0.72-1.19	0.53	0.92	0.71-1.18	0.51
Per-protocol sample (N=4784)	0.93	0.71-1.22	0.60	0.93	0.71-1.23	0.61

Notes: Results from negative binomial regression models with cluster robust standard errors. IRR=incidence rate ratio; CI=confidence interval. Adjusted model also includes: age, sex, current grade attended, repetition of current grade, maternal death, paternal death, maternal education, paternal education, number of total household members, number of younger household members, relationship to household head, sex of household head (taken from HDSS schooling survey), household socioeconomic status, coresidence with a regular smoker, exposure to sources of household smoke other than cooking (taken from CAPS baseline survey), the month of HDSS interview, HDSS survey round, interview timing relative to school holidays, and months between CAPS enrolment and HDSS survey. The intra-class correlation was estimated at 0.04.

The stratified analyses presented in Table 5.3 investigate the relationship between cookstove status and absenteeism by sex, age, and season. Although the adjusted IRRs showed absenteeism reductions in the hypothesised groups—namely, female cookstove recipients, students in the older age categories, and students interviewed during the rainy season—no conclusive evidence for effect modification was found. To investigate whether combining these subgroups yielded cookstove-related attendance benefits, separate models were run for girls and boys among students interviewed during the rainy season. These did provide some evidence that the cookstoves were associated with reduced absenteeism among girls aged 15 or older (Table 5.4), but this category comprised relatively few students.

Table 5.3 Stratified analysis of the relationship between cookstove exposure and days of absence in the past four weeks, by sex, age and season of interview

	Unadj. IRR	95% CI	p-value	p-value interaction	Adj. IRR	95% CI	p-value	p-value interaction
ITT sample (N=6168)								
1) By sex				0.52				0.40
Male (N=3157)	0.96	0.73-1.27	0.77		0.97	0.74-1.27	0.82	
Female (N=3011)	0.88	0.67-1.17	0.39		0.87	0.64-1.17	0.35	
2) By age (years)				0.73				0.89
<12 (N=4155)	0.92	0.72-1.19	0.54		0.94	0.72-1.21	0.62	
12-14 (N=1310)	0.87	0.61-1.22	0.41		0.88	0.65-1.20	0.43	
≥15 (N=703)	1.03	0.63-1.66	0.91		0.88	0.55-1.40	0.60	
3) By season				0.58				0.55
Dry (N=4252)	0.95	0.73-1.24	0.71		0.97	0.75-1.25	0.80	
Rainy (N=1916)	0.81	0.48-1.35	0.41		0.81	0.48-1.37	0.43	
Per-protocol sample (N=4784)								
1) By sex				0.40				0.23
Male (N=2456)	0.98	0.73-1.32	0.92		1.01	0.76-1.37	0.90	
Female (N=2328)	0.86	0.62-1.20	0.38		0.84	0.60-1.18	0.32	
2) By age (years)				0.43				0.71
<12 (N=3220)	0.93	0.71-1.22	0.61		0.95	0.71-1.27	0.74	
12-14 (N=1015)	0.81	0.52-1.25	0.34		0.84	0.57-1.23	0.36	
≥15 (N=549)	1.18	0.68-2.03	0.55		1.00	0.59-1.68	0.99	
3) By season				0.38				0.35
Dry (N=3179)	0.99	0.75-1.32	0.96		0.99	0.74-1.33	0.96	
Rainy (N=1605)	0.75	0.43-1.31	0.31		0.73	0.41-1.30	0.29	

Notes: Stratum-specific IRRs from three unadjusted and adjusted negative bionomial regression models with cluster robust standard errors and interactions between cookstove status and 1) sex, 2) age group, and 3) season. IRR=incidence rate ratio; CI=confidence interval. All adjusted models include the covariates listed in Table 5.2, with the exception of Model 3, which excludes month of interview due to collinearity with interview season. Wald tests were used to assess evidence for interaction.

Table 5.4 Stratified analysis of the relationship between cookstove exposure and days of absence in the past four weeks among boys and girls interviewed during the rainy season, by age

	Unadj. IRR	95% CI	p-value	p-value interaction	Adj. IRR	95% CI	p-value	p-value interaction
Boys: ITT sample (N=996)								
Overall	0.75	0.46-1.24	0.27	--	0.62	0.39-0.99	0.045	--
By age				0.88				0.44
<12 (N=669)	0.78	0.47-1.29	0.33		0.63	0.40-0.99	0.05	
12-14 (N=200)	0.64	0.27-1.48	0.29		0.47	0.23-0.94	0.03	
≥15 (N=127)	0.74	0.25-2.22	0.60		0.89	0.29-2.75	0.84	
Boys: Per-protocol sample (N=834)								
Overall	0.72	0.40-1.29	0.27	--	0.59	0.35-0.98	0.04	--
By age				0.67				0.27
<12 (N=557)	0.74	0.41-1.36	0.34		0.59	0.35-0.99	0.046	
12-14 (N=168)	0.48	0.17-1.41	0.18		0.35	0.13-0.92	0.03	
≥15 (N=109)	0.83	0.25-2.70	0.76		1.04	0.33-3.35	0.94	
Girls: ITT sample (N=920)								
Overall	0.87	0.46-1.65	0.67	--	0.68	0.38-1.24	0.21	--
By age				0.04				0.12
<12 (N=664)	1.11	0.57-2.16	0.77		0.79	0.43-1.46	0.45	
12-14 (N=182)	0.52	0.24-1.14	0.10		0.58	0.26-1.33	0.20	
≥15 (N=74)	0.46	0.17-1.21	0.11		0.32	0.14-0.75	0.009	
Girls: Per-protocol sample (N=771)								
Overall	0.79	0.41-1.52	0.48	--	0.71	0.39-1.28	0.26	--
By age				<0.001				0.14
<12 (N=565)	1.05	0.54-2.03	0.89		0.88	0.47-1.64	0.69	
12-14 (N=149)	0.41	0.17-1.00	0.050		0.51	0.21-1.27	0.15	
≥15 (N=57)	0.31	0.06-1.62	0.16		0.20	0.04-1.02	0.053	

Notes: Pooled and stratum-specific IRRs from unadjusted and adjusted negative bionomial regression models with cluster robust standard errors, among girls and boys interviewed during the rainy season. Stratum-specific IRRs generated by interacting cookstatus and age group. IRR=incidence rate ratio; CI=confidence interval. All adjusted models include the covariates listed in Table 5.2. Wald tests were used to assess evidence for interaction.

5.3.4 Reasons for absenteeism

Figure 5.5 shows that, among members of the ITT sample who were absent in the past four weeks, no difference in the distribution of reasons reported for missing school was found between the intervention and control groups. In both cases, the vast majority of absences (75.1% in the intervention group, 79.5% in the control group) were attributed to illness, while household chores, economic activities and caregiving were reported to make consistently negligible contributions to absenteeism. Although no school fees are charged for primary education in Malawi, approximately 10% of absences (10.6% intervention, 8.0% control) were attributed to lack of money for school supplies, transport or meals.

Figure 5.5 Primary reason reported for missing school in past four weeks, by trial group
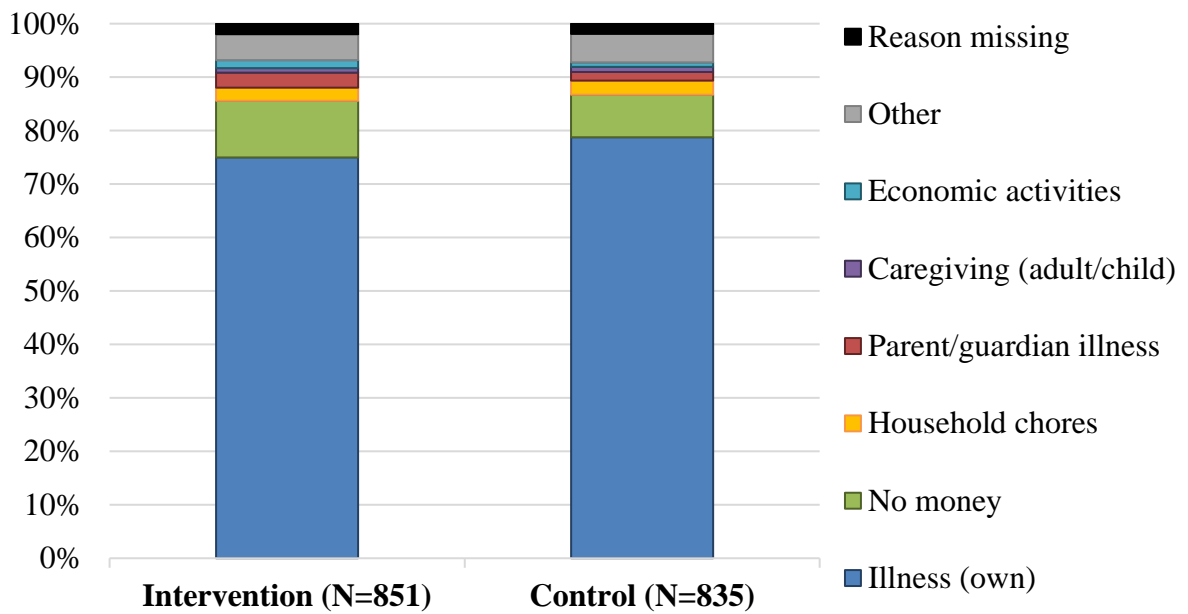
5.3.5 Qualitative analysis

Data from IDIs and FGDs confirmed that ill health represented an important cause of school absence. However, many of the sicknesses described would not be expected to derive from HAP exposure, such as malaria and stomach ache. Indeed, most participants did not perceive any change in household health status resulting from the cookstoves: 'Sickness is sickness, it just comes' (Male, intervention group (IG)). One IDI participant did observe, however, that her sister suffered fewer asthma attacks since receiving the cookstoves— '[She] used to be sick but now has changed […] Doesn't get sick often nowadays' (Female, IG)—which may have had positive implications for school attendance.

Although the perceived health benefits of the cookstoves were less pronounced than anticipated, there was nearly universal agreement among students from intervention households that the cookstoves produced time and resource savings. Many participants observed that the cookstoves used considerably less fuel than traditional open fire cooking, which reduced fuel collection burdens:

> On three stones [open fire] methods we used more firewood but now we use little firewood. (Female, IG)

> When using little firewood, it doesn't take time to go and fetch for the firewood. (Female, IG)

Because the cookstoves needed only small pieces of wood and biomass, which could be readily found, another participant noticed time savings from not needing to chop firewood:

> For three stone method, it requires you to first put the stones but when using a cookstove you just insert the small pieces of firewood and set fire. For three stone method, you need also to take an axe and cut firewood which is a waste of time. (Male, IG)

Participants also agreed that cooking meals was noticeably quicker when using the cookstoves, partly because households were given two units and cooking pots and so could prepare multiple dishes at once, but also because the cookstove fire burned much more efficiently: 'When cooking using the cookstove, the food cooks fast […] Because when using the cookstove, the fire goes direct to the pot unlike when using three stones the fire gets wasted' (Female, IG).

While these insights provide support for the hypothesis that the cookstoves yielded important time and resource savings, it is less clear that these savings translated into reduced school absenteeism. In particular, evidence that cooking or resource collection interfered with daily school attendance was limited, even in the control group. Among students, primarily girls, who reported collecting fuelwood, all described doing so on weekends or holidays, or during free time after school, such that it was compatible with school attendance:

> **Interviewer (I): [D]o you ever fetch firewood?**
> Participant (P): Yes but I usually do this on Saturdays.
> **I: […] Have you ever missed school because of fetching firewood?**
> P: I have never since we fetch firewood on Saturdays when we don't go to school.
>   (Female, control group (CG))
>
> **I: So when maybe you are fetching maize cobs, how long do you take?**
> P: I don't take time, maybe only one hour. (Female, CG)

A minority of participants indicated that their households purchased wood or charcoal for cooking, but did not comment on any changes in expenditure as a result of the cookstoves.

As anticipated, responsibility for cooking itself was borne predominantly by female household members, and often discussed in gendered terms. One male focus group participant observed, for example, that: 'Girls can sometimes be told to miss school so that

they should just cook food when we [boys] are at the farm and when we come back from the farm, we should find that the food is already cooked' (Male, CG). Among female participants, however, cooking was portrayed as largely compatible with school attendance, with students taking responsibility for the afternoon or evening meals upon return from school. As such, cooking-related absences were rarely reported, although one FGD participant described missing school to help with other aspects of food preparation: 'If maybe at home they are expecting visitors, they say don't go to school, you have to chase that chicken for visitors who are coming' (Female, IG). None of the cookstove recipients linked the cookstove to any changes in school attendance.

Instead, students reported a number of barriers to school attendance that were unrelated, either directly or indirectly, to cooking activities. In addition to ill health, these included engaging in household agricultural work or informal paid labour to help raise funds for schooling expenses, or school-related issues such as lack of uniform or supplies. There was some suggestion, however, that the cookstoves improved other educational outcomes not captured by our measure of school attendance. For instance, two participants observed that reduced time to cook breakfast in the morning resulted in fewer late arrivals to school:

> I go early to school when I cook on new cookstoves rather than on three stone cookstoves which requires more time to prepare fire. (Male, IG)

> **I: What is the change that you have noticed about time you go to school?**
> P: We cook food very fast and eat earlier and then we rush to school.
> **I: So you mean you go to school early?**
> P: Yes. (Female, IG)

Even when cooking or fuelwood collection does not directly compete with schooling, reduced time burdens associated with these activities may allow students to spend more time studying or resting, with positive implications for school performance. Although most IDI participants reported having adequate time to combine household work and self-study, when asked a hypothetical question about how they would use any time savings from reduced domestic burdens, 11 of 16 indicated that they would spend the extra time on reading, writing or homework, including the following students:

> **I: Do you have enough time in your day to spend on school and homework here at home?**
> P: Yes.

I: If you could spend less time on doing household chores, how would you use the extra time in your day?
P: I can use it to read my school notes and also revising what I got wrong at school.
I: Is there any other thing you can also do?
P: Apart from that, I can also be doing my homework […]
I: Suppose you have done your homework but still more you have extra time, how would you use it?
P: Then I can be drawing water in preparation for tomorrow. (Female, IG)

I: Do you have enough time in your day to spend on school and homework?
P: Yes.
I: If you could spend less time on doing household chores, how would you use the extra time in your day?
P: I can use it for reading.
I: Why reading?
P: *(Silence)*
I: Is there anything else you could do apart from reading?
P: After reading if I still have time then I can use it to cook.
I: Suppose you have finished cooking.
P: Then to play with my friends. (Female, CG)

5.4 Discussion

This study combined quantitative and qualitative data to assess the impact of cleaner burning biomass-fuelled cookstoves on primary school attendance in northern Malawi and found that the CAPS intervention had no measurable impact on primary school attendance overall. These findings echo a separate evaluation of the CAPS trial's primary outcome, which found no evidence that the cookstoves reduced the incidence of pneumonia in children under five years old (Mortimer et al. 2016). The authors of the latter study speculated that the cookstoves did not sufficiently reduce exposure to air pollution in a context where other forms of smoke exposure including burning rubbish, brick burning and tobacco smoking were prevalent (Mortimer et al. 2016).

The target population of the CAPS trial consisted of children under five years old, so data were not collected from school-age household members with which to assess the direct impact of the cookstoves on adolescent health. Most participants in the qualitative study did not perceive a change in household health after receiving the cookstoves, although there was some suggestion that the cookstoves reduced asthma exacerbations. Strong links have been drawn between open fire cooking and asthma prevalence in both younger (age 6-7)

and older (age 13-14) school-age children in global studies (Wong et al. 2013), but asthma is reported to be uncommon among children in Malawi, comprising just 0.6% of cases admitted to hospital (Gordon and Graham 2006). Although the CAPS evaluation found that the cookstoves significantly reduced burns among children under five (Mortimer et al. 2016), it is likely that students' caregiving responsibilities did not diminish to a sufficient degree to observe a population-level impact on school attendance.

Qualitative data confirmed that students perceived time and resource savings associated with the cookstoves, consistent with findings from a CAPS socioeconomic study carried out among primary cooks (Cundale et al. 2017). Evidence that these savings translated into improvements in school attendance, however, was minimal. In particular, participants from both trial groups indicated that cooking-related responsibilities were compatible with school attendance. Wodon and Beegle (2006), using data from the 2004 Malawi Second Integrated Household Survey, examined the contribution of various activities to household labour and found that the time associated with fuelwood collection—between 0.1 and 0.5 hours per week for rural boys aged 5-14 and 0.4-1.2 hours for rural girls, depending on the month—was relatively limited, suggesting that it could be successfully combined with schooling. As reflected in our qualitative findings, larger time burdens were associated with agricultural labour and, for girls, also with other household chores including cooking, laundry, cleaning and water collection (Wodon and Beegle 2006). The present study would benefit from detailed time use data from the larger survey sample to quantify the time burdens attached to fuel collection and cooking among household members in control and intervention clusters, to identify other activities that inhibit regular school attendance, and to establish the extent to which students complete homework or engage in non-school-related educational activities such as reading or listening to the radio. Hourly, rather than daily, school attendance data would also have enabled an examination of the cookstoves' impact on a more nuanced set of school attendance outcomes, including timely arrival at school, which the qualitative data suggest may have improved in intervention households.

While the primary analysis followed ITT principles, the per-protocol analysis excluded students from households that did not report using the cookstove exclusively during the follow-up period corresponding to the schooling survey. Three percent of students lived in households in which the cookstove was not used at all, while a further 33% came from households that continued using open fire cooking methods alongside the cookstove. Non-

and concurrent use of cookstoves has been noted in cookstove trials in a variety of settings (e.g. Hanna et al. 2012; Piedrahita et al. 2016; Romieu et al. 2009; Ruiz-Mercado and Masera 2015) and highlights the difficulty of implementing interventions involving behaviour change. Even employing a strict per protocol definition there was no evidence of benefit of the cookstoves on absenteeism, with the possible exception of older girls interviewed during the rainy season. The latter finding merits further research.

This study has demonstrated the value of supplementing quantitative evaluation measures with qualitative data, as a way of corroborating and explaining the quantitative findings. Insights from IDIs and FGDs were particularly helpful in shedding light on the proposed mechanisms (or lack thereof) between cleaner burning cookstoves and school absenteeism. The scope of the qualitative study was, however, limited by the time and resources available. A pre-/post-intervention interview design, as well as a larger sample size and a more explicit focus on seasonality, would have provided greater depth, particularly with respect to changing perceptions surrounding health, time use, and schooling.

5.5 Conclusion

This mixed methods study combined quantitative and qualitative data to assess the impact of cleaner burning cookstoves on primary school absenteeism in Karonga district, northern Malawi. Taken together, the findings indicate that the cookstoves did not yield measurable reductions in primary school absenteeism, but suggest that they might confer other school-related benefits not captured by the outcome measure available. On this evidence, interventions that aim to increase school participation should more directly target the barriers to school attendance that are salient in this population, including cost constraints and non-HAP-related illness. An appreciation of context is important, however: Malawi's northern region, where the study was located, is characterised both by comparatively favourable educational outcomes (National Statistical Office and ICF Macro 2011; World Bank 2010), as well as higher forest cover than the two southerly regions (Government of Malawi 2009). Interventions from settings where rates of absenteeism are higher and fuelwood more scarce may yield different results.

Acknowledgements

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Student	Christine Kelly
Principal Supervisor	Judith Glynn
Thesis Title	School absenteeism in Karonga district, northern Malawi: Trends, influences and the impact of cleaner burning biomass-fuelled cookstoves

If the Research Paper has previously been published please complete Section B, if not please move to Section C

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For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	With input from co-authors, I designed the study, managed the data, conducted the analysis and wrote the manuscript

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Supervisor Signature: _____   **Date:** 16.10.17

Chapter 6: Absenteeism and future educational trajectories

Primary school absenteeism and future educational trajectories in Karonga district, northern Malawi: A longitudinal analysis

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Abstract

School attendance forms one element of the production function of learning, whereby years of schooling, school and teacher characteristics, household characteristics and household-level school inputs including daily attendance and school supplies combine to determine a student's achievement. The link between school attendance and educational outcomes may, however, be more uncertain in low-resource settings where the marginal productivity of class time is relatively poor and absenteeism represents one of many threats to instructional time. This study exploits longitudinal data from the annual household survey of the Karonga Health and Demographic Surveillance System to investigate the relationship between school absenteeism and future educational trajectories for more than 7,000 primary school students in northern Malawi. Pooling a maximum of eight observations per student, we find that students who were absent in one survey round were more likely to be absent again in the next round, and to repeat their school grade. A measure of cumulative absence over multiple survey rounds was also significantly associated with lower grade attainment after six years. Although our analysis cannot establish a causal relationship between absenteeism and subsequent adverse educational outcomes, attendance records can nevertheless provide an important early warning system to identify students at risk of future grade repetition and dropout.

6.1 Introduction

Although Malawi has achieved great strides in recent decades with respect to expanding primary school enrolment, students' trajectories through school are far from smooth. Taniguchi (2015) showed that one-quarter of standard (grade) 5 and 7 students across 30 schools in Nkhata Bay did not progress to the next grade after one academic year, while Sunny et al. (2017) found that 39% of primary students in Karonga district had repeated their current grade. Repetition not only increases students' risk of school dropout (Branson et al. 2014), but it also represents a large and costly source of inefficiency for a school system (Glick and Sahn 2010), which may compromise its ability to deliver high-quality education. In Malawi, the World Bank has estimated that, because of repetition and dropout, twenty-three student-years are required to produce one graduate of the eight-year primary cycle (World Bank 2010).

School absenteeism has been identified as an important risk factor for adverse educational pathways, such as in the framework designed by the Consortium for Research on Educational Access, Transitions and Equity (CREATE) to describe educational zones of exclusion, where 'precursors to dropout include repetition, low achievement, temporary withdrawals, [and] low attendance' (Lewin 2009, pp. 156-7). However, empirical evidence linking absenteeism with subsequent educational outcomes is limited in sub-Saharan African settings, where under-resourced classrooms, poor learning outcomes, and multiple threats to instructional time may reduce the marginal benefit of school attendance (Abadzi 2004; Lavy 2015; Rivkin and Schiman 2015).

Analyses of data from the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) have shown that increased absenteeism is significantly associated with lower literacy and numeracy scores in Kenya (Hungi and Thuku 2010a), Tanzania (Yu and Thomas 2008) and pooled analyses of 14 member countries (Hungi and Thuku 2010b; Yu and Thomas 2008). Because the SACMEQ studies rely on cross-sectional data, however, they are unable to establish the temporal sequence of absenteeism relative to other adverse educational outcomes, while SACMEQ's focus on standard 6 students does not capture the experience of many primary school students in light of high repetition and dropout rates (Barnett 2013). Sunny et al. (2017) and Taniguchi (2015) use two rounds of longitudinal data to show in Malawi that absenteeism in one year is significantly associated

with grade repetition in the next, although Taniguchi, too, only includes students at advanced stages of primary school (standards 5 and 7 at baseline). The relatively short time horizon of both studies, moreover, precludes examination of the accumulation of absenteeism over time and its relationship with longer-term educational pathways.

Additionally, as none of the existing studies focus on absenteeism specifically, as distinct from other individual-, household- and school-level risk factors for poor achievement or grade progression, they do not explore potential thresholds of absenteeism that are particularly problematic for student trajectories. They also do not assess possible interactions between absenteeism and such characteristics as sex, age, socioeconomic status, and standard attended to identify the students for whom missing school has the greatest adverse impact.

This paper harnesses a longitudinal dataset of 7,823 primary school students from Karonga district, northern Malawi, to investigate the following research questions:

1. To what extent are the same students absent repeatedly across school years?
2. Are students who miss school in one year more likely to repeat their grade in the next year? Is there a dose-response relationship between days of school missed and likelihood of repetition?
3. How is cumulative absenteeism over multiple school years related to long-term educational trajectories, as measured by grade attainment?
4. Is the association between absenteeism and grade repetition modified by students' background characteristics?

6.1.1 Instructional time and educational outcomes

According to economic theory, school attendance forms one element of the production function of learning, whereby years of schooling, school and teacher characteristics, household characteristics and household-level school inputs including daily attendance and school supplies combine to determine a student's achievement (Glewwe and Kremer 2005). Research from the United States (Goodman 2014; Gottfried 2011) has convincingly shown that students' performance on school examinations or standardised tests is significantly associated with their number of absence days.

The link between school attendance and educational outcomes may, however, be more

uncertain in low-resource settings. An analysis of the impact of instructional time[27] on Programme for International Student Assessment (PISA) test scores found that the positive impact of teaching hours was much smaller in developing countries relative to OECD members (Lavy 2015), suggesting that the marginal benefit of class time is lower in resource-constrained environments where learning outcomes are poor. Importantly, Lavy's developing country sample comprised entirely middle-income economies including Mexico, Thailand and Turkey, and not very low-income countries comparable with Malawi. Were data available from low-income contexts, this may further widen the disparities observed with respect to productivity of class time. Rivkin and Schiman (2015), also using PISA data, showed that the return to instructional time was lower in low-quality classroom environments, as measured by an index of characteristics including student attendance and behaviour. This finding suggests that frequent absences of classmates, or lax school management styles that facilitate frequent student absences (Dunne 2007), may hamper the learning even of students who regularly attend, thereby reducing the relative disadvantage of absentees.

Moreover, absenteeism has been identified as only one of a number of threats to instructional time. Figure 6.1, adapted from Abadzi (2004) and modelled on classroom observations in low-income settings, shows that school closures, teacher absenteeism, class time away from task, as well as student absenteeism, all reduce students' exposure to curriculum content. In this learning environment, we might not expect absenteeism to have as large an impact on student performance as it would in a context without other instructional time constraints.

Figure 6.1 Sources of instructional time wastage

Official class time
Remaining after school closures (strikes, weather, teacher training, extra holidays)
Remaining after teacher absenteeism
Remaining after student absenteeism
Class time devoted to any learning task
Learning time relevant to curriculum
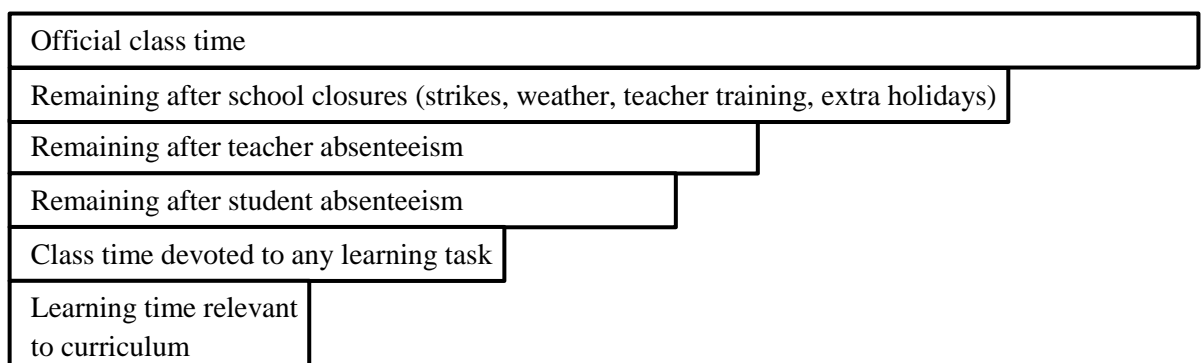
Source: Adapted from Abadzi 2004. Education for all or just for the smartest poor? *Prospects* 34(3), p.274.

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[27] Note that instructional time in these analyses is measured by the length of the official school day, rather than any measure of students' actual attendance – see Goodman (2014) on this important distinction.

6.1.2 Education in Malawi

Malawi became one of the first countries in sub-Saharan Africa to eliminate primary school fees when it introduced free primary education in 1994. While the policy led to a large and immediate increase in student enrolment, its limited planning and rapid implementation placed considerable strain on personnel and infrastructure (Chimombo 2009), which continue to be stretched by rapid population growth (World Bank 2010). According to surveys carried out in 2007 under the auspices of SACMEQ, 46% of standard 6 students attended schools that were reported to be in good physical condition; 12% attended schools that had electricity; half attended classes that met the Ministry of Education's standard of sixty students per teacher; and just 35% had teachers who demonstrated appropriate subject-specific knowledge in reading or maths (Milner et al. 2011). Findings from the World Bank's Quality of Service Delivery Survey of 2014/15 indicated that, on average, teachers were scheduled to teach for less than four hours per day, while 20% of instructional time was spent off-task, and only 25% on active learning, according to classroom observations (Ravishankar et al. 2016).

Malawian students also score consistently poorly on standardised assessments relative to peers in neighbouring countries; in the latest set of SACMEQ tests in 2007, just 63% of Malawian standard 6 students demonstrated functional literacy and 40% functional numeracy, compared to figures approaching 90% in both subjects among counterparts in Kenya, Tanzania and Swaziland (Taylor and Spaull 2015). Students in Karonga district were among the top performing students in Malawi, but on average achieved scores well below the SACMEQ mean (Mulera et al. 2017). In this context, we might not expect to observe as strong or consistent a relationship between school attendance and performance as has been found in other settings.

6.2 Methods

6.2.1 Study population

Data for this analysis come from the Karonga Health and Demographic Surveillance System (HDSS), which includes an annual household survey covering a population of approximately 35,000 people in Karonga district, northern Malawi (Crampin et al. 2012). Using the eight survey rounds in which school attendance data were collected—spanning the period 2008-2016—we establish an open cohort of primary school students, who enter

the cohort when they start standard 1. Students who entered primary school in 2008 therefore contribute a maximum of eight observations to the analysis, whereas students who entered in the 2014-5 survey round contribute two observations. After cohort entry, students do not contribute observations in survey rounds in which they were not enrolled in school, were resident in the study area but attending school outside Karonga district, had left the catchment area, had died, or were not interviewed for any other reason. As surveys were administered to household members aged 15 or over who were at home at the time of the field team's visit, most information was provided by adult household members—primarily parents—on behalf of resident children. For each child, survey respondents were asked to report if he/she had attended school during the past four weeks that school was in session, and if so, how many days he/she had been absent during that period.

Each survey was administered over a 12-month period roughly corresponding with the academic calendar, except during the first two surveys when the school year transitioned from a January to a September start (see Figure 6.2).

Figure 6.2 Timing of HDSS survey administration relative to the primary school calendar
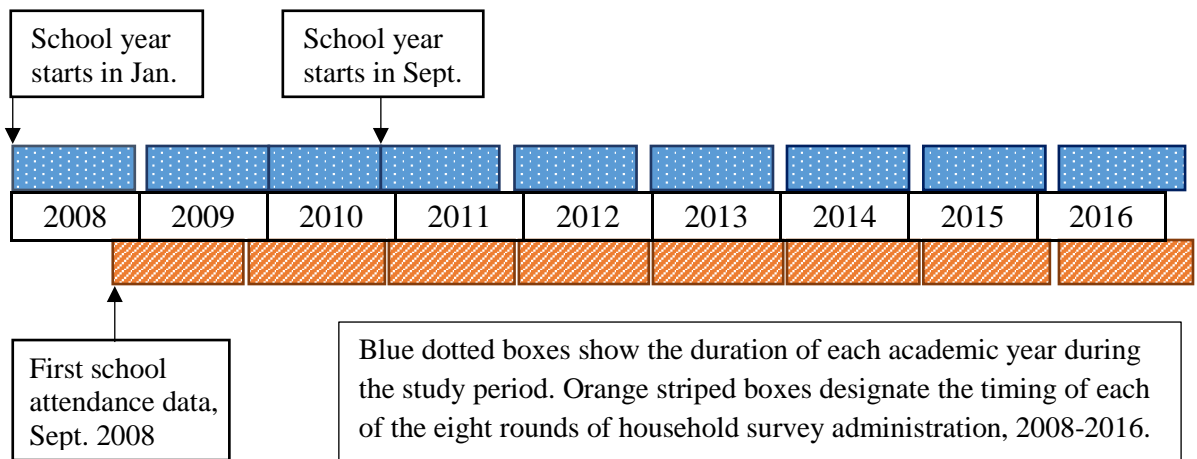
6.2.2 Analysis methods

The analysis capitalises on longitudinal data from the HDSS to examine the relationship between absenteeism and three subsequent educational outcomes: 1) absenteeism, 2) grade repetition, and 3) grade attainment. For each set of analyses, three thresholds of absence are compared—generated separately for each survey round—in order to investigate whether students who experience the most absenteeism suffer worse outcomes. To reflect differences in the distribution of absenteeism across survey rounds (see Figure 6.4), and

that our measure of absenteeism can provide only a snapshot of attendance at one point in the school year, relative rather than absolute thresholds are used: 1) any episode of absence in the past four weeks, 2) a period of absence above the 90th percentile and 3) a period of absence above the 95th percentile for that survey round. Students who breached these absence thresholds are compared to all other students.

After a brief description of absenteeism trends over time and by standard attended, we investigate the extent to which absenteeism is repeated by the same individuals across rounds. We run a logistic regression model estimating the association between missing school in one round and the probability of being absent at least once in the next round (separate models for each of the three absenteeism thresholds), among cohort members with at least two consecutive interviews. Students contribute one observation for each pair of interviews across rounds, up to a maximum of 7 observations; we use individual random effects to account for non-independence of observations. Multivariable models adjust for demographic characteristics including sex, current age, age started primary, standard and school attended, as well as household factors that have been shown to influence school attendance (see Chapter 4): parental education, parental death, household head occupation, sex of household head, and household size and age distribution.[28] To account for variation in the school calendar, as well as any seasonal differences in the timing of survey administration across rounds, multivariable analyses also adjust for both the survey round and month of interview. Models are restricted to students attending 23 schools with at least ten observations per round to avoid the problem of perfect correlation of absenteeism and school.

We then turn to examine the relationship between absenteeism in one survey round and grade repetition in the next, using logistic regression models with individual random effects. Once again, students contribute one observation per pair of consecutive interviews and separate models are run for each of the three absenteeism thresholds defined above. Multivariable models contain the same covariates as listed for the first analysis, but are lagged one round behind the grade repetition measure, to examine the effect of absenteeism and other factors in one year on repetition the following year. By adding appropriate

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[28] Note that although agricultural variables were shown in Chapter 4 to be highly related to absenteeism, these variables were not collected in the HDSS survey after 2010-11 so could not be examined here.

interaction terms to each model, we also assess whether the effects of absenteeism differ by any of the observed background characteristics.

We finally investigate the long-term impact of cumulative absenteeism in past rounds on future grade attained. Cumulative absenteeism is measured by the number of rounds a student's absenteeism breached the three respective thresholds defined above, among students interviewed in consecutive rounds. To allow a sufficient period of follow-up, we restrict this analysis to students who entered the cohort in the first three years of the study, and who were interviewed continuously for six years. Linear regression models estimate the relationship between the cumulative measure of absenteeism over the first five years of school with standard attended in the sixth year. Multivariable models adjust for individual and household characteristics measured contemporaneously with the outcome.

6.2.3 Attrition analysis

Of the 7,823 students who entered the cohort before the last survey round in 2015-16 (see Figure 6.3), 28.0% missed at least one interview between cohort entry and the last survey round. Of these, 23.2% exited the cohort after their first interview, 49.7% completed multiple interviews but left the cohort before the end of the study period, while the remaining 27.1% were present at the end of the study period following an earlier interruption. Overall, of the 38,451 person-rounds possible among the students who entered the cohort before the 2015-2016 survey, 33,383 (86.8%) were observed. However, because consecutive interviews are required for the longitudinal analysis, a maximum of 24,817 person-rounds (64.5%) are available after eliminating single, isolated interviews.

Table A.4 in the Appendix shows results from a random effects logistic regression model estimating the relationship between students' characteristics in one round and non-interview in the next. Missing data were not associated with absenteeism status, nor with age or standard attended, but were linked to other background characteristics. Controlling for other factors, female students were more likely to miss an interview, as were those who were not the biological child of the household head or were living in a female-headed household. Students in non-farming households, and those with more educated fathers, were less likely to be followed up than peers in agricultural households or whose fathers had not progressed beyond primary school. Attrition was also associated with smaller household size, and with having one or more resident younger than the index student. For

the purpose of this paper, we adjust all models for covariates that are shown to be associated both with non-interview and with the outcomes of interest, under the assumption that attrition is independent within strata of these covariates (Greenland et al. 2008).

6.3 Results

6.3.1 Analytic cohort

Figure 6.3 shows the composition of the primary school cohort across the eight survey rounds, 2008-2016. Approximately 1,000 children entered standard 1 in each successive round[29], while very few left school, died, or transferred to schools outside Karonga district during the study period. Students were interviewed an average of 3.8 times (range 1-8), or 4.5 times (range 2-8) in the analytical sample of students interviewed in at least two consecutive rounds. In light of Malawi's eight-year primary cycle, as well as high repetition rates in the sample, the educational trajectories of most students are truncated. Cohort members in the latter stages of primary school thus represent an increasingly selective student sample by virtue of having progressed through the primary cycle without repeating.

Figure 6.3 Composition of student cohort across eight survey rounds, 2008-2016
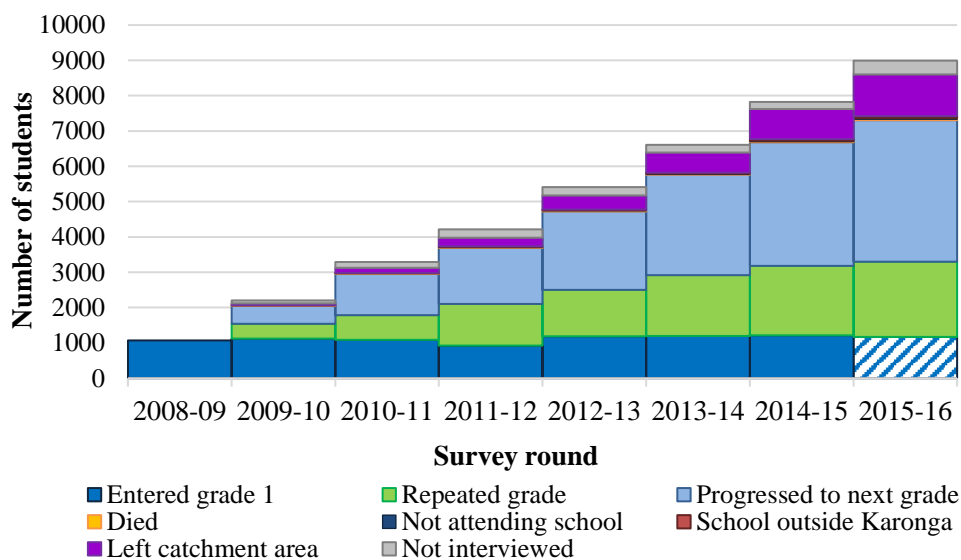
Note: The 1173 students who entered primary school during the 2015-16 survey round (shown in the striped box) are excluded from the analysis.

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[29] Note that the students who entered primary school in the last survey round—shown in the striped box—are not included in the analysis as they lack follow-up time.

Table 6.1 shows individual and household baseline characteristics of the 7,236 students who entered the primary school cohort before the 2015-16 round and were interviewed in two or more consecutive rounds. Approximately equal numbers of male and female students entered the cohort during the study period. Students had a mean age of 6 years old at baseline, which matched the official age of primary school entry, but just over one third entered the cohort before age 6 and 17% entered at age 7 or older.[30] The majority of students lived in households engaged in subsistence farming, with 10.6% residing with household heads in skilled occupations, including teachers, health professionals, or managers of large organisations. Approximately 5% and 2% of cohort entrants were paternal or maternal orphans, respectively.

Table 6.1 Baseline characteristics of primary school cohort

Sex	n (%)
Male	3693 (51.0)
Female	3543 (49.0)
Age	
≤5	2470 (34.2)
6	3531 (48.8)
7	1044 (14.4)
≥8	191 (2.6)
Mean years (SD)	6.4 (0.76)
Father's education	
Primary or less	4322 (59.7)
More than primary	2842 (39.3)
Missing	72 (1.0)
Mother's education	
Primary or less	5763 (79.6)
More than primary	1452 (20.1)
Missing	21 (0.3)
Father's survival status	
Alive	6876 (95.0)
Died	353 (4.9)
Missing	7 (0.1)
Mother's survival status	
Alive	7110 (98.3)
Died	126 (1.7)
Relationship to household head	
Child	5734 (79.2)
Step-child	166 (2.3)
Grandchild	1083 (15.0)
Niece/nephew	77 (1.1)
Other	176 (2.4)

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[30] Note, however, that not all 7 year-olds entered primary school late, depending on the timing of interview relative to the student's birthday.

Table 6.1 continued Baseline characteristics of primary school cohort

Sex of household head	n (%)
Male	6118 (84.5)
Female	1118 (15.5)
Occupation of household head	
Subsistence farmer/herdsman	4968 (68.7)
Fisherman	372 (5.1)
Other non-skilled	1011 (14.0)
Skilled	735 (10.2)
Not working	109 (1.5)
Missing	41 (0.6)
Number of household members	
1-4	1179 (16.3)
5-8	5121 (70.8)
9+	936 (12.9)
Mean members (SD)	6.3 (2.0)
Number of younger members	
None	1698 (23.5)
1	3145 (43.5)
2	1967 (27.2)
$\geq$3	426 (5.9)
Mean younger members (SD)	1.2 (0.85)
Survey round of cohort entry	
2008-09	1004 (13.9)
2009-10	1059 (14.6)
2010-11	1038 (14.3)
2011-12	869 (12.0)
2012-13	1118 (15.5)
2013-14	1084 (15.0)
2014-15	1064 (14.7)

Note: Restricted to analytic sample of students interviewed in two or more consecutive rounds and who entered the cohort before 2015-16

6.3.2 Absenteeism prevalence

Figures 6.4 and 6.5 show the overall prevalence of absenteeism by survey round (Figure 6.4) and standard attended (Figure 6.5), among cohort members with non-missing data. Levels of reported absence varied somewhat across rounds, both in terms of the proportion of students who missed school in the previous four weeks and the number of days missed. Prevalence of absenteeism was highest in standard 1 and declined with successive grades.[31] Attendance data were missing for approximately 4% of observations.

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[31] Although very few students reached standard 8 in the cohort under study, a previous analysis by the authors with a larger sample of standard 8 students also showed that absenteeism was lowest in the final year of primary school (see Chapter 4).

Figure 6.4 Proportion of students who missed school in the past four weeks, and mean number of days missed, by survey round
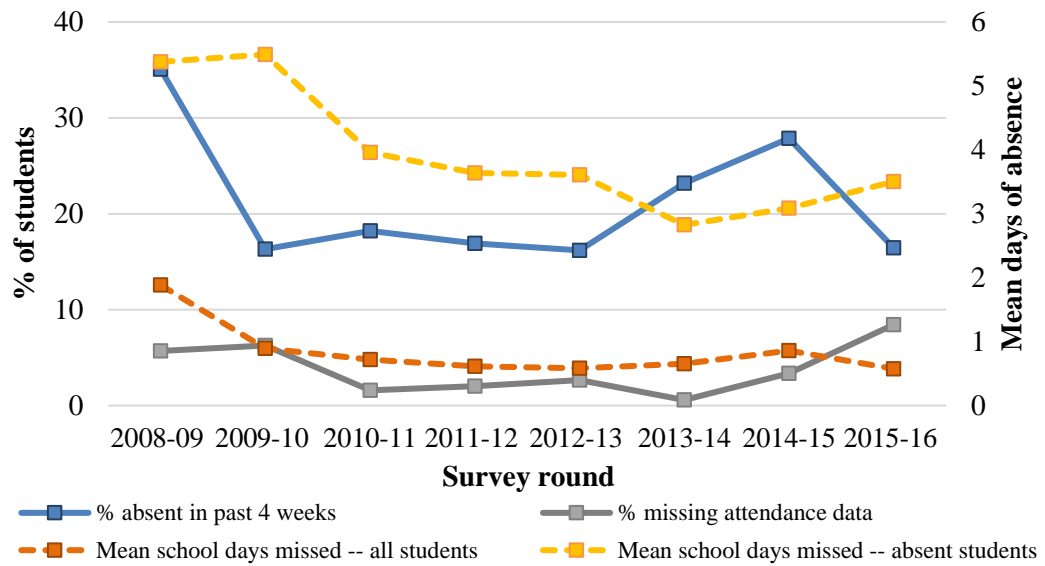
Figure 6.5 Proportion of students who missed school in the past four weeks, and number of students interviewed, by standard
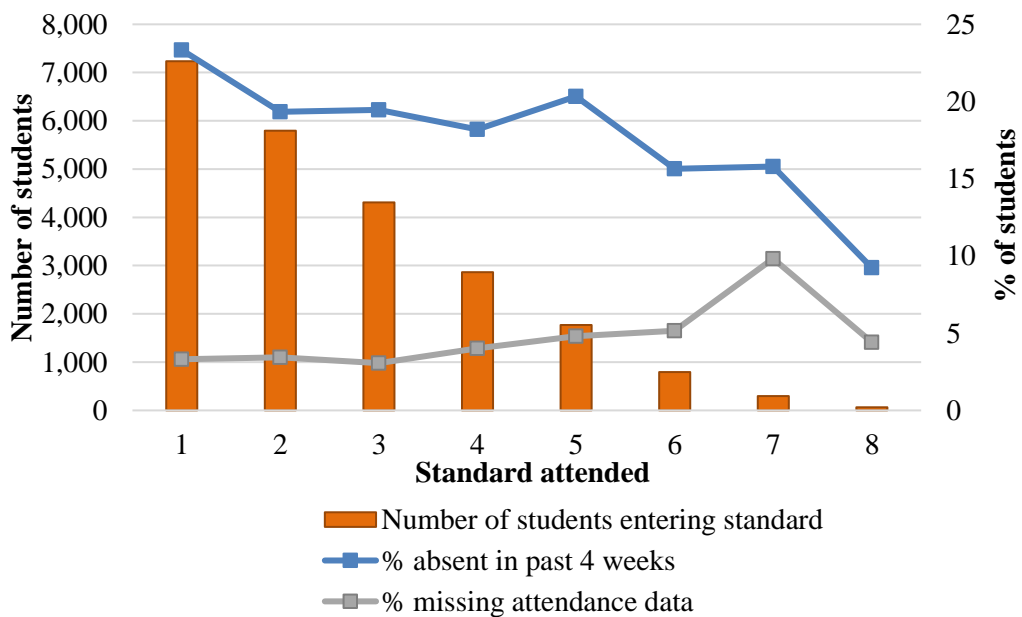
6.3.3 Repeated absenteeism

We now investigate the extent to which students who reported absenteeism in each survey round are the same or different students across time. That is, we seek to assess whether students who are absent in one round are more or less likely than their peers who were not absent to miss school in the next round. Table 6.2 shows results from unadjusted and

adjusted logistic regression models assessing the association between lagged (i.e. in round$_{t-1}$) and current (round$_t$) absenteeism, using the three round-specific thresholds: 1) any in the past four weeks, 2) absenteeism above the 90th percentile and 3) absenteeism above the 95th percentile. The results confirm that, among students with at least two consecutive rounds of attendance information, absenteeism in the previous round was significantly associated with missing school in the current round, and particularly when current absenteeism breached the highest absenteeism thresholds. No evidence for differences in levels of absenteeism between male and female students, nor for effect modification by background characteristics, was found (see Table A.5 in the Appendix for full model results).

Table 6.2 Association between three thresholds of absenteeism in the past four weeks and three thresholds of lagged absenteeism, among students with at least two consecutive interviews

	OR	95% CI	p-value	AOR	95% CI	p-value
Any absenteeism in past 4 weeks (N=21,834 [6,765])						
Model 1: Any lagged absenteeism	1.18	1.07-1.30	0.001	1.14	1.03-1.25	0.009
Model 2: Lagged absenteeism >90 %ile	1.18	1.04-1.34	0.010	1.12	0.99-1.27	0.080
Model 3: Lagged absenteeism >95 %ile	1.13	0.95-1.33	0.168	1.11	0.94-1.32	0.220
Absenteeism > 90th percentile past 4 weeks (N=21,834 [6,765])						
Model 1: Any lagged absenteeism	1.34	1.18-1.52	<0.001	1.28	1.13-1.46	<0.001
Model 2: Lagged absenteeism >90 %ile	1.49	1.22-1.81	<0.001	1.37	1.13-1.67	0.002
Model 3: Lagged absenteeism >95 %ile	1.29	1.00-1.65	0.047	1.19	0.93-1.53	0.171
Absenteeism > 95th percentile past 4 weeks (N=21,834 [6,765])						
Model 1: Any lagged absenteeism	1.55	0.33-1.82	<0.001	1.41	1.20-1.66	<0.001
Model 2: Lagged absenteeism >90 %ile	1.71	1.35-2.16	<0.001	1.54	1.22-1.96	<0.001
Model 3: Lagged absenteeism >95 %ile	1.58	1.11-2.26	0.011	1.43	1.00-2.04	0.050

Notes: Table shows results from a logistic regression model with individual random effects. The first number in brackets designates total observations; the second in square brackets shows the number of students who contributed observations. Students contributed an average of 3.2 observations. Adjusted models also include: sex, age group, age started primary, standard attended, relationship to household head, father's education, mother's education, father's survival status, mother's survival status, occupation of household head, number of household members, number of younger household members, interview month, school attended, change of school across rounds, and survey round. Sample was restricted to students attending schools with at least 10 observations per round. Note that 190 observations from one school were dropped for predicting failure perfectly in models with absenteeism >95th percentile as the exposure. See Table A.5 for full model results.

By way of sensitivity analysis, we also compared absenteeism patterns of students whose interview pairs occurred during the same calendar month across rounds with those who were interviewed in different months, to ensure that the timing of survey administration did not drive the observed relationship between current and lagged absenteeism. Focusing on any absenteeism in the past four weeks as the outcome variable, the stratified models show

that, among students interviewed in the same calendar month, evidence for the association between current and lagged absenteeism consistently lost statistical significance, suggesting that the relationship in the full model does not result simply from seasonal patterns of absence (Table 6.3). Indeed, the association between any lagged absenteeism and current absenteeism was strongest among students interviewed in different months across rounds (AOR: 1.26 [1.14-1.39]).

Table 6.3 Association between any absenteeism in the past four weeks and three thresholds of lagged absenteeism, according to whether students were interviewed in the same month or different months across rounds

	OR	95% CI	p-value	AOR	95% CI	p-value
Students interviewed in same month across rounds (N=8,389 [4,802])						
Model 1: Any lagged absenteeism	1.14	0.99-1.31	0.060	1.10	0.96-1.27	0.183
Model 2: Lagged absenteeism >90 %ile	1.23	1.00-1.52	0.047	1.11	0.90-1.37	0.340
Model 3: Lagged absenteeism >95 %ile	1.26	0.95-1.66	0.105	1.18	0.89-1.56	0.245
Students interviewed in different months across rounds (N=13,445 [5,777])						
Model 1: Any lagged absenteeism	1.35	1.22-1.48	<0.001	1.26	1.14-1.39	<0.001
Model 2: Lagged absenteeism >90 %ile	1.27	1.09-1.47	0.002	1.22	1.05-1.43	0.012
Model 3: Lagged absenteeism >95 %ile	1.16	0.94-1.42	0.170	1.16	0.94-1.44	0.168

Notes: Table shows results from a logistic regression model with individual random effects. The first number in brackets designates total observations; the second in square brackets shows the number of students who contributed observations. Students contributed an average of 1.7 and 2.3 observations in the two models, respectively. Adjusted models also include the same covariates as listed in notes for Table 6.2. Sample was restricted to students attending schools with at least 10 observations per round.

6.3.4 Absenteeism and grade repetition

We now examine whether the grade progression of students who missed school was measurably worse than for peers who did not experience absenteeism. Figure 6.6 plots the survival profile for each grade in primary school, among male and female students who entered the cohort in the first survey round and were therefore observed for the (theoretical) duration of the eight-year primary cycle. It calculates the cumulative probability of reaching each grade on the first attempt, accounting for the probability of progressing through each previous grade without repeating or dropping out. The curves indicate that promotion rates to standards 2 and 4 were lowest for both boys and girls, and highest for standards 7 and 8, although it should be noted that the sample from which these probabilities were generated becomes increasingly selective at later grades. Although promotion rates for girls were slightly higher than for boys at nearly every grade, the

probability of children entering standard 1 and progressing to standard 8 without repeating or dropping out was very low for both sexes: just 4% for boys and 5% for girls.[32]

Figure 6.6 Survival profiles of boys and girls who entered primary school in the 2008-09 survey round
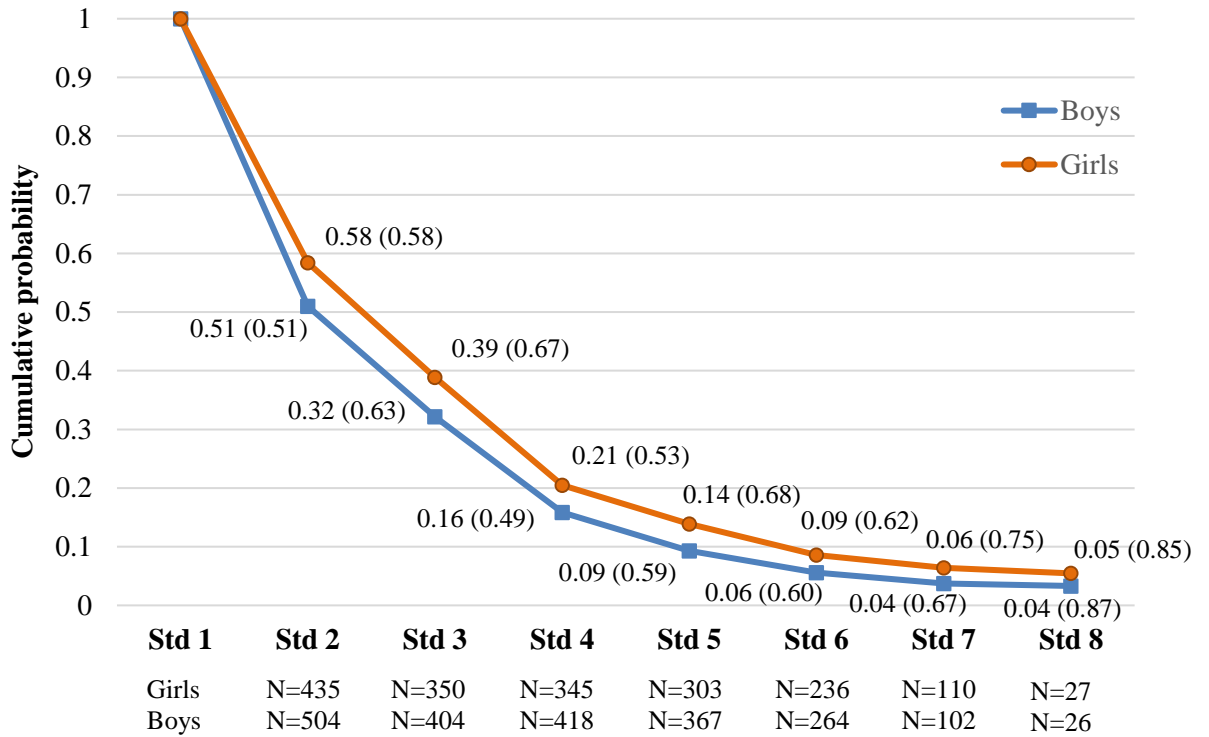
Notes: Data points show the cumulative probability of reaching each respective standard on the first attempt, accounting for the probability of passing through each previous standard without repeating or dropping out. Individual promotion rates for each standard are shown in brackets.

Table 6.4 shows results from a logistic regression model estimating the relationship between absenteeism in the previous survey round and current grade repetition for the three thresholds of absenteeism, each compared to all other students. It indicates that lagged absenteeism was significantly associated with grade repetition in all three cases, but the effect size increased with days of absence. Thus, students whose absenteeism fell in the uppermost 5%—missing more than 4-10 days in the past four weeks, depending on the round—were significantly more likely to repeat their next grade than students who missed less than this (AOR 1.37 [1.19-1.57]).

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[32] Although there is some variation across school year cohorts for the years observed, average promotion rates combining all members of the longitudinal sample are similar to those shown in Figure 6.6.

Table 6.4 Association between lagged absenteeism and current grade repetition, among students with at least two consecutive interviews

	OR	95% CI	p-value	AOR	95% CI	p-value
Model 1: Any absenteeism	1.22	1.15-1.30	<0.001	1.19	1.12-1.27	<0.001
Model 2: Absenteeism >90 %ile	1.36	1.23-1.50	<0.001	1.28	1.16-1.42	<0.001
Model 3: Absenteeism >95 %ile	1.48	1.29-1.69	<0.001	1.37	1.19-1.57	<0.001

Notes: Table shows results from logistic regression models with individual random effects. N=22,933 representing 6,960 individuals contributing an average of 3.3 observations. Adjusted models also include: sex, age group, standard attended (lagged), age started primary school, occupation of household head (lagged), sex of household head (lagged), relationship to household head (lagged), mother's survival status (lagged), father's survival status (lagged), mother's education, father's education, number of household members (lagged), number of younger household members (lagged), month of interview (lagged), school attended (lagged), change of school across rounds, and survey round. Sample restricted to students attending schools with at least 10 observations per round. See Table A.6 for full model results.

Consistent with Figure 6.6, boys were more likely than girls to repeat their grade (see Table A.6 in the Appendix), but no gender differences in terms of the effect of absenteeism on repetition were observed. The relationship between absenteeism and repetition was, however, significantly modified by age at primary school entry. Taking the highest absenteeism threshold as the exposure variable, the stratum-specific adjusted odds ratio for lagged absenteeism was 1.16 (0.94-1.43) for students who started primary by age 5, but 2.29 (1.46-3.59) for those who started at age 7 or later (Table 6.5). Similarly, although students living with a household head engaged in a skilled occupation were significantly less likely to repeat their grade compared to peers in subsistence farming households, the association between absenteeism and grade repetition was largest in skilled households (stratum-specific AOR 2.24 [1.41-3.57]).

Table 6.5 Association between lagged absenteeism above the 95th percentile and current grade repetition, stratified by selected background characteristics

	Stratum-specific AOR	95% CI	p-value	p-value interaction
Age started primary				0.021
Early (age 5 or younger)	1.16	0.94-1.43	0.174	
On time (age 6)	1.43	1.17-1.73	<0.001	
Late (age 7 or older)	2.29	1.46-3.59	<0.001	
Occupation of household head				0.072
Subsistence farmer	1.26	1.07-1.47	0.005	
Fisherman	1.04	0.55-1.97	0.914	
Other unskilled	1.87	1.26-2.77	0.002	
Skilled	2.24	1.41-3.57	0.001	
Not working	1.17	0.37-3.73	0.787	

Notes: Table shows results from logistic regression models with individual random effects. N=22,933 representing 6,960 individuals contributing an average of 3.3 observations. Likelihood ratio were tests used to assess evidence for interaction between lagged absenteeism and background characteristics. See Table 6.4 for list of adjusted model covariates. Sample restricted to students attending schools with at least 10 observations per round.

6.3.5 Cumulative absenteeism and grade attainment

Having examined the association between absenteeism in one round and grade repetition in the next, we now investigate the relationship between *cumulative* absenteeism over five years on grade attainment after six years. Figure 6.7 shows the standard attended after six years among students who entered the primary school cohort in the first three survey rounds, by cumulative rounds of absenteeism. Standard attended significantly declined with rounds of reported absenteeism: students with no reported absences had completed on average 4.4 standards (SD 0.98, range 2-7) of the expected six, while those who had missed school in one round had completed 4.3 standards (SD 1.01, range 1-7), and those who had missed school in multiple rounds had completed 4.1 standards (SD 1.04, range 1-7, differences significant at p<0.05).

Figure 6.7 Standard attended after six years of primary school, by cumulative rounds in which absenteeism was reported
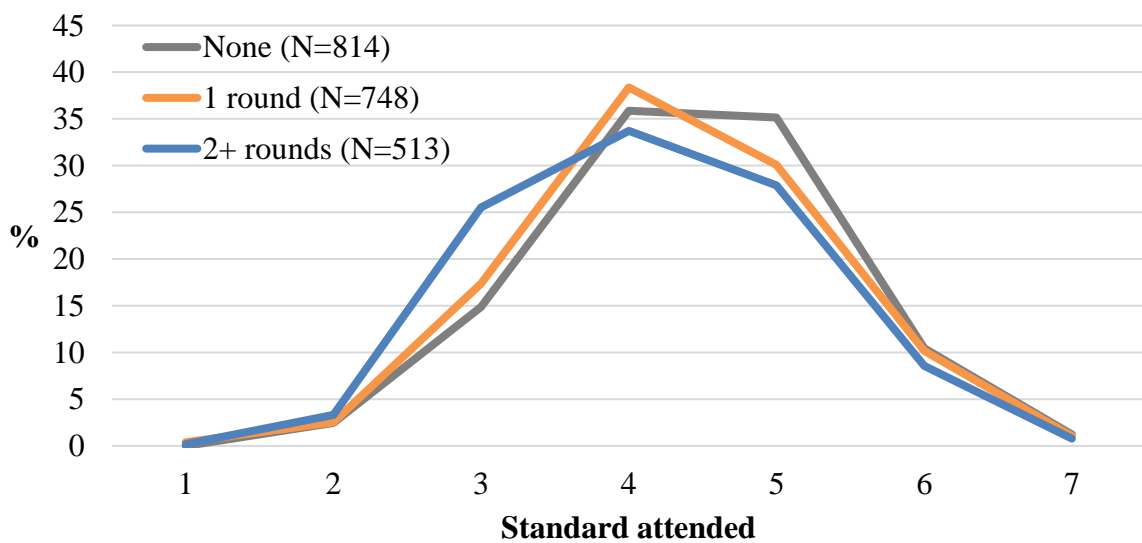
Note: Restricted to students who entered the primary school cohort in the first three survey rounds and who attended school continuously for six years. Cumulative absenteeism designates the number of rounds over the first five surveys that a student reported absenteeism.

Table 6.6 shows results from linear regression models estimating the relationship between standard attended six years after cohort entry and the number of times in the first five surveys the student's absenteeism exceeded the three round-specific thresholds. In both unadjusted and adjusted models, the number of rounds of reported absenteeism demonstrated a significantly negative association with grade attended for all three

absenteeism thresholds.[33] Wald tests confirm that the coefficients for Models 2 and 3, respectively, are significantly different from the coefficient for Model 1 at p<0.05, demonstrating that students who breached the highest absenteeism thresholds lagged further behind peers who were absent less than this.

Table 6.6 Association between cumulative rounds of absenteeism over five years with standard attended in the sixth year

	Unadjusted coefficient (95% CI)	p-value	Adjusted coefficient (95% CI)	p-value
Model 1: Any absenteeism	-0.11 (-0.16, -0.07)	<0.001	-0.09 (-0.13, -0.04)	<0.001
Model 2: Absenteeism >90 %ile	-0.20 (-0.28, -0.13)	<0.001	-0.15 (-0.22, -0.08)	<0.001
Model 3: Absenteeism >95 %ile	-0.22 (-0.33, -0.12)	<0.001	-0.18 (-0.28, -0.08)	<0.001

Notes: Table shows results from linear regression model, N=2,075. Sample restricted to students who entered the primary school cohort in the first three survey rounds, were interviewed continuously for six years, and attended schools with at least 10 observations per round for the duration of the period. Cumulative absenteeism measures the number of rounds that students' absenteeism breached the three respective thresholds. Adjusted model includes the same set of covariates listed in Table 6.2. See Table A.7 for full model results.

Attending a higher standard was also significantly associated with being female, having more educated parents, living in a household with a skilled head, and with larger household size (see Table A.7 in the Appendix). Standard attended was negatively associated with the number of younger household members.

6.4 Discussion

This analysis has investigated the relationship between school absenteeism and subsequent educational outcomes by capitalising on longitudinal school attendance data rarely available in sub-Saharan African contexts. Even in a low-resource setting, and with very crude measures of school absenteeism, our results are consistent with the education production function, whereby daily school attendance contributes to attainment and achievement through exposure to curriculum content. We show both that students who were absent in one school year were more likely than their peers who were not absent to miss school the following year, and that students at the uppermost end of the absenteeism

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[33] Results from a Poisson regression model with the outcome variable measured as count variable of the cumulative number of repetitions over six years (shown in Table A.8 in the Appendix) corroborate this result.

distribution were more likely to experience adverse educational pathways than were peers who missed less school.

However, we cannot necessarily conclude that absenteeism has a direct impact on student performance. It is probable, for instance, that absenteeism and grade repetition are jointly determined by low academic ability or motivation, limited perceived returns to schooling, inadequate household support for education, or other unmeasured factors. Alternatively, frequent absenteeism may send signals about students' commitment to schooling, independent of actual performance, which affects their promotion prospects. Evidence from case studies of four Ghanaian students indeed suggests that teachers factor attendance records into promotion decisions: according to one student, he repeated 'because the teachers said I was not serious about my attendance' (Dunne and Ananga 2013, p. 200). A comparison of high and low achieving schools in Jamaica—as determined by predicted composite measures of math and reading—similarly found that students who attended school irregularly and lagged behind academically were considered 'non-starters' by teachers in poorly performing schools, and consequently neglected in lessons (Lockheed and Harris 2005: 20).

Nevertheless, despite uncertainty about the underlying mechanism, by showing that frequent absenteeism is related to subsequent adverse educational outcomes, attendance records can provide an early warning system to identify students at risk of future grade repetition and dropout, as has been advocated in other settings (Henry et al. 2012; Neild et al. 2007; UNICEF and UIS 2016). Large-scale surveys that monitor daily attendance—as distinct from enrolment and retention—are increasing in sub-Saharan Africa, for instance through SACMEQ in Southern and Eastern Africa, or the Uwezo initiative, which has collected attendance data across Kenya, Uganda and Tanzania as part of national literacy and numeracy assessments (Uwezo 2011). In monitoring outputs, however, absenteeism is typically reported as a school- or region-wide average (e.g. Milner et al. 2011; Uwezo 2016; Uwezo Tanzania 2013), which masks variation in attendance at the individual level. Moreover, one-off or cross-sectional measures of absenteeism do not account for repeated absences over time, which we have shown to affect a substantial subset of students. Our results highlight the importance of appropriately identifying students with long or frequent periods of absence whose risk of adverse educational outcomes is highest (Gottfried 2014; UNICEF and UIS 2016).

By including interactions between absenteeism and students' background characteristics, we have also identified subgroups for whom missing school is most detrimental for future educational pathways. We found that the relationship between absenteeism and subsequent grade repetition was modified by age of primary school entry, such that the association was significantly strongest among students who started school after the official age. Previous research in Malawi has highlighted that overage students are subject to ridicule and humiliation from younger classmates, particularly if they are physically larger than other students, leading to emotional disengagement from school, which may in turn contribute to both absenteeism and repetition (USAID 2014). Alternatively, students who start school late may come from households who face financial barriers to schooling (Wils 2004), which similarly promotes both absenteeism and repetition. Indeed, research from South Africa has shown that households spend less money on school fees, transportation and other school expenses for children who are overage for grade (Anderson et al. 2001), which may signal a lack of investment in the education of overage students—or a corresponding inability to pay—that influences students' capacity to attend regularly and perform well. Finally, children who enrol late miss learning experiences at a time when they are most receptive to learning basic skills and establishing foundations for future cognitive development (Lewin and Sabates 2012), which may exacerbate the detrimental impact of absenteeism on grade progression.

We also saw that the association between absenteeism and repetition was strongest among students living with a household head engaged in a skilled occupation. Since these students were least likely to repeat a grade overall, this suggests that grade progression for students in skilled households was more sensitive to school attendance than for students from other backgrounds who face other barriers—including poverty, labour demands, or lower perceived returns to schooling—that inhibit achievement and attainment. Interestingly, we did not observe a gender difference in either the extent of absenteeism or the relationship between absenteeism and grade progression. Girls were less likely than boys to repeat their grade, but were also more likely to be lost to follow-up, so it is possible that girls who experienced more adverse educational outcomes were not observed.

A number of limitations to this analysis should be noted. Firstly, school attendance data were available only for a four-week period, rather than for the whole school year, so our results provide a snapshot of student absenteeism that may not reflect trends over a longer

period. However, that repeated absenteeism was more common among students interviewed in different months across school years, rather than those interviewed in the same month, suggests that relationships are not driven simply by seasonal patterns of absenteeism. Attendance data were also drawn from household surveys rather than school attendance registers or other administrative sources, and may thus be subject to social desirability or recall bias associated with self-reported data (Rosenman et al. 2011). Moreover, most attendance data were provided by proxy respondents—typically parents—on behalf of resident students, which may additionally have influenced the accuracy of reporting (Bardasi et al. 2011; Dammert and Galdo 2013). Pooling data for the same students across multiple survey rounds, however, increases confidence in the robustness of our findings. Finally, because only eight rounds of survey data were available, we cannot observe the educational outcomes of the majority of students who progressed through the primary cycle in more than that time. While this would likely influence the distribution of absenteeism and grade repetition by standard, as well as the survival profiles shown in Figure 6.6, we would expect that by observing only the top performing students at the latter stages of primary school, the relationship between absenteeism and repetition would, if anything, be underestimated. The study would benefit from the addition of literacy and numeracy assessments to better evaluate the links between academic skills, school attendance and grade progression.

6.5 Conclusion

Taken together, our results highlight the importance of daily attendance monitoring of primary school students both within and across school years, as a means of identifying those at risk of subsequent adverse educational pathways. More research is needed to ascertain the precise mechanism linking absenteeism with grade repetition, but efforts to address financial barriers to school attendance, as well as increasing support for remedial programmes for frequently absent students, particularly those who are overage for grade, represent potentially promising policy prescriptions.

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Student	Christine Kelly
Principal Supervisor	Judith Glynn
Thesis Title	School absenteeism in Karonga district, northern Malawi: Trends, influences and the impact of cleaner burning biomass-fuelled cookstoves

If the Research Paper has previously been published please complete Section B, if not please move to Section C

SECTION B – Paper already published

Where was the work published?			
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Where is the work intended to be published?	Compare
Please list the paper's authors in the intended authorship order:	Christine A. Kelly, Elaine Unterhalter, Levie Gondwe, Aaron Ndovi, Green Kapila, Cecilia Nyirenda, Deborah Johnston, Amelia C. Crampin, Judith R. Glynn
Stage of publication	**Not yet submitted**

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	With input from co-authors, I designed the study, managed the data, conducted the analysis and wrote the manuscript

Student Signature: ███████████   **Date:** 16/10/2017

Supervisor Signature ███████████   Date: 6 . 10 . 17

Chapter 7: Students' experiences of absenteeism

'It is important that children should be going to school every day because in future, they can have everything they want': Exploring students' perceptions and experiences of school absenteeism in northern Malawi and the implications for absenteeism reporting in household surveys

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Abstract

Although school enrolment has increased markedly in recent decades, persistent absenteeism inhibits sustained educational access. Monitoring of absenteeism in household- or school-based surveys is typically restricted to quantitative tabulations of reasons for missing school, which overlook the dynamic set of underlying processes that influence school attendance decisions, as well as the incentives students or caregivers may face to misreport absenteeism causes. This study uses data from in-depth interviews and focus group discussions with 48 primary school students in Karonga district, northern Malawi, to explore perceptions and experiences of school absenteeism. Analysis shows that students attach a form of moral significance to maintaining regular school attendance as a signal of commitment to education that is somewhat divorced from their daily realities. Many participants held absentees responsible for their own poor attendance, despite acknowledging a variety of household, school and community constraints on school attendance. As such, evaluative judgements about absenteeism influenced the way students discussed missing school, as well as proposals to improve attendance. Students' insights have important implications both for understanding the drivers of absenteeism and for interpreting school attendance data collected in quantitative surveys.

7.1 Introduction

Global school enrolment has increased markedly in recent decades such that the number of out of school children and adolescents has fallen by almost half in the period since 2000 (UNESCO 2015). Although much work remains to be done to reach those children who have yet to enter school, substantial barriers of access to quality education remain even among those successfully enrolled. Humphreys et al. (2015) applied four distinctive meanings to phases of access: access as enrolment, access as sustained attendance, access to the classroom once in school, and access to the curriculum for meaningful learning. The focus of this paper is on the second of these phases, which has received limited attention in the literature, but is critical for ensuring that all children achieve the promise of Education for All (Lewin 2009).

School absenteeism, which is widespread in many sub-Saharan African countries (Loiaza and Lloyd 2008), is detrimental not only to absentees' attainment and achievement (Gottfried 2010), but can also interfere with the learning of students who regularly attend by disrupting teaching rhythms and creating negative peer effects (Wittenberg 2005). 'Arriving late at school', 'absenteeism', and 'skipping classes' were the three most common student behavioural problems reported by head teachers in large-scale surveys conducted in the 15 member countries of the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) (Hungi 2011). Efforts to understand barriers to sustained attendance in SACMEQ and other surveys have principally relied on quantitative national or regional-level tabulations of reported absence rates and associated reasons for missing school (e.g. Milner et al. 2011). While a useful starting point, categorising episodes of absence into static frequencies neglects the 'dynamic, multi-layered, constantly negotiated social process' inherent in school attendance decisions (Humphreys et al. 2015, p. 141).

We have previously used household survey data from northern Malawi to explore the range of individual- and household-level characteristics associated with missing school in the past four weeks (Chapter 4), and the relationship between absenteeism and future educational trajectories (Chapter 6). The analysis in Chapter 4 advanced beyond simple reported reasons for absenteeism to identify a range of underlying risk factors for missing school, but was nevertheless limited by the selection of background variables available in the survey, crude or static measures of complex concepts such as motivation or aspirations, and, critically, inability to explore the mechanisms underlying observed relationships. The

paper also revealed an apparent paradox with respect to absenteeism reporting: while statistical analysis suggested that participation in agricultural labour contributed to student absenteeism, work-related absences were rarely acknowledged by survey respondents. Qualitative data that delve beneath statistical aggregations, such as those we have gathered here, are therefore critical for understanding the intricate interplay of factors that inhibit sustained access to education, as well as incentives students or caregivers may face to misreport absenteeism in household surveys.

Our previous research was predicated on the assumption that students implicitly value school attendance and as such are prevented from attending only by external constraints, rather than by lack of interest or desire to attend. However, in settings where school quality is low and learning outcomes poor, students may feel their time can better be spent engaged in income-generating or leisure activities instead of attending school. Indeed, as Rolleston (2009, p. 198) has highlighted, for some children:

> [N]on-attendance at school may be better considered in terms of a rational choice, for example, where school quality and relevance is judged to be poor despite being available and affordable, or where children's current earnings are judged to be high in relation to the net benefits of schooling.

Econometric evidence from Egypt supports the view that students' school attendance decisions are informed by perceptions of the school environment: holding constant students' own ability and achievement, Hanushek et al. (2008) found that students in lower-quality schools were more likely to leave school and complete fewer grades than students attending higher-quality schools, although they could not unpack the particular aspects of quality that most influenced these choices.

Understanding the barriers to sustained educational access therefore requires an appreciation of both 'push' and 'pull' factors that influence students' school attendance (Streuli and Moleni 2008). In particular, qualitative data is needed to explore the value that students place on attending school every day, what informs the significance that school attendance holds in their lives, what factors they consider to be most disruptive to sustained attendance, and what can be done to mitigate absenteeism in their communities.

After describing the educational context in Malawi, this paper uses data from in-depth interviews and focus group discussions with 48 primary school students in Karonga district,

northern Malawi to explore these questions. In doing so, we focus particularly on two areas in which qualitative data can address identified shortcomings of existing quantitative survey research. Firstly, we examine the extent to which distilling episodes of absence into a single, proximal reason for missing school—as, for instance, in SACMEQ reports (e.g. Milner et al. 2011)—obscures complex underlying processes that have different implications for identifying and addressing absenteeism risk. Secondly, we assess whether evaluative judgments about absenteeism influence the way students talk about missing school, and explore the implications for interpreting school attendance data collected in surveys. Our analysis thus aims both to enhance understanding of the drivers of school absenteeism and to inform collection of attendance data.

7.1.1 Educational access in Malawi

Malawi became one of the pioneers of free primary education (FPE) in sub-Saharan Africa when, as part of the transition to multiparty democracy in 1994, the new government eliminated primary school fees. The FPE initiative led to an immediate explosion in primary school enrolment from 1.8 million to nearly three million students (Castro-Leal 1996), but the limited planning, particularly with respect to supply-side investments, resulted in pressures on personnel and infrastructure by which the education system remains characterised (Chimombo 2009). Increased focus on primary schooling additionally diverted resources away from the secondary and tertiary sectors (Bloom et al., cited in Frye 2012), such that the proportion of students enrolled in secondary and higher education institutions in Malawi is well below SADC and African averages (World Bank 2010). At the same time, however, FPE was accompanied by an influx of ideological campaigns from government outlets, newspapers, radio programmes, and non-governmental organisations establishing education as the route to 'bright futures' in high-skilled formal-sector careers, which produced 'a wide gap between the actual opportunities provided by the educational reforms and the social imaginary surrounding them' (Frye 2012, p. 1579). We thus consider how this disconnect between students' aspirations and their daily realities manifests in their discussion of school attendance.

Furthermore, although the elimination of primary school fees removed one important financial barrier to primary school attendance, significant schooling costs endure (Kendall and Silver 2014). Expenditures on such items as exercise books, pens and clothes remain prohibitively expensive for some households (Kadzamira and Rose 2003), while

community involvement in education is primarily 'extractive', founded on contributions of money or labour to finance physical infrastructure projects (Barnett 2013; Rose 2003). Studies have also shown that, although the 1994 reforms formally eliminated the requirement to wear a school uniform and the administration of corporal punishment, these practices continue to be enforced at many schools (Pridmore and Jere 2011), representing additional sources of exclusion.

Our previous analysis of household survey data from Karonga district provided evidence that participation in household labour contributed to primary school absenteeism (Chapter 4). Students living in households intensively engaged in agriculture—as measured by ownership of relatively larger endowments of land, livestock and other productive assets— were significantly more likely to miss school than peers in less 'agriculture-rich' households, even after adjusting for other measures of household socioeconomic status. This result suggests that agricultural households are characterised by greater demand for child farm labour that competes with school attendance, although the actual extent to which children engaged in agricultural work was not discernible from the survey.

Consistent with other survey research in Malawi (Grant et al. 2013; Milner et al. 2011), the most common reason reported for missing school in Karonga district was student ill health, followed in much smaller proportions by inability to meet the costs of schooling and lack of interest in school. Despite the apparent importance of agricultural labour for school absenteeism, absences attributed to involvement in household chores or economic activities were consistently negligible (Chapters 4 and 5). It is against this backdrop that we seek to gain a deeper understanding of the constraints that students perceive to impede school attendance, as well as to assess the extent to which reasons reported for absenteeism faithfully reflect the processes underpinning educational exclusion.

7.2 Methods

Data collection activities consisted of in-depth interviews (IDIs) and focus group discussions (FGDs) with 48 male and female primary school students aged 12-18 years attending schools within the catchment area of the Karonga Health and Demographic Surveillance System (HDSS) (Crampin et al. 2012). The HDSS includes a large annual household survey of sociodemographic characteristics of a population of more than 35,000 people, including approximately 10,000 primary school students, which formed the basis

of our previous quantitative analyses of absenteeism trends and determinants in Karonga district (Chapters 4-6).

7.2.1 In-depth interviews

Using the Karonga HDSS dataset as a sampling frame, 16 IDI participants (8 male, 8 female) were purposively sampled (Schatz 2012) to vary by age (12-18 years), standard attended (grades 3-8), and community type (lakeside, semi-urban and rural) in order to capture a range of students' experiences. The semi-structured IDI guide explored students' perceptions of the barriers to regular school attendance, their educational motivations and aspirations, household health status, economic and domestic responsibilities, and the effect of missing school on educational engagement.[34] The guide was iteratively updated based on feedback from eight pilot interviews, as well as from preliminary analysis of early IDIs. In order to gain insights of students' daily time use, each IDI also included an exercise in which participants were asked to identify the activities in which they had engaged on the most recent school day, from among a selection of ten activity cards: attending school, doing homework, going to the market, collecting firewood, drawing water, cooking, fishing, agricultural work, caregiving, and playing. The activity formed the basis for follow-up discussion regarding potential work-school trade-offs and intra-household labour allocation. IDIs were conducted in the local language, Chitumbuka, by co-authors Gondwe, Kapila, Ndovi and Nyirenda, and lasted approximately 1.2 hours (Range: 55 minutes - 1 hour 56 minutes).[35]

7.2.2 Focus group discussions

Participants for the four FGDs were drawn from communities contiguous to those from which IDI participants were selected. Upon arrival in a target cluster, 'natural groups' (Green and Thorogood, 2014) of eight participants were identified for participation in FGDs. In contrast to IDIs, which focused on participants' own experiences, FGDs solicited participants' views on community norms surrounding education, and observations of the primary challenges to school attendance among both themselves and their peers. Topic

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[34] This study was also nested within a randomised controlled trial of cleaner burning biomass-fuelled cookstoves (Mortimer et al. 2016), so IDIs additionally addressed the relationship between cookstove allocation and school attendance. Insights from this aspect of the study are presented elsewhere (Chapter 5).
[35] Kelly, a non-Chitumbuka speaker, observed approximately one-third of the IDIs and three of the four FGDs.

guides were informed by preliminary findings from IDIs as well as two FGD pilot sessions. Separate male and female FGDs were conducted to allow for discussion of gender-specific or sensitive topics.

Perceived barriers to school attendance were explored via a 'draw and tell' activity (Driessnack 2006) embedded within each FGD. Participants were asked to draw the activities in which children in their community engaged on days when they did not attend school. The primary purpose of the exercise was to facilitate the exchange of ideas in an interactive and inclusive way (Driessnack 2006; Noonan et al. 2016). With the help of probing questions from the FGD facilitator, participants described their drawings and the practices they represented, while other members were encouraged to share their own observations related to the activity their colleague had depicted. FGDs were conducted in Chitumbuka by the same research team in central community locations—deliberately not school facilities—and lasted between one and two hours (range: 1 hour 25 minutes - 1 hour 49 minutes).

7.2.3 Data collection and analysis

In-depth interviews and FGDs were conducted in May 2016, during the third and final school term. Each was audio-recorded and transcribed into English by the lead interviewer/facilitator. Where possible, participants were matched with interviewers by sex, but in light of the composition of the team—three men and one woman—it was not possible in all cases. Given the longstanding presence of HDSS activities in the area (see Crampin et al. 2012 for an overview), research personnel were highly familiar to students and their families, which may have reduced participants' reticence in IDIs/FGDs, while evidence from the pilot phase suggested that girls were willing—unprompted—to broach potentially sensitive topics with male interviewers.[36]

Transcripts from IDIs and FGDs were read repeatedly by the first author, and any queries resolved with the research team. As a validity check, four IDI transcripts—one per interviewer—were externally audited for completeness and accuracy by a bilingual consultant. Since errors identified during this process were minimal and minor, no additional review of the remaining transcripts was undertaken.

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[36] Elsewhere in Malawi, Poulin (2010) has shown that propensity to report sexual activity among unmarried young women was not linked to interviewer sex. She emphasised the importance of building trust between interviewers and participants as a means of eliciting sensitive information.

Data were analysed using an ecological approach (Smith et al. 1997), framing a student's environment as a 'nested arrangement of structures, each contained within the next' (Bronfenbrenner 1976, p. 5). We sought to explore how individual-, household-, school-, community-level factors—and the interactions between them—influenced students' school attendance. In particular, we examined the relationship between proximal, or immediate, causes of absenteeism and distal, or underlying, factors that created the conditions for missing school (Figure 7.1). Analysis consisted first of grouping students' experiences or accounts of absenteeism by proximal cause, before mapping the network of underlying factors that students implicitly or explicitly linked with each reason for missing school. Reflecting SACMEQ teacher reports that missing school, skipping classes and arriving late are all disruptive to teaching and learning (Hungi 2011), in conceptualising absenteeism we include any student-specific loss of lesson time.

Figure 7.1 Ecological model of distal and proximal determinants of school absenteeism
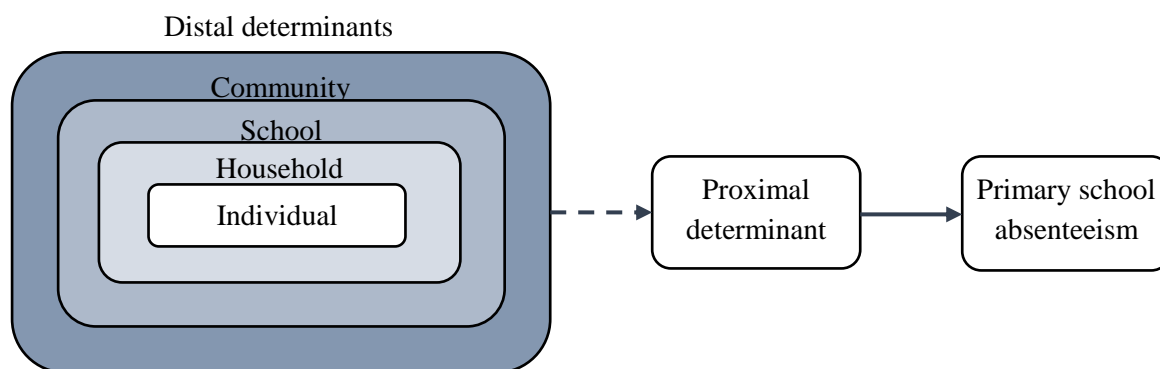
7.2.4 Participant characteristics

Table 7.1 shows the sociodemographic characteristics of students who participated in IDIs and FGDs.[37] Participants were on average 14 years old (14.5 male, 14.0 female) and attended standards 3-8. Approximately one-third of participants (37.5% male, 33.3% female) had repeated their current standard. Most participants came from households primarily engaged in subsistence farming.

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[37] Written informed consent (or a thumb print in lieu of signature) was obtained from a parent or guardian of each IDI or FGD participant before written assent was received from participants themselves. All parents and students approached for study participation provided consent. The study protocol was reviewed and approved by the London School of Hygiene and Tropical Medicine Research Ethics Committee in the UK (ref no. 10401) and the National Health Sciences Research Committee in Malawi (ref no. 15/1/1509).

Table 7.1 Demographic characteristics of in-depth interview and focus group discussion participants

	IDIs		FGDs	
	Boys (N=8)	Girls (N=8)	Boys (N=16)	Girls (N=16)
Age				
12	0	1	0	3
13	4	2	5	3
14	1	4	3	5
15	0	0	5	3
16	1	1	2	0
17	1	0	1	1
18	1	0	0	1
Mean	14.6	13.8	14.4	14.1
Standard attended				
3	1	0	1	0
4	1	1	1	3
5	0	1	4	3
6	1	3	4	3
7	3	2	5	4
8	2	1	1	3
Mean	6.3	6.1	5.9	6.1
Repeated current standard				
Yes	3	1	6	7
No	5	7	10	9
Household head occupation*	4	6	11	15
Farmer	1	1	4	0
Fisherman	1	0	1	1
Other unskilled	2	1	0	0
Teacher/health worker				
Community type				
Semi-urban	3	3	8[†]	8[†]
Lakeside	2	2		
Rural	3	3	8	8

* Drawn from HDSS dataset for IDI participants, self-reported for FGD participants.

[†] One pair of FGDs took place in communities bridging lakeside and semi-urban areas.

7.3 Perceived value of education

Before examining perceived barriers to school attendance, we first explore the extent to which participants attached value to attending school every day. Although numerous commentators have highlighted the resource constraints and poor learning outcomes by which Malawian schools are characterised (e.g. Chimombo 2009; Mulera et al. 2017), as well as the disconnect between the social and economic promises of FPE and the limited opportunities it ultimately provided (Frye 2012; Kendall and Silver 2014), participants universally stressed the importance of daily attendance. Study participants emphasised the instrumental role (Robeyns 2006) of education in general and school attendance specifically in securing financial security for themselves and their families:

> *Davie*[38]: The best part about going to school is that it gives you future wealth.
>
> *Edith*: It is important that children should be going to school every day because in future, they can have everything they want.

Although most participants came from households engaged in subsistence agriculture, fishing or petty trading, the majority had ambitions to pursue skilled professions including nursing, teaching or law, reflecting the 'bright futures' rhetoric of Malawi's post-FPE era (Frye 2012). These choices were rooted primarily in material concerns, and backed with little practical knowledge about what training or qualifications would be required, or even what the job involved, perhaps reflecting limited exposure to people in these positions in their communities (Unterhalter 2012).[39] Sixteen year-old Kondwani, for instance, reported without hesitation that he wanted to become a doctor but, when probed, expressed considerable uncertainty about his motivation:

> *Interviewer*: So what kind of work you want to do when you reach form three [grade 11] as you have stated?
> *Kondwani*: I want to be a doctor.
> *Interviewer*: Why do you want to be a doctor?
> *Kondwani*: (Short pause)
> *Interviewer*: Or what things motivate you to be a doctor?
> *Kondwani*: (Silent) I don't know it in details.
> *Interviewer*: Why do you like the profession of doctor?
> *Kondwani*: I want to cure people and the salary is better off.

Despite observations by the research team of crowded classrooms, shortages of desks and blackboards and other resource constraints, participants did not identify school quality as detrimental to their educational experience. Rather, they identified benefits of physical presence in the classroom associated with accessing material that would be required for exams or increasing comprehension of curriculum content. These contributed to participants' perceptions of the value of school attendance and coloured their arguments against absenteeism:

> *Adamson*: I think it is important that we go to school every day otherwise when those things that we miss when we are absent from school come during examinations

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[38] All participants have been assigned pseudonyms.

[39] Indeed, one of the most 'visible' jobs in the community was with the HDSS research programme. Two participants aspired to work at the HDSS research site, including Alice, 12, who indicated, 'That's the only job which can be easy for me to get. […] I can say I just admire the way [HDSS] staff ride their motorbikes.'

we may find ourselves failing because we were not there when they were being taught.

> *Enoch*: [W]hen teachers write notes, they explain to us some of the difficult words so that we should easily study the notes. They explain those words to us so that we should know their meanings and if you have just copied notes from your friends, you can't know the meaning of such words. You also can't study properly the notes that you have just copied.

A second, pervasive argument for maintaining regular school attendance, also deeply rooted in post-FPE imagery, emphasised attendance—independent of academic performance—as a signal of commitment to education. Proponents of this view used language that established students with regular attendance as morally superior to students who missed school (Frye 2012). Dorothy, 14, drew a distinction between her own dedication to schooling with that of her peers, including some members of her FGD, who failed, in her view, to take education sufficiently seriously: 'Some of us we go to school to play while some go to school with an aim of getting educated and staying well in future.' Absentees were described in openly pejorative terms as 'spend[ing] time smoking Indian hemp' (McDonald) or 'always think[ing] about men and going to entertain themselves in beer halls' (Dorothy), and as such were considered undeserving of educational opportunities and resources. When asked a hypothetical question about how households should allocate funds for children's education, several students proposed using absenteeism as a means of signalling which children did not merit financial support:

> *Justice*: The money should be spent on children who go to school every day without missing. There are other children who sometimes attend school and sometimes miss, so in this way parents know that they can spend money on this child not that one.

The value that students attached to daily school attendance thus derived both from its instrumental role in imagined future economic trajectories, as well as for its symbolic importance in signalling commitment to education. However, although all participants emphasised the importance of daily school attendance in the abstract, these views did not necessarily reflect actual attendance patterns.

7.4 Barriers to school attendance

Citing their own personal experiences, as well as observations of peers in their community,

participants listed a wide variety of reasons for missing school, linked to health (personal illness, household caregiving, or funeral attendance), household or economic labour (farming, fishing, herding, brick building, or domestic chores), leisure activities (playing football or netball), inability to meet schooling costs (examination fees, school uniform, notebooks and pens, soap for washing clothes), school-related disciplinary issues (sent away for arriving late, lack of uniform or inappropriate haircut) or other aspects of school routine (not wanting to sweep the school compound on the opening day of term, not attending on days after exams). Table 7.2 summarises the proximal reasons identified for missing school in IDIs—based on students' reports of absence over the course of the school year in which they were interviewed—and FGDs—based on participants' drawings of activities in which children engage when they are not attending school.[40]

Table 7.2 Reasons reported for missing school by boys and girls aged 12-18 in in-depth interviews and focus groups discussions

Reason	IDIs		FGDs	
	Boys (N=8)	Girls (N=8)	Boys (N=16)	Girls (N=16)
Health/caregiving				
Own illness/injury	4	7	3	6
Other's illness/caregiving	2	1	0	2
Funeral	1	0	0	1
Work				
Agricultural work (farming, herding, food processing)	3	1	11	8
Fishing	0	0	4	0
Household chores (cooking, cleaning, drawing water)	0	0	1	5
Leisure activities				
Football	0	0	0	2
Netball	0	0	6	4
School factors				
Lack of soap/clothes/notebooks	3	2	0	1
Avoid sweeping on opening	1	0	0	0
day	1	0	0	1
Sent home for arriving late	0	0	1	0
Sent home for haircut	1	0	0	0
No learning taking place				
Other	1	1	2	0

Notes: Reasons for missing school taken from IDI participant reports of absence during the past school year and activities drawn in FGD drawings. Individuals are counted once per row; multiple responses possible.

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[40] The number of activities participants could draw was not limited and ranged from one to four. Note that the instructions to the drawing activity did not require students to isolate the immediate cause of absence – see section 7.4.1 below for a discussion of this point.

We focus on three frequent proximal causes of absence discussed in IDIs and FGDs—playing, working, and missing school due to illness—to explore the intersecting influences of individual-, household-, school-, and community-level factors on school attendance. The selected proximal causes correspond with common reasons reported for absence in previous Malawian student surveys (Grant et al. 2013; Milner et al. 2011) and thus serve to illustrate how qualitative data can deepen our understanding of quantitative tabulations. In particular, as shown below, students' accounts demonstrate how a single proximal cause of absence obscures complex underlying processes, while also reflecting evaluative judgements made about absenteeism.

7.4.1 Theme 1: Playing

Although no IDI participant reported missing school to engage in leisure activities, boys and girls in three of the four FGDs identified playing football as a common reason for absence in their communities. Some participants described taking part in matches during school hours, while 17 year-old Adamson described how he sometimes missed school because he was still tired from having travelled the night before to play a distant opposing team. Elsewhere in the FGD, however, he revealed that he sometimes lacked motivation to attend school because he was so much older than his classmates:

> *Adamson*: When you have problems with the lessons you may think that going to school is not good because at times when you fail to answer questions correctly you are beaten and even laughed at by even younger classmates and if this happens quite often one may choose to stay away from school. This is what brings my spirit down.

Adamson's experience at school, and particularly the humiliation and ridicule associated with being substantially overage for grade[41], may thus explain the decision to devote his time playing football rather than concentrating on school. Similarly, Enoch,14, suggested that it is the children who 'don't mind about school' who absent themselves to play football: 'That child decides to miss school even if he can see his friends going to school, he just concentrates on playing football with older men.'

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[41] Adamson was attending standard 7 at the time of interview, making him at least four years behind the expected age.

Enoch's description also implies that community-level practices facilitate football-related absenteeism. In particular, he suggests that matches organised by adult men not only accept, but may attract, school-age players. Other participants confirmed that community matches were typically held during school hours, particularly during the dry season, and that temptation played a role in drawing boys out of school to play: 'When other children miss school because of playing football, they take their ball and play near the school. They do this so that we should also desire to play football with them like during break time' (Justice).

While the games described by male participants involved only other boys or men, female students were also reported to miss school while playing football or netball: 'Most of the times when there is a football match girls too have their game' (Adamson). However, although multiple female FGD participants drew pictures of girls playing games during school hours, they each faced different underlying causes of absenteeism:

> *Flora*: I missed school because clothes were dirty [and because I had] nothing to do at home played the ball.[42]

> *Cynthia*: This one [pictured in drawing] missed school because her parents didn't have money to pay for examination, that is why was playing the ball at home.

Figure 7.2 Participant drawings of missing school while playing football or netball

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[42] The translation reflects use of the Chitumbuka word '*bola*', which is a generic term for 'ball' that can apply to football or netball. Flora's drawing depicted football, Cynthia's netball.

The wording of the instructions for the drawing exercise asked participants to draw the activities in which they or their peers engaged on days when they did not attend school, and as such did not require students to isolate the causal factors preceding absence. Thus, in the case of Flora and Cynthia, the proximal cause of absenteeism relates to inability to meet costs associated with schooling. Nevertheless, participants' choice of drawing, combined with subsequent discussion, help to illustrate how students' decisions to play games during school time were shaped by a combination of distal determinants, including age, classroom environment, household poverty and school costs.

7.4.2 Theme 2: Working

Absences related to some form of work, and in particular agricultural labour, were the most common images depicted in the drawing activity and also frequently reported in IDIs (see Table 7.2). As with playing, however, the circumstances surrounding these episodes were not uniform for all participants. The passages below demonstrate the range of participants' experience (emphasis added):

> *Enoch*: Sometimes children miss school when they ***don't have food***, so parents send them to dig cassava at the farm.

> *Charity*: When they [my grandparents] discover that there is ***too much work*** it's when they ask me to accompany them so that we can work together, finish the work quickly and go to school on the next day.

> *Mabvuto*: Sometimes a child attends school irregularly because of ***lacking clothes***. He tries his best to ***search for piece work*** so that the money realised from that work should be used to buy clothes.

> *Bernard*: I usually go to school late. […] This is usually when my ***father asks me to take our cattle*** to where they usually graze and thereafter go and fetch water before we can leave for school.

These narratives depict two distinct types of work-related absence: some students were pulled away from school due to household labour shortages or lack of food at home, while others were pushed into agricultural work due to inability to meet the direct or indirect costs of schooling. The amount of control students expressed to exert with respect to work-related absences also differed widely: in some cases, children reported lacking household decision-making power to determine their own attendance; in others, they assumed responsibility for

weighing work-school trade-offs and taking strategic decisions to miss school to facilitate longer term educational participation. Indeed, students' use of initiative to secure the income needed to meet school costs was considered another sign of commitment to education:

> *Justice*: If your parents tell you that they don't have school fees and you indeed agree to discontinue your education, it means such kind of children don't like school. If you like school, you try every effort in order to find school fees.

Children's ability to find piece work was dependent on community characteristics including demand for (child) labour, but also on gendered expectations about students' economic and domestic roles. Although one female FGD participant suggested piece work as a means of sourcing school funds, and boys also described how girls helped traders sell their goods on weekly market days, girls did not discuss engaging in paid work with the same frequency as boys. Indeed, Edith indicated that it was harder for girls to secure independent incomes to support their schooling: '[M]ost of the times we girls face challenges to continue with our education while boys they continue because they can manage to find money and clothes on their own.'

Participants suggested that household support for schooling, which influenced not only the importance households placed on daily attendance, but also the financial contribution they made towards school costs, was a critical determinant of work-related absences. Justice described how some parents made sure to find the resources needed for their children's schooling, while others left children responsible for meeting their own expenses:

> *Justice*: Sometimes other children miss school because of lacking clothes, so they search for a piece work in order to earn money for buying clothes. There are other parents who put much interest in their children's education by buying them clothes so that they should work hard in class. There are also other parents who don't mind about their children's education and the children find clothes for themselves, so this is what happens.

Participants further suggested that household support for education was moderated by characteristics of household decision makers, as well as of students themselves. For instance, Gift, 13, reported that although his parents bought school clothes for his younger siblings, they did not do so for him and his brother because 'they say we are elders,' and by implication responsible for sourcing their own funds.

While paid work for these students represented a coping strategy to facilitate long-term school participation, others suggested that the monetary rewards associated with paid agricultural work outweighed the benefits of attending school: '[C]hildren of our age like money and doing piece works. So during the time when we go to school, they think of going to do piece works' (Enoch). Although these children's decisions could be considered rational if the money they earn from piece work exceeds the expected benefit from schooling (Rolleston 2009), the tone of Enoch's remark is derogatory, reflecting his view that students who prioritise work over school attendance lack sufficient commitment to education.

Figure 7.3 Participant drawings of missing school doing agricultural work
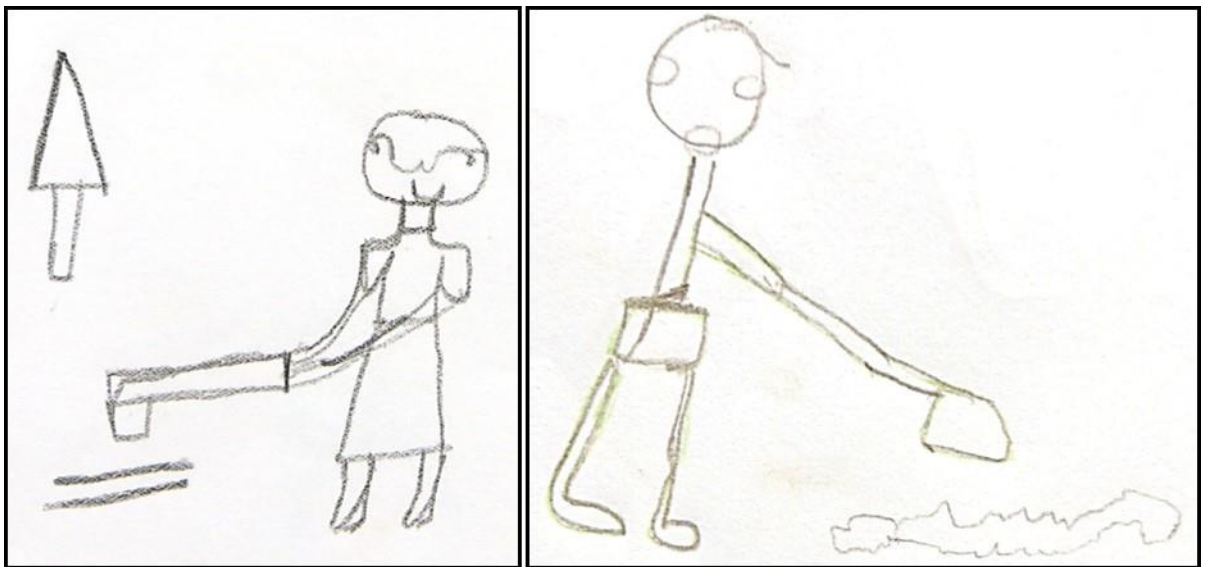
For many other students, work-related absences involved providing unpaid household labour. In these instances, participants described being withdrawn from school largely against their wishes, but lacking leverage to negotiate their attendance. Dorothy described one such scenario: 'Other pupils miss school because their parents tell them that if you don't go work in the garden you will not eat *nsima*.[43] So they miss school and work in the garden so that they can be able to take *nsima* at home.' Some participants, however, expressed an ability to renegotiate their domestic workloads to avoid missing school. Alice, 12, described being asked to stay home to help with household chores, particularly if resident adults were ill or away, but resisting these requests:

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[43] *Nsima* is a staple food made from maize flour.

> *Interviewer*: Do they tell you sometimes not to go to school?
>
> *Alice*: Sometimes but I refuse to do that. […] I normally tell them that I will find you in the afternoon; I have to go to school first.

Students identified a variety of underlying factors they believed to increase the propensity of being withdrawn from school to help with agricultural work. Some suggested that parents who were not themselves educated were more likely to keep their children at home:

> *Joseph*: Parents want to make their children fail to succeed with their education because they are uneducated. […] They say that we should just go to the farm. If the parents really like school, they can encourage their children.

Similarly, other participants indicated that when students lived with relatives other than their parents—relatives with less vested interest in supporting these children's education—they were more likely to be pulled out of school: 'If your parents passed away and if you stay with relatives they like telling children to miss school and do household chores' (Dorothy). This applied particularly when there were no other children with which to share work burdens. Emmanuel, 17, who lived with his uncle, described how he bore the brunt of agricultural labour demands because 'My uncle's children are young, they cannot work in the garden, so I [go] alone.'

Labour assignments additionally reflected household gender roles. Although participants indicated that both boys and girls missed school to conduct farm work such as clearing fields or harvesting, other activities were more strongly gender-demarcated. Grazing cattle, for instance, was 'the duty of boys' while drawing water for domestic use 'is only for girls not boys' (Edith). Some female participants suggested the conflict between work and school attendance, particularly with respect to other household tasks including sweeping and washing dishes, was exacerbated by gendered divisions of labour. Several female students felt that girls were disproportionately asked to miss school to engage in domestic chores, both because such chores were not considered boys' responsibility, but also as preparation for marriage:

> *Elizabeth*: It doesn't happen to both [boys and girls], they [parents] order girls to miss school because they dislike them thinking they will already get married because girls are used to getting married earlier hence they are not concerned with the girl child.

> *Dorothy*: The girl child is the one who is supposed to learn and do household chores because she gets married [and taken to husband's home].

Some boys did themselves report missing school to do domestic chores, but these episodes were largely precipitated by absence or incapacity of female household members and thus represented largely exceptional circumstances.

In summary, students' absences related to a single proximal cause of absence—namely, work—ultimately resulted from very different causal pathways. Some students were pulled out of school into household labour, while others were pushed into paid work to help meet the costs of schooling. The necessity to undertake agricultural or domestic work, as well as students' ability to navigate work-school trade-offs, were themselves influenced by a network of underlying factors. Moreover, the circumstances surrounding work-related absences sent different signals about commitment to education: students were respected for using initiative to source funding for schooling costs, but derided for prioritising paid work over education if perceived to be for reasons other than economic necessity.

7.4.3 Theme 3: Illness

In both IDIs and FGDs, student ill health was frequently cited as a cause of missing school, for reasons including headache, stomach ache, dizziness or malaria. The language used to describe illness-related absences, however, differed from when discussing other episodes of missing school. In contrast to other absences more explicitly linked to external factors, episodes of illness were considered unavoidable and beyond students' control. Students drew distinctions between 'valid' reasons for absenteeism, in which category illness was implicitly included, and others—such as playing football—that signalled a lack of commitment to schooling. A number of participants implied that illness was the only circumstance that could cause them to miss school, including Mary, 16, who asserted, '[I]f I don't go to school, that means I am sick.' In fact, evidence from one IDI suggests that, for some students, illness-related absenteeism did not count as 'missing school.' Memory insisted three times in succession that she had attended every day of the school year, including by taking measures to mitigate potential absences, before ultimately acknowledging missing school recently as a result of sickness:

> *Interviewer*: Now I would like to ask you about some times you might have missed school. Think of your attendance over the course of school year, are there particular times of the year that you miss school more than others?
>
> *Memory*: No I have never missed school.
>
> *Interviewer*: Let's say a month or a certain time when you missed school more than another time?
>
> *Memory*: No I go, I don't miss school. If maybe my clothes are dirty, I wash them.
>
> *Interviewer*: Would you say you miss school on some days of the week more than other days?
>
> *Memory*: No I go every day, I don't miss school.
>
> *Interviewer*: How many days of school have you missed in the past four weeks that school was in session?
>
> *Memory*: It's only one week when I was sick.

Although illness itself was considered to be inevitable, students did describe how the impact of ill health on school attendance was modified by a series of background characteristics. In particular, parental encouragement once again proved to be an important factor in decisions about whether to miss school on days when students felt unwell:

> *Interviewer*: How do your parents encourage you on school issues?
>
> *Benjamin*: When I want to miss school, they force me to go to school.
>
> *Interviewer*: Do you actually mean when you decide not to go to school on your own?
>
> *Benjamin*: Yes, like when I become sick. They ask me if the headache is severe and when I say no, it's when they tell me to go to school.[44]

Figure 7.4 Participant drawings of missing school due to illness
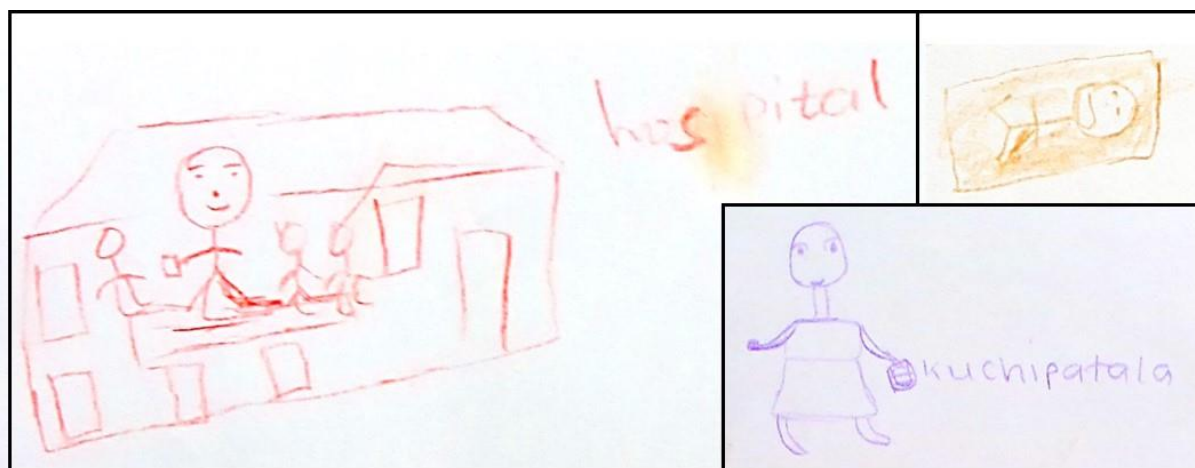
Note: '*kuchipatala*' means 'hospital' in Chitumbuka

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[44] Benjamin's father was a teacher at the local primary school, which may explain the particular importance attached to education in his household

Nearly all participants also described receiving medicine or hospital treatment (e.g. for malaria) during episodes of ill health. Access to these services, often facilitated by family members, may have played an important role in limiting the duration of absence or indeed preventing absences before they occurred. Thus, although illness-related absences were not discussed in the context of household-, school-, or community-level determinants in the same way as other proximal causes, some participants nevertheless mentioned distal factors that influenced both their decision to miss school, as well as their ability to return to school quickly after a period of absence. Evidence also suggested that by considering illness as beyond students' control, illness-related absences were not subject to the same moral judgements as those attached to absences deriving from other factors. We will return to this idea in the next section.

7.5 Strategies to address absenteeism

Despite acknowledging a range of structural barriers to school attendance, most participants nevertheless considered students responsible for their own absenteeism. Indeed, most suggestions to improve attendance in their communities revolved around correcting personal failings, rather than addressing external constraints (emphasis added):

> *Adamson*: [W]e need to **take the responsibility** of checking if our hair needs cutting and ask for money before we are sent away from school.

> *Lusungu*: I think to reduce absenteeism we need to **keep our clothes clean** all the time and we should ask for soap from our parents.

> *Adamson*: [If] we children **stop concentrating on football** this can help us concentrate more on school.

> *Edith*: What can help to reduce absenteeism is when we **work hard** in school.

In assigning responsibility for attendance to students themselves, participants typically favoured enforcing strict punishments for students who missed school or arrived late. They considered these punishments necessary to prevent future episodes of absenteeism or late arrival, to deter other students from following a bad example, or to live up to the standard of behaviour expected of committed students:

> *Justice*: It's necessary that a student who misses school should be punished because if they fail to punish him, he becomes happy and decides to miss school again. He

even boasts that there is nothing that teachers do when I miss school. If they give him a punishment after missing school, he knows that missing school is bad.

Edith: It is good to punish them [students who arrive late] because it is the duty of a pupil to go to school early.

The language used by participants—that missing school is 'bad', that a student's 'duty' is to arrive on time—reinforces the idea that school attendance holds a form of moral significance for students that is divorced from their daily realities. Indeed, Grace, 14, described arriving late to school due to a heavy burden of household chores, but nevertheless found being punished 'fair' since it reflected that 'getting to school late was wrong':

Interviewer: Why were you late for school?
Grace: My mother was not home so I had a lot of things to do.
Interviewer: What were you doing?
Grace: I was sweeping around the house, cleaning dishes and mopping in the house.
    […]
Interviewer: What did the teacher do about your lateness?
Grace: I was given punishment.
Interviewer: What time did you do this punishment?
Grace: I did the punishment after knocking off.
Interviewer: What kind of punishment did you do?
Grace: I was made to clear the football ground.
Interviewer: For how long did you do that?
Grace: For a very short time.
Interviewer: Did you see it as a fair punishment?
Grace: I think it was fair.
Interviewer: Did you get any lesson from the punishment?
Grace: Yes I did.
Interviewer: What lesson did you learn?
Grace: That getting to school late was wrong.

Another participant demonstrated how students conceptually separated the moral significance of school attendance from their own personal experiences. Early in one FGD, Joseph, 15, indicated that his least favourite part about school was being sent to dig a rubbish pit after arriving late. However, when discussing the hypothetical case of how to treat peers who had similarly arrived late, he concluded: 'It's necessary that they should be punished […] because they missed school.'

Punishments for absence or late arrival included manual jobs—sweeping the school yard, slashing grass, cleaning the toilets—or corporal punishment—being whipped or beaten by the teacher. Ironically, some of the punishments administered for missing school resulted in further exclusion from lesson time. Late-arriving students reported, for instance, being told to complete manual tasks before being allowed to join lessons, or alternatively being assigned a punishment to undertake during break time that spilled over into the next lesson. In the most extreme cases, students were sent home from school and told to return the next day, as Davie, 13, described:

> *Davie*: It was raining, so I was unable to see the sun rising. When I woke up, I went to the toilet, took a bath and went to school. There [at school] I found that my classmates were already in class and the teacher was teaching. When I knocked at the door, the teacher said that I should go back home and come early tomorrow because I was late.

The prospect of corporal punishment or strenuous manual labour additionally deterred some students from attending school at all: 'If maybe you go to school late then they [teachers] beat you. […] [S]ometimes I just feel like not going because I am afraid of the teacher that she might beat me' (Jane).

Reflecting greater appreciation for the external constraints that students face, as well as the detrimental impact of harsh punishment on continued school participation, some participants expressed more nuanced views about how to treat late or absent students. In particular, they suggested that the circumstances surrounding each absence should be considered before administering punishment. As we saw in the reporting of illness-related absenteeism, students drew a distinction between what they considered to be 'valid' reasons for missing school and other, less acceptable reasons. They applied this distinction to the administration of punishments:

> *Adamson*: I feel it is necessary [to punish absent students] if they were absent for no valid reason. For instance if this particular child was absent because clothes are dirty and didn't have the money to buy soap or the teacher himself had sent the child home so that he can have his hair cut and unfortunately didn't have the money to go to the barbershop the child need not be punished. If however the child does not give any genuine reason he deserves to be punished so that he would not do it again in future.

Adamson contrasts economic barriers to school attendance, which he classifies as excusable reasons for absence, with others that would not be considered 'genuine' reasons for missing

school. Several participants reported that their teachers similarly considered the reason for absence before taking punitive action. In some schools, teachers also involved students' caregivers when determining the reason for absence, recognising that sometimes parents or relatives are responsible for withdrawing children from school:

> *Emmanuel*: When a pupil misses school our class teacher sends the child to call the parent so the class teacher and parent will discuss issues in the office, mainly asking the parent reasons why the child miss school. […] [I]f the parent fails to give a genuine reason for the absenteeism the pupil is punished but if the parent gives a genuine reason the pupil will just be advised.

Given that teachers consider the reasons for missing school when administering punishments, this suggests that students (and parents) face incentives to misreport the causes of absence in cases when the true reason would not be considered 'genuine'. In her IDI, Alice indeed indicated that on days when she missed school, she sent her friends to tell her teacher that she was unwell, even if she actually stayed home for other reasons: '[I]f my grandmother is sick and there's no one to help her, I don't go to school. I send my friends to tell the teacher that I am sick while it is my grandmother who is sick.'

Judgements about absenteeism, which took a moralising form, thus shaped how students assigned blame for missing school, holding students themselves responsible for maintaining their own attendance. However, just as the significance students placed on school attendance was divorced from the actual constraints they faced, so, too, was students' advocacy of strict punishments for others distinct from their own personal aversion to being punished for missing school. A minority of participants, for their part, proposed solutions for absenteeism that extended beyond the punishment of absent students, by targeting household-level constraints. Enoch proposed that 'Parents should be told not to tell children to miss school anyhow,' while Gloria concluded that 'If our parents don't give us a lot of work at home, absenteeism can be reduced.'

7.6 Discussion

Drawing on in-depth interviews and focus group discussions with primary school students, we have investigated the benefits that students attribute to regular school attendance as well as the barriers to schooling they perceive to be problematic. Reflecting imagery from Malawi's post-FPE period (Frye 2012), participants emphasised the instrumental value of education as a route to high-skilled careers and future financial security, although this was

rarely backed by practical knowledge of how to achieve these aspirations. As significant was the symbolic importance students attached to regular attendance and hard work as a signal of commitment to education, which formed a crucial part of their student identities. Despite acknowledging household-, school- and community-level barriers that impeded attendance, participants nevertheless associated absenteeism more with students' personal failings than with structural constraints. Echoing Margaret Frye's observations (2012, p. 1600) among secondary schoolgirls in Malawi, framing educational aspirations as 'expressions of personal virtue' based on 'effort and striving' rather than actual academic success allowed students to claim moral superiority over their frequently absent peers, even if their own personal and economic circumstances also necessitated missing school.

Participants' accounts of absenteeism were frequently imbued with evaluative judgements that influenced how they discussed their experiences or those of their peers. In particular, students made distinctions between 'genuine' or 'valid' absences, and other reasons for missing school that reflected badly on a student's character. Although ill health was considered an acceptable—and indeed unavoidable—reason for absence, one participant (Memory) went further by appearing to exclude illness-related absences entirely from her conception of 'missing school,' which she interpreted to reflect a lack of commitment or readiness for schooling in a way that suffering ill health did not.

These findings may have important implications for the reporting of absenteeism in quantitative surveys. In particular, they suggest that the distinction drawn by students and teachers between valid and inappropriate absences, and especially the punishments attached to the latter, give students (and parents) incentives to misattribute the reasons for missing school. Comparing the reasons reported for absenteeism in the Karonga HDSS household survey with statistical analysis of individual and household-level determinants of missing school, the discussion in Chapter 4 speculated that absences attributable to agricultural work were relatively under-reported by survey respondents in comparison to illness-related absences. Evidence from Alice's interview, in which she publicly attributed missing school to her own ill health when in fact she stayed home to help her grandmother, provides support for inflated reporting of illness-related absences.

Evaluative judgements about absenteeism may also lead participants to avoid reporting it altogether in quantitative surveys. A longitudinal analysis from southern Malawi showed

that school-going adolescents were more likely to retract reports of sexual activity across survey rounds than were their out-of-school peers, leading the authors to speculate that reporting of premarital sexual behaviour violated student identities that presumed abstinence (Soler-Hampejsek et al. 2013). To the extent that absenteeism also violates this student identity, adolescents may be reluctant to acknowledge episodes of missing school in household surveys.

Our findings additionally highlight how distilling episodes of absence into a single proximal reason for missing school obscures complex underlying processes that create the conditions for absenteeism. Participants referred implicitly or explicitly to a range of individual-, household-, school- and community-level factors that influenced daily attendance patterns. Taking the example of absences attributed to agricultural work, Figure 7.5 summarises the complex network of distal influences on school attendance, as constructed from students' narratives. It corroborates the importance of absenteeism determinants identified in previous statistical analyses, including sex, household size, household age distribution, and ownership of land and livestock (Chapter 4), but also highlights the role of less tangible factors including academic engagement and parental encouragement as key facilitators or mitigators of absence.

Despite acknowledgment of these underlying influences, students nevertheless held absentees largely responsible for their own poor attendance. Many participants supported enforcing strict punishments for absent or late students, even as they disliked receiving such punishments themselves. This finding mirrors research from Ghana showing that 94% of girls across 13 schools reported being whipped by teachers but only 15% questioned corporal punishment as a means of administering discipline (Parkes and Heslop 2011). In Malawi, Kendall (2007) has also described how corporal punishment in the Northern region has historically been considered an integral part of discipline and socialisation processes. Interactions with a head teacher at a rural northern school during her ethnographic study revealed resistance to the FPE reforms outlawing corporal punishment:

> Schools […] are places where we teach our children how to live properly; how to be respectful, educated, and modern. Above all else, this requires discipline—to do well on high-stakes exams, behave properly in society, and survive in the formal employment market. To make school a place where discipline is neither taught nor enforceable would fundamentally destroy children's opportunities to succeed (Kendall 2007, p. 292).

Figure 7.5 Ecological model of individual-, household-, school-, and community-level factors underpinning school absences attributed to work, as constructed from students' narratives
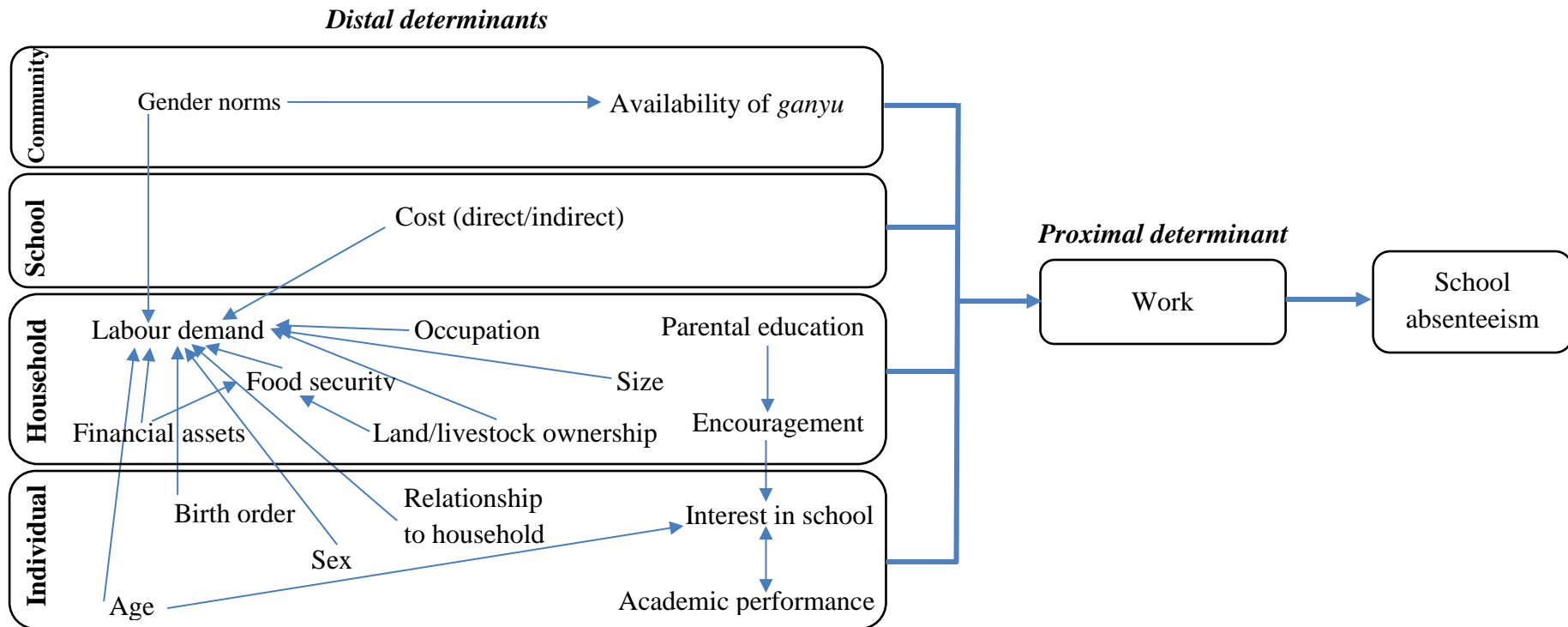
Students' support for punishments suggests may then reflect an acceptance of physical and psychological violence in the classroom context, but also implies a perceived association between absenteeism with personal failings such that strict punishments are considered deserved. In practice, however, the prospect of corporal punishment was shown to deter some participants from attending school, while other punishments for absence or late arrival—such as manual labour or being sent home—served only to compound losses to instructional time (Humphreys et al. 2015).

Reform of classroom practices thus forms an important component of efforts to mitigate absenteeism. Interestingly, however, although numerous students described exclusionary practices including administration of punishments, being sent home for lack of uniform or long hair, or due to fees levied by the school, none proposed changing these practices in order to reduce school absenteeism, echoing observations by Moleni (2008) in a case study elsewhere in Malawi. In a mixed methods study of students in Kenya, Tanzania, Nigeria and South Africa, Unterhalter (2012) observed similar silences, which she attributed to lack of exposure to different ways of life, particularly in rural communities, that prevent students from articulating and challenging the constraints they face. Tellingly, Unterhalter's findings showed that students in rural districts with the poorest classroom conditions were less likely than counterparts in peri-urban areas, where schooling conditions were better, to mention school quality issues as obstacles to educational participation. In understanding absenteeism, then, we must be mindful of what students do not say as well as what they do, and seek to recognise the circumstances that may lead children not to express some of the real obstacles they face (Unterhalter 2012).

Several limitations of the data presented require noting. Firstly, although the 'draw and tell' activity proved effective as a means of soliciting participants' ideas in an inclusive and creative way, it is possible that participants' image choices were motivated by how easy they were to draw rather than by their personal salience. However, as the purpose of the activity was to stimulate conversation, and participants were observed to introduce new ideas unrelated to their drawings, we believe we have captured descriptions of the leading barriers to school attendance. We cannot rule out, though, that despite assuring participants of confidentiality and separating data collection activities from a school setting, participants were reluctant to critique practices at school or at home that contributed to absenteeism, which provides an alternate explanation for the omissions described above. Finally,

although the sampling procedure ensured that a wide range of student voices were included in the study, the number of stratifications meant that comparisons by age, grade, or community environment were not undertaken. Including interviews with parents or guardians, as well as with teachers and education officials, would have helped to contextualise the data presented here.

7.7 Conclusion

Using rich data from in-depth interviews and focus group discussions with primary school students, we have explored students' perceptions and experiences of school absenteeism in Karonga district, northern Malawi. Findings suggest that maintaining regular school attendance holds moral significance for students that influences how they discuss missing school, which may have important implications for the interpretation of existing school attendance data. Students' perspectives are critical for understanding the complex set of processes that facilitate absenteeism, which may be obscured by a single proximal cause. Our data indicate the need for policies that attend to household-, school-, and community-level constraints that students face.

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Chapter 8: Discussion

Combining rich quantitative and qualitative data sources from Karonga district, northern Malawi, this thesis sought to identify the determinants of absenteeism among primary school students, contribute to the evidence base surrounding the potential for cleaner burning biomass-fuelled cookstoves to reduce absenteeism, determine the relationship between absenteeism and subsequent educational outcomes, and explore the value students themselves place on maintaining regular school attendance. Although absenteeism has been identified as an important issue of concern in Malawi (Jere 2012; Pridmore and Jere 2011; Streuli and Moleni 2008), it is worth noting that the prevalence of absenteeism observed in this study was considerably lower than observed elsewhere. Measures are not directly comparable, but data from the 2010-11 Karonga HDSS showed that 16% of students aged 5-18 were reported to have missed school in the past four weeks (Chapter 4), while in southern Malawi, Grant et al. (2013) found using 2007 data that 52% of primary school students aged 14-16 had missed school in the past two weeks and 20% on the most recent school day. Indeed, reported absenteeism levels in Karonga district compare favourably even with figures from some high-income countries: according to 2015 data from the National Center for Education Statistics in the United States, 48% of grade 4 students and 55% of grade 8 students missed at least one day of school in the previous month (National Center for Education Statistics 2015a).

This variation in absenteeism prevalence could stem from a number of factors, both empirical and methodological. Firstly, because school attendance reports in the Karonga HDSS came primarily from adult proxy informants, as opposed to student self-reports collected in the study from southern Malawi (Grant et al. 2013) and the US survey (National Center for Education Statistics 2015b), the validity of reporting across the studies may differ. In particular, proxy reports of absenteeism may be affected by misinformation or lack of awareness about children's attendance patterns (Bardasi et al. 2011), which may have led to under-reporting of absenteeism in the HDSS. In a case study of four Malawian schools, Moleni (2008, p. 51) noted 'a lack of close supervision from some guardians' regarding children's school attendance, which may cause them to report it inaccurately.

Findings presented in Chapter 7 also suggest that evaluative judgements about missing school could additionally have influenced reporting in the HDSS in ways that might not apply in other settings, especially where missing school is not punished or considered socially proscribed. The differences in recall periods between the two Malawian studies—missing school in the past four weeks versus past two weeks/past day—may have additionally influenced participants' ability to report absenteeism accurately (Das et al. 2012), although extrapolation of the figures from southern Malawi suggest that differences in absence rates between the two sites may be even more stark than they appear.

Finally we saw in Chapters 4 and 6 that levels of absenteeism differed by standard attended and students' history of grade repetition, so variation in sample composition by age and grade likely contributes to discrepancies in absenteeism measures. In particular, the sample for the southern Malawian study comprised students aged 14-16 attending standards 4-8 (Grant et al. 2013), which, although selected to reflect the 'typical' education experience of adolescents in southern Malawi, excluded the minority of students who progressed through school at the correct age-for-grade. Given that my results indicate that students who had not repeated their school grade demonstrated lower levels of absenteeism, figures reported by Grant et al. (2013) may overestimate overall absence levels in upper primary school.

Bearing in mind these important methodological differences, the comparatively low prevalence of absenteeism in northern Malawi may also reflect the strong historical educational traditions that characterise the area, described in Chapter 3. In an ethnographic study undertaken in the years following the transition to free primary education, and covering all three regions of Malawi, Kendall (2007, pp. 292-3) observed of a northern community, 'Education and literacy mattered in people's lives and perceived opportunities in a way that was not evident in the other regions studied.' Indeed, by focusing on identifying and addressing episodes of absenteeism, the analyses presented here do not account for activities that schools and communities already undertake to support children's schooling, which may be additionally reflected in prevalence measures.

The characteristics of the Malawian education system more broadly must also be considered when reflecting on patterns of absenteeism. Given the highly competitive nature of secondary school entry, as well as the introduction of school fees at secondary level,

students' primary school attendance may be influenced by the perceived likelihood of progressing to secondary education. We saw in Chapter 4, for instance, that students attending standard 8 were significantly less likely to miss school than counterparts in earlier grades, presumably because of the importance placed on the Primary School Leaving Certificate of Education (PSLCE) examination (but potentially also due to selectivity of students who progress so far through school). On the other hand, a negative feedback loop generated by the bottleneck at the transition to secondary education may negatively affect attendance decisions at earlier stages. Research from Tanzania described in Chapter 2 showed that presence of a secondary school within 5 km of a community increased hours of primary school attendance for girls, suggesting that the availability (or absence) of future secondary education opportunities factored into household decisions about investment in primary, particularly for female students (Burke and Beegle 2004).

Even if absenteeism prevalence is lower in this study relative to regional or global comparisons, irregular school attendance nevertheless remains an important barrier to sustained educational access. My findings suggest that absent students were subject to a number of exclusionary practices at home and at school (Chapter 7), and absenteeism was also linked with future adverse educational outcomes (Chapter 6), such that understanding the drivers of absenteeism forms an essential component of strategies to address 'silent exclusion' from education (Lewin 2009).

The following sections discuss the contributions and implications of thesis findings, according to the four research objectives outlined in Chapter 1. Table 8.1 summarises this discussion.

8.1 Proximal and distal determinants of primary school absenteeism

The analyses presented in this thesis have highlighted the complex network of individual-, household-, school-, and community-level processes that underpin school absenteeism in Karonga district. Both in the literature review in Chapter 2 and in the analysis that followed, socioeconomic barriers and student ill health emerged as particularly prominent sources of absence in the study community.

Table 8.1 Summary of thesis contributions

Research objective	Key findings	Implications	Limitations
1: Identify distal and proximal determinants of absenteeism	• Household agricultural and non-agricultural wealth are significantly associated with recent absenteeism, but in opposite directions • Student ill health is most common reason reported for missing school • No difference in absenteeism prevalence between boys and girls, but some determinants differ	• Complex relationship between agricultural productivity, child work and school attendance in rural settings • Absenteeism not restricted to poorest households if multiple dimensions of SES are considered • Some suggestion of relative over-reporting of illness-related absences	• No time use data to measure participation in household work • No health data to assess disease burden among school-age population • Analysis is cross-sectional so causal inferences drawn with caution
2: Assess relationship between cookstoves and absenteeism	• No conclusive evidence that cookstoves influenced absenteeism overall • Some suggestion that cookstoves improved attendance of older female students during the rainy season • Time and resource savings widely perceived; few observed health impacts	• Cookstoves may influence other educational outcomes – e.g. timely arrival at school • Cookstove interventions should form part of wider clean energy strategy	• No time use data to establish cookstove impact on resource collection and cooking times • No health outcome data for school-age population
3: Establish relationship between absenteeism and subsequent educational trajectories	• Absenteeism in one survey round associated with absenteeism and grade repetition in the next survey round • Dose-response relationship observed between missed days and repetition • Stronger association between absenteeism and grade repetition among students who entered primary late	• Absenteeism serves as observable precursor to adverse educational trajectories • Students who are behind age-for-grade are particularly at risk	• Cannot establish causal relationship between absenteeism and future outcomes • Loss to follow up may introduce bias • 'Snapshot' measure of absenteeism does not capture trends across the school year
4. Explore students' perceptions and experiences of absenteeism	• Students attach a form of moral significance to attending school daily • Absenteeism driven by complex underlying processes • Some reasons for absence (e.g. illness) considered more 'valid' than others	• Evaluative judgements about missing school may influence reporting of absenteeism in household surveys • Distilling episodes of absenteeism into single proximal cause obscures complex underlying processes • Holistic approach needed to understand and address absenteeism	• Time and resource constraints limited study scope • Sample size precluded subgroup comparisons • Participant drawings may not reflect activities with most salience

8.1.1 Socioeconomic barriers

In both quantitative and qualitative analyses, socioeconomic factors acted as constraints on school attendance through a diversity of mechanisms. The analysis from Chapter 4 showed that multiple dimensions of SES were strongly associated with missing school in the past four weeks, but in opposite directions. In particular, students living in households with high levels of non-agricultural wealth were less likely to miss school than those in poorer households, adjusting for other measures of SES. By contrast, students from households characterised by high levels of agricultural wealth were significantly *more* likely to miss school. These findings echo the agricultural 'wealth paradox' observed in other settings, whereby larger endowments of land and productive assets increase demand for household child labour and consequent withdrawal from school (Bhalotra and Heady 2003).

Findings from IDIs and FGDs confirmed the salience of agricultural work as a reason for absence in the study area. Farming activities were the most common image depicted in the 'draw and tell' activity among both boys and girls, while several IDI participants also experienced recent work-related absences. Students described two distinct pathways between agricultural work and absenteeism. According to the first mechanism, students were pulled out of school to provide needed labour on household farms—consistent with the observed statistical concentration of absenteeism in the most agriculture-rich households. Alternatively, students were pushed out of school due to prohibitive monetary costs, leading either to participation in paid work to finance school costs, particularly among boys, or to engagement in household work somewhat by default. This pattern is consistent with the finding from Chapter 4 that monetary poverty—measured in terms of household asset ownership and dwelling quality—was significantly associated with missing school, after adjusting for agricultural wealth. Indeed, although Malawi abolished primary school fees in 1994, students listed a number of other school-related expenses, including for pens and notebooks, school uniforms, or examination fees—as in other Malawian studies (Kadzamira and Rose 2003; Pridmore and Jere 2011)—for which inability to pay led to absenteeism.

These findings underscore the importance of both monetary and opportunity costs of schooling as influences on school attendance, which may operate in different ways. Several implications follow for research and policy. With respect to operationalising socioeconomic status, this thesis has highlighted the multidimensional nature of household

SES and the observation that school absenteeism is not restricted to the poorest students if measures of agricultural wealth are considered. Accordingly, nuanced analysis is required when identifying socioeconomic sources of educational exclusion.

Efforts to address socioeconomic barriers to school attendance, for example through cash transfers, must be equally cognisant of the opposing incentives that rural households face. Unconditional or conditional cash transfers have been widely advocated as a means to facilitate improved educational participation among poor households in low- and middle-income countries (Glewwe and Muralidharan 2015). In 2006, the Government of Malawi launched the Social Cash Transfer (SCT) programme, in which ultra-poor and labour constrained households received an unconditional monthly payment designed to alleviate household hunger and improve children's well-being (Kilburn et al. 2017). As of December 2015 the SCT had reached 163,000 households across 18 districts (Abdoulayi et al. 2017), but has not yet been introduced in Karonga. Evaluations of the SCT programme have found significant improvements in school attendance among children in recipient households, even in the absence of conditions attached to the transfer (Abdoulayi et al. 2017; Miller and Tsoka 2012). Kilburn et al. (2017) showed that the primary mechanism through which the SCT increased attendance was via greater household expenditure on such items as uniforms and notebooks, which had previously excluded children from school.[45]

The impact of the SCT on children's work participation, however, was more nuanced. Abdoulayi et al. (2017) found that children's involvement in informal piece work (*ganyu*) declined in SCT households, but participation in domestic agricultural activities and household chores increased. An earlier analysis similarly found that the SCT reduced child labour outside the home while increasing involvement in household farm work (Covarrubias et al. 2012). These findings suggest that, although cash transfers may alleviate household financial pressures and in turn release children from performing paid work, labour-constrained households rely on children to intensify their domestic agricultural activities (Covarrubias et al. 2012; Miller and Tsoka 2012). Indeed, Abdoulayi et al. (2017) and Covarrubias et al. (2012) both showed that investment in productive assets including hoes, sickles, and livestock increased in SCT recipient households, which may explain the

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[45] Although the requirement to wear a school uniform was formally eliminated in 1994, school policies that still enforce the uniform policy, or ridicule from classmates for not having a uniform, continue to result in exclusion (Moleni 2008).

increased demand for household child labour. Although greater work demands did not appear to interfere with school attendance (Abdoulayi et al. 2017; Kilburn et al. 2017; Miller and Tsoka 2012), they may nevertheless negatively affect pupils' educational performance through injury, fatigue, or lack of time to study (Hazarika and Sarangi 2008; Heady 2003). At the same time, however, children have been shown to derive pride and enhanced self-esteem from their ability to provide for themselves and their families, as well as to learn skills for securing future livelihoods, through their participation in household work (Aufseeser et al. 2017). Design and evaluation of cash transfer programmes, and other interventions designed to address household poverty, must therefore carefully consider the complex relationship between financial assets, agricultural productivity and school attendance in rural settings.

8.1.2 Ill health

In addition to socioeconomic factors, a number of other barriers to school attendance emerged as important constraints. In particular, the most common reason reported for missing school in the HDSS was student ill health, echoing previous survey research from Malawi (Grant et al. 2013; Milner et al. 2011): in the 2010-11 school year, nearly three-quarters of absences in the previous four weeks were attributed to illness (Chapter 4). Despite suggestions in both quantitative (Chapter 4) and qualitative (Chapter 7) data of relative over-reporting of illness-related absences, which I will discuss further in section 8.4, findings nevertheless suggest that student ill health posed an important barrier to sustained school attendance. In IDIs and FGDs, students described missing school due to malaria attacks, as well as more generic symptoms including dizziness, headache and stomach ache. Addressing preventable illness in this community could thus have an important impact on school attendance.

With specific reference to malaria, this study lacked prevalence and incidence data with which to measure disease risk, but other research from Malawi has emphasised that school-age populations bear a high malaria burden. According to a study from Zomba district, 60.0% of school children (ages 5-21) were infected with *Plasmodium falciparum* (Mathanga et al. 2015), while in Blantyre, Thyolo and Chikhwawa, children aged 6-15 years had almost five times the odds of rainy season malaria infection than both younger children and adults (Walldorf et al. 2015). School-aged children in southern Malawi have also been shown to use bed nets significantly less frequently than household members of

other ages (Buchwald et al. 2016), and to be taken for treatment less frequently than younger children (Walldorf et al. 2015). Although no Malawian study has quantified the contribution of malaria to school absenteeism, other research from African settings suggests that absences attributable to malaria constitute 13-50% of annual school days missed from preventable medical causes (Brooker et al. 2000).

School health programmes, such as those that target malaria, thus represent a promising means to enhance educational access. In framing school health as 'a key component of Education for All', Bundy (2011) emphasised the critical role schools can play as sites for health interventions that improve students' attendance and ability to learn. Indeed, reduced absenteeism, as well as time and resource savings associated with ready access to treatment, were identified by both students and parents as among the key benefits of a recent school-based malaria diagnosis and treatment programme implemented in southern Malawi (Mphwatiwa et al. 2017). According to one student:

> When you are sick, you do not have to be absent from school you still come; you go to […] receive medication and go back to class. Our parents are very happy because they are not having any problem with taking us to the health facility to receive treatment so they say they are able to save money (Mphwatiwa et al. 2017).

The 2015 Global Burden of Disease Study indicates that, in addition to malaria, major contributors to morbidity and mortality among children and adolescents in Malawi include iron-deficiency anaemia, skin and soft tissue infections, and diarrhoeal diseases (The Global Burden of Disease Child Adolescent Health Collaboration 2017). More research is needed to identify the health conditions that lead to preventable school loss in northern Malawi, and for which appropriate and effective treatment measures can be designed. I review evidence for absences related to household air pollution, and the potential for cleaner burning cookstoves to improve school attendance, in section 8.2 below.

8.1.3 Gender differences

Consistent with previous studies in Malawi (Grant et al. 2013) and elsewhere in sub-Saharan Africa (Ainsworth et al. 2005; Loiaza and Lloyd 2008; Mensch and Lloyd 1998; Orkin et al. 2014), I did not observe a difference in the prevalence of absenteeism between boys and girls. However, some determinants of missing school did follow a gendered pattern. For instance, the analysis in Chapter 4 showed that the number of household

members younger than the index student was associated with absenteeism for girls but not for boys, suggesting that girls assume greater responsibility for caregiving or household chores, a hypothesis supported by the qualitative data presented in Chapter 7 as well as previous literature (Lloyd et al. 2008; Wodon and Beegle 2006). Indeed, IDI and FGD participants described gendered divisions of labour that influenced their education. Echoing findings in Kendall and Kaunda (2015), some girls perceived that it was easier for boys to secure the paid work necessary to finance schooling expenses, which may explain why a significant positive relationship between participation in economic activities and school absence was observed for boys but not for girls in Chapter 4. Additionally, many domestic tasks that were not included in the survey's definition of economic activities, including drawing water for cooking and cleaning and sweeping the compound, were considered exclusively in girls' domain. Although these activities were less frequently mentioned as barriers to school attendance than was agricultural work in Chapter 7, they are nevertheless indicative of the extra burden girls bear to combine household responsibilities with school attendance (UNICEF 2016).

Some girls also described how familial expectations about marriage meant that households were less willing to invest in girls' education. Quantitative research among students in Ghana similarly showed that household gender attitudes were significantly related to attendance patterns: when students' caregivers endorsed a statement that it is better to educate boys than girls, girls' absence rates were significantly higher—and boys' significantly lower—than counterparts whose caregivers disagreed with the statement (Wolf et al. 2016). In the Ghanaian study, as in the present one, overall levels of absenteeism were equal across sexes, but I echo the authors in advocating that:

> [R]esearchers and practitioners must look beyond the raw rates of school attendance […] to understand the patterns of barriers that may uniquely limit access to school for boys versus girls. Targeting the specific types of barriers faced by different groups of children from different contexts may provide the most efficient way to improving overall access and parity (Wolf et al. 2016, p. 189).

8.2 Impact of cleaner burning biomass-fuelled cookstoves on school attendance

Against this backdrop of health and economic barriers to school attendance, I capitalised on opportunities offered by the Cooking and Pneumonia Study to examine the effect of cleaner burning biomass-fuelled cookstoves on absenteeism. I hypothesised that reduced

household air pollution and fuelwood demand resulting from the cookstoves could improve school attendance via both health and time/resource savings, particularly for girls relative to boys, and older students relative to younger students, due to greater resource collection and caregiving duties undertaken by these subgroups. I also expected to observe more pronounced cookstove benefits during the rainy season, when most cooking activities are conducted indoors.

The analysis in Chapter 5 ultimately showed that, although school absenteeism was slightly lower in the intervention group than in the control group, no statistically significant differences in attendance were found in either the intention-to-treat or per protocol analyses. Similarly, subgroup analyses suggested a differential effect of cookstove ownership on absenteeism in the expected directions—namely, among girls, older children, and during the rainy season—but none of these results was statistically significant. Combining all three subgroups, there was some indication that cookstoves yielded greater attendance benefits among older girls interviewed during the rainy season, a finding that merits further in-depth research.

Qualitative data helped shed light on why the cookstoves did not appear to yield the anticipated school attendance benefits. Although nearly all participants in the qualitative study observed time and resource savings associated with the cookstoves, echoing the perceptions of primary household cooks interviewed in Cundale et al. (2017), cooking and fuel collection activities were considered to be compatible with school attendance in both trial groups due to the ready availability of fuelwood and agricultural residues in the trial community. Instead, students listed a range of alternative impediments to schooling, particularly related to (non-pollution-related) illness and other domestic responsibilities, as described in section 8.1. Time and resource savings from cookstoves—and corresponding school attendance gains—may, however, be greater in settings where environmental resources are more depleted. Future trials should explore this hypothesis further by comparing intra-household time allocations across settings with different levels of environmental degradation.

Few participants perceived any changes in household health after receiving the cookstoves, consistent with the finding that the CAPS trial had no effect on incidence of pneumonia in children under five (Mortimer et al. 2016). One student did, however, observe that her sister

suffered fewer asthma exacerbations after CAPS enrolment. The latter finding, which reflects previous studies linking biomass cooking to asthma in school-age populations (Wong et al. 2013), warrants further research in the context of a cookstove trial. More generally, by recognising school-age children as important and relatively neglected stakeholders in health research (Mokdad et al. 2016), future studies can fill important gaps in the evidence base surrounding the health impacts of clean cooking technologies in this population.

However, as in previous cookstove trials (e.g. Hanna et al. 2012; Romieu et al. 2009), CAPS demonstrated the difficulties associated with achieving sustained and consistent behaviour change. A large fraction of households reported continuing to use traditional cooking methods alongside the cookstove, such that 64% of households used the cookstove exclusively for all meals at time of follow-up. Household cooks reported reverting to three stone fires when the cookstoves were damaged or not properly charged, when preparing large volumes of food that the cookstoves could not accommodate, or when cooking some foodstuffs that they considered more amenable to open fire cooking (Cundale et al. 2017).

Evidence from cookstove acceptability studies in other settings has confirmed that although households value time and resource savings associated with more efficient cookstoves, they also demonstrate a diverse range of preferences with respect to cookstove capacity and functionality (Rosenbaum et al. 2015). Continued innovation is required to develop a variety of high-quality cookstove models that increase the choice of clean cooking technologies among households, while enhancing acceptability (Rehfuess et al. 2014). For instance, recent biomass cookstove prototypes field tested in Malawi have included a small electricity generator sufficient to charge mobile phones, lights or radios, in order to increase their appeal in off-grid rural communities (O'Shaughnessy et al. 2014; O'Shaughnessy et al. 2015). In addition to supply-side measures, however, efforts to increase cookstove uptake should also include appropriately tailored communication and community engagement strategies to facilitate sustained cookstove use (Barnes et al. 2015).

Importantly, too, cooking represents just one of several sources of damaging air pollution, so isolated programmes of cookstove distribution may not be sufficient to improve household health (Ezzati and Baumgartner 2017). Baseline data from CAPS reported in Table 5.1 showed that approximately 70% of households regularly burned their rubbish,

and smaller proportions reported daily or almost daily smoke exposure from brick production or paraffin/kerosene lighting, as well as tobacco smoking. Other research from Malawi has similarly highlighted elevated levels of environmental smoke exposure (Brouwer et al. 1997; Das et al. 2017). Strategies to address HAP must therefore form part of a comprehensive clean and affordable energy strategy, combined with safe waste disposal, to reduce solid fuel combustion.

Nevertheless, although the analysis from Chapter 5 suggested that cleaner burning cookstoves did not influence school attendance, there was some indication that they improved timely arrival at school. Future research should thus explore linkages between clean energy technologies and other aspects of educational access. In particular, time and resource savings attributable to cookstove use may translate into greater opportunity to engage in non-school educational activities, including studying or listening to the radio. Students may also benefit from improved concentration in lessons if cookstoves enable them to eat breakfast before school more regularly than with time-consuming traditional methods. As highlighted by Vladimirova and Le Blanc (2016), synergies between the energy and education sectors are under-exploited in the policy community, so opportunities to widen the scope of the research agenda to explore the educational impacts of other forms of clean energy technology should also be pursued. Increased access to solar powered or electric lighting, for instance, has the potential to enhance learning outcomes by allowing students to complete homework at night—or indeed other household responsibilities that compete with schooling—although existing evidence from African settings is mixed (Furukawa 2014; Peters and Sievert 2016).

8.3 Relationship between absenteeism and subsequent educational outcomes

Having examined the factors associated with school absenteeism, and assessed one potential intervention to address it, the analysis presented in Chapter 6 investigated the relationship between absenteeism and future educational pathways by exploiting eight years of longitudinal school attendance data. Findings showed that, even using the fairly crude measures of absenteeism available in the HDSS, students who were absent in one survey round were more likely to be absent again in the next round, and to repeat their school grade. A dose-response relationship was observed between absenteeism and repetition, with students who missed more school increasingly likely to fall behind. A

measure of cumulative absence over multiple survey rounds was also significantly associated with lower grade attainment after six years.

Combined with the observation from Chapter 4 that students who were repeating their current grade were more likely to have missed school in the past four weeks, these results suggest a cycle of silent exclusion in which absenteeism and repetition are mutually reinforcing. While my analysis cannot establish a causal relationship between absenteeism and repetition—and indeed it is likely that both are jointly influenced by monetary poverty, domestic responsibilities, and other forms of vulnerability—one male FGD participant also described how humiliation and ridicule associated with being overage for grade promoted disengagement from school (Chapter 7). Research by USAID in Malawi similarly showed that being laughed at by classmates and feeling 'too big for their class' contributed to absenteeism and school withdrawal (USAID 2014, p. 21). In Chapter 6, the relationship between absenteeism and grade repetition was significantly stronger among students who entered primary school late relative to those who entered early, providing further indication that students who were overage for grade were particularly vulnerable to adverse educational trajectories.

These observations suggest two primary implications:

1) In light of the link between absenteeism and adverse educational trajectories, school attendance data can be used to identify students at risk of future repetition and dropout.
2) Interventions targeted specifically at students who are overage for grade are needed to arrest cycles of exclusion involving absenteeism and repetition.

8.3.1 Using attendance data to identify students at risk of adverse educational pathways

Given the observed link between absenteeism and future absence and repetition, school attendance data can play an important role in identifying students at risk of adverse educational trajectories, but lack of appropriate monitoring mechanisms often renders frequently absent students 'invisible' in the classroom (Creative Associates International 2015; Jere 2012). As discussed in Chapter 1, National Education Management Information Systems (EMIS) typically do not include indicators for absenteeism, while cross-national survey programmes such as the DHS do not account for students' attendance frequency

(UNICEF and UIS 2016). At school level, numerous commentators have lamented the poor quality of daily attendance registers, including one South African study that dismissed them as 'notoriously unreliable' (Hochfeld et al. 2016, p. 8) and observations in Malawi that they were 'poorly kept' (Moleni 2008, p. 78). By not monitoring the regularity of school attendance, official enrolment estimates may not only overestimate the number of students currently in school, but education authorities also miss opportunities to use absenteeism patterns to identify students at risk of repetition or dropout.

A recent set of USAID programmes to prevent school dropout in Cambodia, India, Tajikistan and Timor-Leste explicitly centred around development of an 'early warning system' as part of its strategy to keep students in school (Creative Associates International and Mathematica Policy Research 2015b). The early warning system harnessed administrative data including daily attendance and class performance to identify at-risk students, to whom targeted responses ranging from increased teacher attention to home visits were directed. These efforts were complemented by community engagement activities to raise awareness about the importance of school attendance. The pilot from Cambodia—the only country to test the early warning system in isolation from other interventions—found that after two years of implementation in 107 schools, the early warning system reduced dropout by 6% overall, and 11% among at-risk students, compared to in 107 control schools (Creative Associates International and Mathematica Policy Research 2015a).

A school-based intervention in Malawi under the auspices of the SOFIE project (Strengthening Open and Flexible learning to Increase Educational access), which included a package of measures to support the learning of children at risk of dropout, similarly highlighted the value of improved attendance monitoring for arresting adverse educational outcomes. The programme evaluation found that school dropout was lowest in the subset of intervention schools where teachers were trained to keep registers of vulnerable students in which they recorded their attendance, progress and participation in lessons (Jukes et al. 2014; Pridmore and Jere 2011). Interestingly, too, reductions in dropout were particularly large among students not selected for participation in the wider programme, which the authors attributed to spillovers from enhanced monitoring mechanisms:

> [A]cross the majority of intervention schools, participants reported a notable improvement in record-keeping, monitoring of pupil attendance and follow-up of

all pupils, not just those in the SOFIE clubs. […] In this way, it was less easy for habitual absentees, or those who had temporarily withdrawn, to slip through the net and to dropout permanently (Jukes et al. 2014, p. 199).

Enhancing school attendance data collection mechanisms thus forms a critical component of strategies to address silent exclusion from education. In recognition of the importance of high-quality and timely school attendance data, several innovative electronic data collection systems have been developed in sub-Saharan Africa, which also facilitate real-time monitoring and analysis by local and national stakeholders. UNICEF's eduTrac monitoring system in Uganda, for instance, uses mobile phones to collect attendance data from teachers via weekly SMSs.[46] Tanzania's tablet-based School Information System harnesses FHI 360's all-in-one (internet or SMS) transmission technology to collect daily attendance data.[47]

While electronic systems have a number of potential advantages, including quicker data entry compared to paper-based registers, reduced costs of data transmission and automated generation of attendance reports (Bernbaum and Moses 2011; Mohandes 2017), early evidence suggests that take-up and acceptability are low. The pilot study of the Ndi Hano! (Here I Am) programme in Rwanda, which used SMS technology to collect daily attendance data, found that only one-third of teachers submitted attendance records during the first two months of implementation and, of these, more than half sent only ten messages or fewer during that period (Center for Education Innovations 2015). Explanations for limited uptake included technological errors, unacceptable time burdens, and lack of systematic data collection procedures at school level. With other programmes including eduTrac and Tanzania's School Information System still in their infancy, 'it is too early to determine the precise links between education progress and such approaches to data', although they hold promise (UNESCO Institute for Statistics (UIS) and UNICEF 2015, p. 55). Continued research is needed to develop and evaluate systems that produce timely and accurate attendance data, while meeting users' needs.

Importantly, however, data collection systems must be nested in monitoring structures that avoid incentivising misrecording of student absenteeism. Several commentators, for

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[46] More information at: https://www.rapidsms.org/projects/edutrac/
[47] More information at: http://www.fhi360bi.org/user/tanzaniaSIS/

instance, have argued that tying attendance records to school resource allocation decisions encourages inflated reporting of attendance levels (Humphreys et al. 2015; Ravishankar et al. 2016). A recent World Bank report instead advocated apportioning school grants on the basis of a measure of 'effective pupil years', which would consider grade progression over and above reported attendance in funding decisions, although an 'ideal' measure would also account for students' actual learning (Ravishankar et al. 2016, p. 53). Unannounced spot checks by education authorities to verify the accuracy of attendance data, as well as clear communication strategies that make clear how high-quality data can be used to benefit students and schools, represent additional strategies to improve reporting (National Forum on Education Statistics 2009; UNICEF and UIS 2016).

8.3.2 Interventions to arrest adverse educational trajectories

Although all students stand to benefit from improved school record keeping, the analyses in Chapters 4, 6 and 7 suggested that students who were repeating their grade and/or overage for their class were particularly at risk of adverse educational outcomes and hence merited targeted interventions. This observation is echoed by the evaluation of the SOFIE programme in Malawi, which found that the intervention was particularly effective at reducing dropout among older students (aged 14-20 years in standard 6), despite age not being used as a criterion to identify at-risk students (Jukes et al. 2014).

As previous research has noted (Jere 2012), grade promotion in Malawi is norm-based and highly subjective. Indeed, many focus group participants in the present study supported requiring frequently absent students to repeat their grade, regardless of their academic ability or extenuating circumstances.[48] During one school visit, a head teacher also shared the perception that absent students were not interested in school, which, as in Dunne and Ananga's (2013) case studies in Ghana, may influence grade promotion decisions. To the extent, however, that absenteeism and grade repetition among overage students stem from poor academic performance and disengagement from school, programmes that support the learning of students who have fallen behind represent a critical policy response to arrest

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[48] The following exchange from a girls' FGD demonstrates this point:
  Facilitator: Why are we saying they should repeat that class if they have been absent for a long time? […]
  Patricia: It will make her/him work hard so that he/she should pass.
  Facilitator: Suppose he/she didn't fail but because he/she was absent too much what should be done?
  Edith: That child must repeat that class.

adverse trajectories. Measures proposed by the Malawi Education Sector Plan 2008-2017, and the follow-up covering 2013-2018, include expansion of remedial education programmes for failing students to reduce the repetition rate in government schools (Ministry of Education, Science and Techology 2008; Ravishankar et al. 2016). These initiatives may also serve to improve attendance by re-engaging students who fall behind, but few studies have assessed the link between remedial instruction and time spent in school (Glewwe and Muralidharan 2015).

According to a 2011 survey from 10 districts in Malawi, approximately 70% of schools offered some form of remedial support outside of class time, but 5% asked students to pay for these sessions (Nampota et al. 2012). Moleni (2008) additionally noted that some teachers cut short timetabled classes in order to force children to attend private lessons after school, but many students found the fees for these lessons to be prohibitive. Research is therefore required to establish the coverage of current remedial education programmes, their effectiveness for improving attendance and grade progression, and non-exclusionary methods of provision, as well as alternative models of curriculum delivery to complement formal education structures (Jere 2012; Yates 2008). More generally, in-depth study of schools with lower average repetition rates and higher rates of promotion and learning achievement is needed to enhance understanding of the performance features of these schools and their student populations, and to develop appropriate policy prescriptions (Ravishankar et al. 2016).

8.4 Students' perceptions and experiences of absenteeism

Having identified statistical relationships between absenteeism and individual and household characteristics, and an association between missing school and future educational outcomes, the thesis finally sought to delve beneath quantitative representations of school attendance to shed light on young people's *experiences* of educational access (Camfield 2011). While exploring students' perceptions of the value of education and the primary barriers to sustained attendance, it also sought to make two additional methodological contributions: firstly, to highlight the extent to which distilling episodes of absence into a single reason for missing school obscures complex underlying processes, and secondly, to examine the incentives participants in quantitative surveys face to misreport absenteeism levels or determinants.

We saw in Chapter 7 that, even in the context of relatively over-crowded and under-resourced Malawian schools (Chimombo 2009), IDI and FGD participants attached importance to attending school every day. The value derived from daily school attendance reflected both a vision of education as a route to 'bright futures' in formal employment (Frye 2012; Kendall and Silver 2014), and its contribution to a student identity forged on commitment to education. In particular, framing educational aspirations as 'expressions of personal virtue' based on 'effort and striving' rather than actual academic success (Frye 2012, p. 1600) allowed students to claim moral superiority over their frequently absent peers, even if their own personal and economic circumstances also necessitated missing school.

Corroborating the findings from Chapter 4, students identified a range of constraints on school attendance including ill health and domestic responsibilities. However, absences attributed to the same proximal cause were influenced by a dynamic and interacting set of individual-, household-, school-, and community-level circumstances. Some of these factors—including age, sex, financial resources, and household composition—served to 'thicken' or 'thin' students' agency with respect to attending school (Klocker 2007). Participants in the qualitative study, for instance, described how households' pressing economic needs, combined with unequal power relations and prevailing gender norms, limited their range of options with respect to school attendance and their ability to circumvent attendance barriers (Chapter 7). However, even in the context of external constraints, some participants reported using initiative to secure funding for school supplies, to pre-emptively wash clothes, or to renegotiate household workloads in order to facilitate sustained school attendance. Previous research among female students in a Tanzanian technical and vocational school has similarly demonstrated a range of creative ways in which they exercised agency to navigate challenging circumstances and achieve desired goals (DeJaeghere 2016). Future education research would benefit from further attention to students' coping strategies and personal agency in the face of structural constraints (Jere 2014); recent analysis by Wilson-Strydom (2017) exploring interactions between students' resilience, agency and social context at a South African university represents an illuminating example of this approach.

When seeking to understand the drivers of absenteeism, results from Chapter 7 caution against the reduction of complex absenteeism processes into a single reason for missing

school. As Figure 7.5 demonstrates, absences attributed simply to 'work'—as in the SACMEQ Malawi report (Milner et al. 2011)—overlook the very different underlying mechanisms leading to work-related absence, discussed in section 8.1, which suggest different policy solutions. Importantly, too, we saw from participants' FGDs that some explanations for absence were considered by teachers and peers to be more 'valid' than others. One participant (Alice) acknowledged telling her teacher she missed school due to illness, when she in fact stayed home to help her grandmother. Another (Memory) went further by excluding illness-related absences entirely from her conception of 'missing school'. These insights provide a possible explanation for the paradox observed in Chapter 4, whereby absenteeism was significantly associated with agricultural wealth for boys and girls and economic participation (boys only) but work-related absences were rarely reported by HDSS survey respondents.

Indeed, if moral judgements about missing school promote general under-reporting of absenteeism (Baird and Özler 2012; Özler 2013), this may contribute to the relatively low prevalence of absenteeism observed in Chapters 4 and 5. Perhaps tellingly, of the three IDI participants who were interviewed in the same week as the HDSS household survey was conducted, all three described missing school in the two weeks prior to the IDI, while none of their caregivers attributed any absences to these students in the household survey. Although by no means a perfect validation measure, this provides some indication of discord between accounts of absenteeism in the quantitative and qualitative data sources. Future methodological research is needed to establish whether variation stems from use of proxy versus self-reports, issues with recall, or different propensities to acknowledge absenteeism in surveys relative to in-depth interviews.

Reflecting moral significance attached to school attendance, as well, perhaps, of inability to challenge the constraints they face (Unterhalter 2012), most students held absentees personally responsible for their own poor attendance. Nevertheless, their narratives also suggest several measures that could mitigate absenteeism in the study area. IDI and FGD participants described exclusionary practices carried out by schools and teachers, including sending students away for lack of uniform or for having long hair. A combination of inflexible school policies, as well social expectations surrounding neatness, continue to necessitate uniform use. As Moleni (2008, p. 41) observed elsewhere in Malawi:

> Socio-cultural norms expect children to bathe daily, put on body lotion […] and clean clothes and be neat in appearance. When a lack of basic necessities prevents this, children, particularly adolescents, are likely to feel uncomfortable going to school. Teachers reinforce these requirements and school regulations insist on the wearing of uniform – an additional cost for the household to bear.

Relaxing school uniform policies or distributing free uniforms to those who have difficulty affording them thus have the potential to enhance educational access (Evans et al. 2009; Jere 2012). Measures to reframe harsh school discipline policies and encourage greater inclusivity in the classroom (Jere 2012), as well as to address the costs of schooling and improve student health—as discussed in section 8.1—may also yield important attendance benefits.

These findings suggest that, particularly in rural contexts with limited variability in school conditions, factors including uniform and discipline policies may hold more salience for students' attendance decisions than school inputs such as classrooms or textbooks that are typically included in quantitative analyses, but for which limited evidence of impact on attendance has been observed (Burke and Beegle 2004; Dreibelbis et al. 2013). More generally, this thesis has demonstrated the value of mixed methods approaches to understanding the influences of absenteeism, in which qualitative data collected from young people both elucidate and challenge observed quantitative relationships reported by proxy respondents. Absenteeism monitoring systems, as well as strategies to address the barriers to school attendance, should therefore be informed by in-depth qualitative data in addition to quantitative trends (National Forum on Education Statistics 2009; UNICEF and UIS 2016).

8.5 Towards a holistic approach to educational access

The analyses presented here underscore the complexity of processes driving absenteeism and suggest that no single 'silver bullet' can mitigate the diversity of underlying forces. Although this thesis has identified several targeted interventions that hold promise based on the findings described, it has additionally demonstrated the ineffectiveness of a single-input intervention previously championed as a means to improve school attendance, particularly for girls—namely, cleaner burning cookstoves (Global Alliance for Clean Cookstoves n.d.). Achieving sustained access to education will ultimately require a coordinated range of reforms that address both immediate causes of absenteeism and wider

structural constraints. As Unterhalter (2015) has argued, 'the problem of children not attending school, or attending irregularly, is a social, economic and political problem, with complex, highly contextual reasons'. As such, solutions to the forms of 'silent exclusion' highlighted in the CREATE conceptual framework entail implementing processes of social change that are equally complex.

Moreover, although ensuring continuous and consistent attendance is a crucial step towards an expanded vision of educational access, meaningful learning depends on more than physical presence in the classroom. Interventions or policies that serve to increase attendance without transforming the underlying processes that give rise to imbalances in educational access threaten the sustainability of access improvements and run the risk of perpetuating exclusion (Kabeer 2000; Sayed et al. 2003). Cash transfers or bursaries to increase girls' education, for example, are 'insufficient' without addressing the 'structural constraints that make these bursaries necessary in the first place' (Kendall and Kaunda 2015, p.36). As Miles and Singal (2010, p.12) highlight:

> Inclusive education offers an opportunity for EFA [Education for All] to begin to make distinctions between 'moral' and 'mechanical' reforms. A commitment to providing education for all children is not about 'bums on seats', but about revisiting our conceptions about schooling and the purpose of education.

Indeed, enhancing inclusion in one respect—namely, by reducing student absenteeism—may lead to new forms of exclusion with regard to participation or achievement (Sayed et al. 2003). For example, without corresponding investments in teaching, infrastructure and management systems, increasing student attendance could serve only to reduce school quality for all learners by further stretching available resources (Miller and Tsoka 2012). Alternatively, students who attend school regularly may still suffer from 'unfavourable terms of inclusion' (Sen 2000, p.28), for instance if they are forced to sit at the back of the class, are taught in a language they do not understand, or experience discrimination and violence. The assumption, therefore, that 'getting children to attend school equals the realization of their right to education […] often conflicts with reality' (Tomaševski 2001).

Fulfilling children's right to *available*, *accessible*, *acceptable* and *adaptable* education, as well as well as maximising individual and social returns to schooling, thus requires looking beyond attendance to other dimensions of access—including access to the classroom and to the curriculum (Humphreys et al. 2015)—that ensure meaningful learning experiences.

It also requires a multi-sectoral outlook, not only to address the network of underlying exclusionary processes, but also to ensure that young people can reap the benefits of education through appropriate future employment opportunities (Tomaševski 2001). Indeed, as McCowan (2011, p. 289) highlights, the three defining principles of human rights—*indivisibility*, *interrelatedness*, and *interdependence*—imply that the right to education cannot exist in isolation:

> If we see educational rights as involving all three of these [principles], it will be necessary not only for people to have access to educational experiences, but also to have their full set of human rights upheld within the institution and to develop those capacities necessary for exercising and defending those rights throughout their life. In this way, rights to adequate nutrition, health, freedom of expression and so forth would need to be upheld in conjunction with the right to education, with the different rights being mutually reinforcing.

Circumstances including ill health, undernourishment, fatigue and anxiety have been shown in sub-Saharan Africa to affect students' ability to concentrate and learn effectively (Bundy et al. 2009; Cluver et al. 2012; Jewitt and Ryley 2014; Levison et al. 2017; Orkin 2011), thus reinforcing the need for a comprehensive approach to the delivery of inclusive education.

8.6 Limitations

Limitations associated with each analysis are discussed in their respective chapters, but I reflect here on some broader limitations to the scope of the thesis. Firstly, while I have explored a wide range of barriers to school attendance, and engaged in an 'international interdisciplinary research conversation' (Slee 1997, p. i) advocated by scholars of inclusive education, I did not explicitly target some of the 'hard to reach' groups identified in Chapter 3 as requiring particular attention. I did not, for instance, explore forms of marginalisation associated with disability, concern for which formed the central basis of inclusive education movements (Balescut and Eklindh 2006). The 2008 Malawi Population and Housing Census indicates that 2.8% of 5-14 year-olds report having difficulty seeing, speaking, hearing, walking/climbing or another form of disability (National Statistical Office 2010), a figure which likely underestimates true prevalence given the challenges associated with collecting data on child disability (Cappa et al. 2015). A situation analysis in Malawi entitled *From exclusion to inclusion: Promoting the rights of children with disabilities* revealed that disabled children were less likely than non-disabled peers to attend school,

and that those who did attend experienced a range of exclusionary pressures including bullying, lack of specialised teaching, poorly adapted school facilities and limited household support that severely hampered their educational trajectories (Munthali et al. 2013). Although a series of disability questions were added to the HDSS annual survey in 2014, they were only asked to participants aged 18 and older, thus precluding an estimation in this thesis of either the prevalence of disability among the primary school-aged cohort or its relationship with school absenteeism. Urgent research is therefore required to inform efforts address to the access needs of disabled children in this context.

The present study also did not examine the impact of HIV/AIDS on educational access. The prevalence of HIV in the Northern region is lower than elsewhere in Malawi (see Table 3.1), but it nevertheless affects a substantial proportion of households in the study area (Chihana et al. 2012), and as such represents a potentially important dimension of educational exclusion not captured here. Earlier research examining the impacts of parental HIV on children in Karonga district showed that parental HIV was associated with increased orphanhood, non-residence with parents, and child migration (Floyd et al. 2007; Hosegood et al. 2007), but no differences in grade attainment between students with HIV-positive and HIV-negative parents was observed (Floyd et al. 2007). The analysis in Chapter 4 found that neither a student's orphanhood status nor relationship to household head were significantly associated with absenteeism in the past four weeks, but previous studies suggest that school attendance patterns are sensitive to the timing of parental death, which was not accounted for here (Ainsworth et al. 2005; Evans and Miguel 2007).

On the other hand, the SOFIE intervention in Malawi found that children identified as vulnerable by their communities on the basis of such characteristics as orphanhood status actually experienced better educational outcomes than their peers who were not classified as at-risk (Jukes et al. 2014). One possible explanation, as suggested by the authors, was that 'children who were perceived as being at-risk by their communities were not, in fact, those most at risk' (Jukes et al. 2014, p. 197). As the sampling design and topic guides for my qualitative study were informed primarily by the cookstove intervention, IDIs and FGDs did not focus on HIV/AIDS as distinct from more general forms of illness and household caregiving, so I was unable to further examine the particular impact of HIV/AIDS on students' school attendance and experience.

In setting absenteeism as the primary outcome, this thesis additionally did not highlight the range of supportive factors that enabled students' consistent school attendance. These factors may also help to explain the cookstoves' observed lack of impact on absenteeism. Kendall and Kaunda (2015, pp. 26-27) have noted profound 'cultural shifts' following the transition to FPE and multi-party democracy in Malawi which have led to an embrace of education, particularly for girls, and more gender-equitable notions among teachers and caregivers of boys' and girls' ability—although girls' onset of puberty moderates these views (see also Grant 2012). Previous qualitative research among both parents and youth in Malawi has confirmed the high value that households place on education and the measures that some caregivers undertake to sustain children's schooling, including taking on additional paid labour to finance school costs, reducing children's household work responsibilities, migrating or harnessing extended family networks to arrange access to (better) schools, and providing emotional support or encouragement (Grant 2008; Kendall and Kaunda 2015; Moleni 2008; van Blerk and Ansell 2006). The qualitative data presented in Chapter 7 suggest an important role for household support in facilitating sustained access, not least by buying school uniforms and supplies, but also by emphasising the importance of education for future life outcomes. We additionally saw in Chapter 2 that students in Swaziland whose parents always helped with homework, engaged with problems and provided supervision, were less likely to report truancy than those whose parents rarely did each of these things (Siziya et al. 2007). Research among orphaned students in Uganda has shown that perceived support from an important adult was positively associated with future educational aspirations (Ssewamala et al. 2010).

Students' wider peer interactions or social networks may also represent important supportive factors. Recent qualitative research among adolescents in rural Malawi revealed that in-school youth engaged in activities with their student peers that facilitated their continued school participation, including helping each other with homework, sharing school supplies, and advising against romantic relationships that would derail their academic progress (Rock et al. 2016). Students also benefitted from opportunities to socialise and discuss their problems with friends. Importantly, however, participants in the study by Rock and colleagues (2016), as well as in the present one, additionally described fighting, bullying, teasing and stigmatisation among classmates such that peer influence can by no means be considered universally positive. Nevertheless, in shifting focus away

from barriers to educational access, there is much to learn about the social interactions that support students' sustained attendance.

In light of the data and resource limitations described in Chapter 3, school- and community-level practices that may similarly support students' attendance are also under-explored. As documented in my field notes from two school visits, a number of initiatives that deliberately targeted students' attendance were already undertaken by schools and communities in the study area. These efforts included parent-initiated school feeding programmes, distribution of notebooks and pens, community mothers' groups, and mobilisation of religious and traditional leaders, although they were at times implemented inconsistently. The impact of such initiatives on educational access merit further in-depth study.

In response to apparent discrepancies in the reporting of absenteeism in the HDSS survey, as well as enduring questions about the impact of proxy- vs. self-reported measures of school attendance, this study would have additionally benefitted from a methodological component to more robustly validate the household survey data. For instance, conducting attendance spot checks at schools in the study area to coincide with the timing of HDSS survey administration would have provided an objective measure of school attendance against which survey reports could be compared. Although evaluative judgements about missing school described in Chapter 7 suggest that absenteeism would, if anything, be under-reported in the HDSS, I am ultimately unable to determine either the extent or direction of reporting bias.

Finally, by focusing on trends and influences of school absenteeism, this thesis has, by definition, targeted students who are already enrolled in school. I therefore did not investigate the constraints that prevent children from attending school at all, nor those that keep students who have left school from returning. Although very few children in Malawi have never enrolled in school (National Statistical Office and ICF 2017), these children represent the most marginalised and hence merit specific attention in future research (Streuli and Moleni 2008). Similarly, as one-quarter of students who enter primary school drop out before reaching standard 8 (National Statistical Office 2015), and many more do not successfully complete the PSLCE exam (de Hoop 2011), there can be no doubt that addressing the needs of out-of-school children and adolescents is of critical importance.

My focus on currently enrolled students may additionally have introduced 'survivor bias', stemming from systematic differences between young people who persist in school and those who never enrol or drop out early.[49] For instance, we saw in Chapter 4 that girls were less likely than boys to repeat their school grades and were on average younger than their male counterparts attending primary school, suggesting that poorly performing girls may be withdrawn from school while boys are permitted to repeat. Alternatively, as suggested by evidence from the Malawi Longitudinal Study of Families and Health, differences in educational trajectories observed after age 14 may result from girls' more rapid and successful progression through primary school rather than by increased dropout rates (Grant 2008). In either case, an analytic sample comprised only of currently-enrolled students will over-represent boys with low attainment but who remain in school.

The analysis in Chapter 6 attempted to mitigate survivor bias by assembling an open cohort of students as they entered standard 1. In this way, results were not influenced by unobserved educational trajectories preceding the HDSS surveys, and by focusing on (at most) the first eight years of schooling, when rates of dropout were negligible (see Figure 6.3),[50] school dropout would not be expected to influence the observed relationship between absenteeism and grade repetition. It is possible, however, that differential sample attrition from loss to follow-up introduced an alternative source of bias.

The cross-sectional analysis presented in Chapter 4 may have been more susceptible to survivor bias by not accounting for students who had already completed or dropped out of primary school, especially among those in late adolescence when sex-specific enrolment rates sharply diverge (Sabates et al. 2010). By instead including only the students aged 5-20 years currently attending primary school in the 2010-11 school year, the analytic sample over-represents poorly performing students (primarily boys) at advanced ages who have prolonged their primary education without dropping out. Accordingly, this analysis may

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[49] This scenario is analogous to the 'healthy worker bias' observed in epidemiological research assessing associations between occupational exposures and health outcomes. This type of analysis is susceptible to two forms of bias: firstly, where healthy individuals are more likely to be hired for formal employment, and secondly, where healthy workers persist longer in the workforce (Buckley et al. 2015).

[50] An early version of the analysis presented in Chapter 6 defined school dropout as one of the educational outcomes of interest, but two few school leavers were identified during the eight-year period of observation to conduct a meaningful analysis.

not generate findings applicable to all primary students, but it nevertheless reflects the experience of those currently enrolled.

8.7 Conclusion

Through a mixed methods analysis of household survey data and IDIs and FGDs with primary school students, this thesis has highlighted the complex range of processes that underpin school absenteeism in Karonga district, northern Malawi. The analyses presented here suggest that no single 'silver bullet' can mitigate the diversity of underlying exclusionary processes. Improving school attendance thus requires a holistic approach that attends both to the social, economic and institutional context as well as to the multi-sectoral drivers of absenteeism.

Efforts to address 'silent exclusion' from education will also benefit from robust and timely data to increase the visibility of absent students. This thesis has highlighted the dearth of data available from both administrative and survey-based sources, as well as the diversity in absenteeism measures that limits comparability of patterns across studies. At the same time, it has demonstrated the utility of school attendance data—even crudely measured— in establishing a link between current absenteeism and future adverse educational trajectories, and has advocated for the development of early warning systems to identify students at risk of future repetition and dropout. Bolstering data collection systems at local level, raising the profile of irregular attendance in national and international monitoring frameworks, and complementing these with insights from in-depth qualitative studies can help to mobilise attention and resources to the issue of silent exclusion and inform efforts to effect educational social change (Sachs 2012).

Finally, although ensuring continuous and consistent attendance is a crucial step towards an expanded vision of educational access, meaningful learning depends on more than physical presence in the classroom. Beyond achieving sustained attendance, then, continued efforts must be made to ensure that students receive an education that is high-quality, inclusive and equitable, and in which they can participate fully.

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Appendices

Appendix to Chapter 2

Table A.1 Summary of studies from sub-Saharan Africa that link ill health with school absenteeism

Study authors	Year	Country	Risk factor(s)	Study population	Sample size	Study design	Measurement of absenteeism	Key findings	Notes
Chippaux & Larsson	1991	Benin	Guinea worm disease (GWD)	School-age children (6-15 years)	Community surveillance 377; national survey: 193,295 (neither separated by sex)	Longitudinal (community surveillance) + cross-sectional national survey	1) From community surveillance: Number of days of incapacity due to GWD 2) Absence on day of national survey	From community surveillance: strong association between incidence of GWD and absence in communities with a school; no significant association in communities with no school. From national survey: 14% of registered students absent on day of survey; absenteeism common among students with GWD, but small proportion of absenteeism overall	Analysis purely bivariate; Measure of absenteeism attributable to GWD relies on teacher report.
Chippaux, Banzou and Agbede	1992	Benin	Guinea worm disease (GWD)	Two villages in Zou Province	250 inhabitants (25 enrolled in school)	Longitudinal	From community surveillance: Number of days of incapacity due to GWD	Absenteeism due to physical incapacity = 365 student-days per year for 25 enrolled students; 20% of students missed >30 days during school year	Small sample size; cannot disaggregate by/control for background factors
de Clercq et al.	1998	Mali	Schisto-somiasis	Primary school students aged 6-16 years	294 boys, 286 girls	Cross-sectional	From teacher rating: 1 (rarely absent), 2 (absent from time to time), 3 (often absent)	Significant increase in absenteeism with age and intensity of Schistosomiases infection	Limited control of sociodemographic factors; Possible bias if students absent on day of stool sample collection were not followed up for testing
De Smedt et al.	2012	Rwanda	Vernal kerato-conjunctivitis (VKC)	Children aged 8-14 years	3,041 (not separated by sex)	Cross-sectional	From self reports: Number of school days missed for ocular reason in past 3 months	36% of children with VKC missed school for ≥ 1 day for an ocular reason in past 3 months; Children with severe VKC more likely to miss > 1 week of school than less affected children	Study took place at end of long dry season when VKC at its peak, so possible that VKC does not result in loss of as much schooling at other times of the year

Study authors	Year	Country	Risk factor(s)	Study population	Sample size	Study design	Measurement of absenteeism	Key findings	Notes
Ezenwosu et al.	2013	Nigeria	Sickle cell anaemia (SCA)	Primary school students aged 5-11 years	90 SCA patients, 90 matched students (55 boys, 35 girls each)	Matched cohort	From school registers: Number of days of absence in past year	Mean number of days of absence significantly higher among children with SCA than among non-SCA counterparts (15.9 days vs. 7.7 days, p<0.001)	No control of background factors; relatively small sample size
Ibekwe et al.	2007	Nigeria	Epilepsy	Primary school students aged 5-14 years	50 epileptic children, 50 matched counterparts (36 boys, 14 girls each)	Matched cohort	Number of days of absence in past year (data source unclear)	Mean number of days of absence significantly higher among children with epilepsy than among counterparts (15.3 days vs. 9.4 days, p<0.001)	Methods suggest that selection of cases not exhaustive; small sample size
Ilegbodu et al.	1986	Nigeria	Guinea worm disease (GWD)	6-14 year-old students	1,495 (768 boys, 727 girls)	Cross-sectional	From school registers: 1) Proportion of class absent during school year 2) Average duration of absence	GWD was primary cause of absenteeism; peak absenteeism associated with guinea worm season. Average duration of absence for GWD=9 weeks vs. 1 week for non-GWD absence.	Absenteeism measures and causes rely on teacher reports (with some follow-up to relatives in doubtful cases); analysis purely descriptive
Mushi et al.	2012	Tanzania	Epilepsy	6-14 year-old children with epilepsy & their carers	38 carers (35 female, 3 males) reporting for/ with 18 boys & 20 girls with epilepsy	Qualitative	From carer interviews: Episodes of missing school or classes	Half of carers' children did not attend school regularly; Factors impairing school attendance included ongoing seizures, learning difficulties, behavioural problems & distance to school.	Findings context-specific; Possible that information withheld due to stigma associated with epilepsy; Study does not target absenteeism specifically
Mustapha, Briggs and Hansell	2013	Nigeria	Respiratory illness	State school students aged 7-14 years	675 boys, 722 girls	Cross-sectional	From self-reports: Any absence from school in past 12 months due to respiratory illness	2.5% of children reported school absenteeism due to respiratory illness; more likely among rural children and (marginally) females	Possibility of residual confounding by social class; potential for selection bias as rural schools generally smaller with younger students
Ofovwe & Ofili	2010	Nigeria	Headache	Secondary school students aged 11-18 years	1675 (809 girls, 870 boys)	Cross-sectional	From self-reports: Absences attributable to headache	19.5% of students reported headache, 13.5% diagnosed with migraine (9.2% among boys, 18.2% among girls, p<0.001). 76.8% of migraineurs reported negative	Limited control of sociodemographic factors; measure or duration/frequency of absenteeism not specified

impact on quality of life, of whom 14.3% reported absenteeism.

Study authors	Year	Country	Risk factor(s)	Study population	Sample size	Study design	Measurement of absenteeism	Key findings	Notes
Ogunfowora, Olanrewaju and Akenzua	2005	Nigeria	Sickle cell anaemia (SCA)	School-age children aged 6-17 years	52 SCA patients (29 boys, 23 girls), 42 siblings (26 boys, 16 girls)	Matched cohort	From school registers: Number of days of school absence in past school year	Mean number of days of absence significantly higher among SCA children than siblings (9.3 days vs. 4.1 days, p<0.05)	No control of background factors; small sample size
Pufall et al.	2014	Zimbabwe	Childhood vulnerability	Young people aged 6-24	>5000 (sample derived from survey of 5520 2-17 year-olds); not separated by sex	Longitudinal	From self-reports: <80% attendance in previous 20 school days	Being HIV+ not associated with any education measures; Young carers significantly less likely to attend secondary school, but no difference at primary level; All types of orphan significantly less likely to be in correct grade for age, but no difference in attendance	Attendance measure conflates enrolment and absenteeism (those not enrolled coded as attending <80%); Small number of HIV+ children (n=94)
Thuilliez et al.	2010	Mali	Malaria	Primary school children	227 children (81 girls, 146 boys)	Longitudinal	From teacher records: Number of school days missed in past school year	Malaria was most common reason for absence, accounting for 14.5 of 45.5 school days lost	Early treatment of malaria cases reduced duration of absence; study does not link absenteeism with background characteristics
Trape et al.	1993	Senegal	Malaria	School children aged 7-11 years	419 children (not separated by sex)	Longitudinal	From active surveillance: Proportion of total student-days missed during observation period	Low levels of absenteeism observed: 6.7% of 2817 school days (Jun 1987), 3.0% of 3970 school days (Nov 1987), and 2.3% of 4411 school days (Feb 1988); Proportion of medical-related absenteeism due to malaria varied considerably by season: 36% in Nov, 6% in Feb, 3% in June	Study does not link malaria-related absenteeism to background characteristics; Unit of analysis is student-days, not students
Wolka et al.	2013	Ethiopia	Iodine-deficiency disorders	Primary school children aged 6-12 years	270 children with goitre (122 boys, 148 girls), 264 without (123 boys, 141 girls)	Comparative cross-sectional	From school records: Non-attendance at school during school hours for ≥5 days in last academic year	Significantly higher absenteeism among students with goitre than without (34.1% vs. 27.3%, p<0.05)	Study does not link goitre to absenteeism in multivariable context

Appendix to Chapter 3

A3.1 Confirmation of ethics approval for Karonga Health and Demographic Surveillance System

LONDON SCHOOL OF HYGIENE
& TROPICAL MEDICINE

ETHICS COMMITTEE

APPROVAL FORM
Application number: 5081

Name of Principal Investigator   Dr Neil French & Dr Judith Glynn

Department   Epidemiology and Population Health

Head of Department   Pat Doyle

Title: The Impact of HIV in Northern Malawi in the era of antiretroviral therapy

Approval of this study is granted by the Committee.

Chair   ......████████..
Professor Tom Meade

Date ....*20 February 2007*...............................

Approval is dependent on local ethical approval having been received.

Any subsequent changes to the consent form must be re-submitted to the Committee.

A3.2 Confirmation of ethics approval for nested qualitative study – LSHTM

London School of Hygiene & Tropical Medicine
Keppel Street, London WC1E 7HT
United Kingdom
Switchboard: +44 (0)20 7636 8636

www.lshtm.ac.uk

LONDON
SCHOOL of
HYGIENE
&TROPICAL
MEDICINE

Observational / Interventions Research Ethics Committee

Ms Christine Kelly
LSHTM

31 March 2016

Dear Christine

Study Title: School absenteeism in northern Malawi: Trends, influences and the impact of highly efficient cooking stoves

LSHTM Ethics Ref: 10401

Thank you for responding to the Observational Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Conditions of the favourable opinion

Approval is dependent on local ethical approval having been received, where relevant.

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document Type	File Name	Date	Version
Investigator CV	CV_ChristineKelly	28/01/2016	1
Investigator CV	CV_MiaCrampin	29/01/2016	1
Investigator CV	CV_JudithGlynn	29/01/2016	1
Information Sheet	InformedConsent_English	29/01/2016	1
Protocol / Proposal	LEO_FullProposal	29/01/2016	1
Covering Letter	LEOresponse_9Mar2016	09/03/2016	2
Investigator CV	CV_AlbertDube	11/03/2016	2
Protocol / Proposal	LEO_FullProposal_Revised	11/03/2016	2

After ethical review

The Chief Investigator (CI) or delegate is responsible for informing the ethics committee of any subsequent changes to the application. These must be submitted to the Committee for review using an Amendment form. Amendments must not be initiated before receipt of written favourable opinion from the committee.

The CI or delegate is also required to notify the ethics committee of any protocol violations and/or Suspected Unexpected Serious Adverse Reactions (SUSARs) which occur during the project by submitting a Serious Adverse Event form.

At the end of the study, the CI or delegate must notify the committee using an End of Study form.

All aforementioned forms are available on the ethics online applications website and can only be submitted to the committee via the website at: http://leo.lshtm.ac.uk

Additional information is available at: www.lshtm.ac.uk/ethics

Yours sincerely,

Page 1 of 2

A3.3 Confirmation of ethics approval for nested qualitative study – Malawi NHSRC

Christine Kelly
Karonga Prevention Study

Dear Sir/Madam,

Re: Protocol # 15/11/1509: School absenteeism in northern Malawi: Trends, influences and the impact of highly efficient cooking stoves

Thank you for the above titled proposal that you submitted to the National Health Sciences Research Committee (NHSRC) for review. Please be advised that the NHSRC has reviewed and **approved** your application to conduct the above titled study.

- **APPROVAL NUMBER**   : NHSRC # 15/1/1509
  The above details should be used on all correspondence, consent forms and documents as appropriate.
- **APPROVAL DATE**   : 03/5/2016
- **EXPIRATION DATE**   :This approval expires on 03/05/2017
  After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the NHSRC secretariat should be submitted one month before the expiration date for continuing review.
- **SERIOUS ADVERSE EVENT REPORTING** :All serious problems having to do with subject safety must be reported to the National Health Sciences Research Committee within 10 working days using standard forms obtainable from the NHSRC Secretariat.
- **MODIFICATIONS**: Prior NHSRC approval using standard forms obtainable from the NHSRC Secretariat is required before implementing any changes in the Protocol (including changes in the consent documents). You may not use any other consent documents besides those approved by the NHSRC.
- **TERMINATION OF STUDY**: On termination of a study, a report has to be submitted to the NHSRC using standard forms obtainable from the NHSRC Secretariat.
- **QUESTIONS**: Please contact the NHSRC on Telephone No. (01) 724418, 0888344443 or by e-mail on mohdoccentre@gmail.com
- **Other**:
  Please be reminded to send in copies of your final research results for our records as well as for the Health Research Database.

Kind regards from the NHSRC Secretariat.

Dr D. Kathyola
FOR: CHAIRMAN, NATIONAL HEALTH SCIENCES RESEARCH COMMITTEE

A3.4 Sample HDSS individual socioeconomic survey

SEI – INDIVIDUAL SOCIO-ECONOMIC SURVEY – KPS

16/12/2010 Version 6

| 1. | **Round** | 4 | | **Interview Date** (DD/MM/YYYY) | | | rd intdate |
| 2. | | | | | RG | Sess: | repgp sess |

Identity

3.	GHHID			ghhid
4.	CRS number			csnum
5.	Name:			name ident
6.	Sex	M F	Birth date		sex birthdat birthyr
7.	Informant type	Self Parent 1 spouse, sibling, child 2 grandparent, grandchild, other relative Non-relative S P 1 2 N		infmtype
8.	Name of informant (If Self, write Self)			informtid

Current household

9.	Relationship to household head	1 self 2 spouse 3 child 4 grand-child 5 niece/nephew 6 sibling 7 cousin 8 parent 9 aunt/uncle 13 step-child 14 step grand-child 15 parent-in-law 16 grandparent 10 family friend 11 other relative 12 other non-relative		relhh
10.	Was subject seen?		Y N	seen
11.	When was (s)he last here?	0 today 1 yesterday 2 in last 7 days 3 in last 4 wks 4 more than 4 wks ago		when

Parents survival status and education (ask only of individuals aged ≤30 years old)

12.	Is your father alive?	Y N DK	Is your mother alive?	Y N DK	fathvita mothvita
13.	If no, when did he die?	Year died	If no, when did she die?	Year died	fathdyr mothdyr
14.	Did your father go to school? If yes, highest level attended by father	None Prim Sec Tert Unknown	Did your mother go to school? If yes, highest level attended by mother	None Prim Sec Tert Unknown	fschltype mschltype

IF SUBJECT IS AGED UNDER 5 YEARS THEN SKIP → Q39,   IF SUBJECT IS AGED 5-11 THEN SKIP → Q22

Marital Status (ask only if aged 12+ years old)

| 15. | N never married M married D divorced/septd W widowed | | If never married skip→ Q22 | marital |
| 16. | How many spouses do you have now? | | | spousenum |

Spouses

For individuals who are currently married, use Columns 1-4 to contain information on *current* spouses.

For individuals who are divorced/separated, use Column 1 for the most recently divorced/separated spouse.

For individuals who are widow(er)s, use Column 1 for the spouse who died most recently.

For individuals who are divorced/separated, or widowed, fill Q17 (name), Q18 (NA if widowed), and Q20. Fill Q19 (the spouse CRS number) only if the spouse was previously seen in the CRS in *this* household.

		Column 1		Column 2	Column 3	Column 4	
17.	Name						spname1-4
18.	Residency in CRS area	Y N DK NA		Y N DK	Y N DK	Y N DK	sparea1-4
19.	crsno						spcrsno1-4
20.	Year marriage start and end	Start	End	Start	Start	Start	spmrstrt1-4 spmrend1-4
21.	ident						spident1-4

Fill spouse ident in office - use GP form for current spouse if not co-resident and not in CRS area, and attach (tick)

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(blue)

Education and Occupation and Economic activities

#	Question								
22.	Have you ever been to school?	Never	Ever	Current					schlever
23.	What is the highest level of education attended?	Prim	Sec	Tertiary	form/standard				schltype schlstd
24.	What is your main occupation? (Specify occupation with a salary or if unsalaried the occupation with most income)						Emp	Occ	emp occ
	Ask Q25-26 only of individuals aged 5-20 years old								
25.	During the last 4 weeks, did you participate in any economic activities? For example farming, fishing, gathering natural products, piece work, preparing and selling food or beverages, selling goods manufactured by this household, providing a service?						Y	N	hhecyn
26.	If yes, which ones? (record the two most important activities, in order of importance)						ec1	ec2	ecactivity1 ecactivity2

For individuals >30 years old, skip → Q46.   For individuals who have never been to school (Never), skip →Q46
For individuals who have been to school, but are not currently enrolled in school (Ever) , skip →Q27
For individuals who are currently enrolled in school, skip → Q28 and then continue with Q29-38

#	Question								
27.	What is the reason that you left school? (record the two most important reasons, in order of importance) *Do not read out possible answers. Record the reasons given, without "prompting".* **Now continue with Q28-Q30**						rsn1	rsn2	rsnleft1 rsnleft2
28.	What is the highest educational qualification you have acquired?								edqual
29.	Age, or year, first started primary school	(age)		(year)		don't know			aschstart yrschstart
30.	Age, or year, left school (Z if still in school)	(age)		(year)		don't know		Z	aschleft yrschleft

Now ask Q31-38 if individual is currently enrolled in school. If not currently enrolled in school, skip → Q37

#	Question								
31.	Name of school								schlname
32.	Who are the fees primarily paid by?	1 parent/step-parent 2 aunt/uncle 3 Sibling 4 Grandparent 5 Other relative 6 Non-relative 7 Organisation 8 Not applic 9 DK 10 Self 11 Government							feespaid
33.	Have you attended school during the last 4 weeks that your school was in session?						Y	N	schlattd
	If yes: During the last 4 weeks that your school was in session, how many school days / weeks did you miss? *(now skip → Q35 if 0 days missed. If has not attended school in last 4 weeks must still ask Q34)*						days	wks	schlday schlwk
34.	What were the 2 most important reasons that you missed school, during the last 4 weeks that your school was in session?						rsn1	rsn2	rsnattd1 rsnatd2
35.	At any time in the last 12 months, did you ever miss >2 weeks of school at one time (consecutive)?						Y	N	schlbrk
36.	Have you attended your current standard/form before? If yes, how many times (including this year)?			Y	N				cstdrep cstdnum
37.	Did you ever leave school for at least 12 months, and later return?						Y	N	schlleave
38.	**If yes** **(to Q37):**	Age first left		Form / Standard when first left: Number of years absent:	P S T _____ (years)		Reason first left		eflage efltype efbstd lfyrs eflrsn

Vaccine history

#									
39.	Vaccine history for children <5 years old. If 5+ years old, skip →Q46				Health passport		Y	N	cardseen
		Vaccines recvd.	Vacc. date	Vacc. HC		Vacc. date	Vacc. HC		
40.	BCG	Y N			Polio0	Y N			bcgdate p0date
41.	Penta1	Y N			Polio1	Y N			dpthh1date p1date
42.	Penta2	Y N			Polio2	Y N			dpthh2date p2date
43.	Penta3	Y N			Polio3	Y N			dpthh3date p3date
44.	Measles	Y N				No of doses Vit A			Measdate vitados
45.			Record dates of the first two doses vit A	1st		2nd			vitadst1 vitadst2

Health and Caring (ask of individuals aged > = 10 years old)

#	Question					
46.	During the last 3 months, for how many days/weeks have you cared for a sick adult (aged 15 or above) at home or at a health facility? (record in EITHER days or weeks, but not both)		(days)	(weeks)	daycare3 weekcare3
47.	During the last 3 months, for how many days/weeks have you been unable to work and/or attend school due to your own illness? (record in EITHER days or weeks, but not both)		(days)	(weeks)	illdays illweeks

Clothing expenditure (money spent by this household on clothes and shoes, including school uniform. Gifts not included)

#	Question	Options		
48.	Over the last 12 months, how much money has been spent on clothing for you?	0 K0 1 K1-500 2 K501-1000 3 K1001-2000 4 K2001-5000 5 K5001-10000 6 K>10000 7 DK		clothexp
49.	Over the last 12 months, how much money has been spent on footwear for you? (incl. slippers)	0 K0 1 K1-250 2 K251-500 3 K501-1000 4 K1001-2000 5 K2001-5000 6 K >5000 7 DK		shoesexp
50.	Did you receive mass drug treatment for filariasis?	Round 1 Oct/Nov2009?	Y N U	Round 2 Oct/Nov2010?	Y N U	massfila
51.	Measles – ask if >8months &<15 years old: Did you receive measles vaccine during the mass vaccine campaign in 2010?				Y N U	massmeas
52.	TB case finding, if individual is seen: do you have a cough?	Y	N	Duration of cough (weeks)		cough coughweeks
53.	Haemoptysis? Y N	*If cough >3 weeks / haemoptysis / TB suspect on other grounds fill GP form and collect sputum*			tbsuspect Y N	haemopt tbsuspect

END   Field-Staffcode [____]   Coder /L1 Checker [__|__]   codr codr_chkr

A3.5 Sample HDSS household socioeconomic survey

SEH – HOUSEHOLD SOCIO-ECONOMIC SURVEY – KPS   10/03/2010   Version 04a

1.	Round		Interview Date (DD/MM/YYYY)			rd intdate
2.	Reporting group and session			RG	Session:	repgp sess
3.	GHHID		Household number			GHHID house
4.	CRS house number					repgp cluster hhlistno
5.	Name of head of house:			(ident)		idhdhse
6.	Is a GHH form filled for this household, at this household visit?			Y	N	ghhyn

If a GHH form is filled for this household, proceed to ask all questions
If no GHH form is filled for this household, *skip → Q39*

Household land and agriculture

7.	If farming, main crops (rank by importance)	A banana G groundnuts P potatoes E tomatoes (1) (2) crop1 crop2

7.	If farming, main crops (rank by importance)	A banana	G groundnuts	P potatoes	E tomatoes	(1)	(2)	crop1 crop2
		B beans	M maize	R rice	V vegetables			crop3 crop4
		C cassava	N cotton	T tobacco	S Sugar cane	(3)	(4)	
					O other (specify)			
8.	Number of plots:	owned and cultivated by this HH		not owned but cultivated by this HH		OC	NOC	plotsow plotrentd
	(1 acre = 4 plots)	owned by this HH but cultivated by other people		owned by this HH but currently not cultivated		OOO	ONC	plotlet plotsfal
	From the last completed cropping season:							
9.	How much maize did you:	Harvest		tins	Sell		tins	maizharv maizsell
10.	How much rice did you:	Harvest		tins	Sell		tins	riceharv ricesell
11.	How many groundnuts did you:	Harvest		tins	Sell		tins	gnutharv gnutsell

1) Record all amounts in tins   *2) For rice, ask about total of last wet season crop, and last dry season crop*

Type of construction of best dwelling in household

12.	Ownership of dwelling	**O** Owned **R** Rented **T** Other:			rent
13.	Total number of sleeping dwellings and sleeping rooms (dwellings / rooms)	dwellings	rooms		dwelltot roomtot
14.	Walls	1 burnt brick 4 plastered thin mud 7 iron sheets			walls
		2 unburnt brick 5 bamboo 8 concrete blocks			
		3 pounded thick mud 6 grass or no walls 0 other:			
15.	Roof	1 grass or leaves 3 grass+iron sheets 6 grass+plastic sheet 7 iron sheets or tiles			roof
16.	Floor	1 mud 2 concrete 3 other 4 tiles			floor
17.	Water used for drinking	Tap to hse Shared comm. tap Bore hole Covered well Open well Lake/river			water

Sources of income

18.	How does this household bring in income? (over the last 12 months)? List activities of all members: 1) tick boxes 2) specify the activity 3) rank by importance			rank order	
19.	through regular employment (salary/wage)	Y	N		emplov
20.	through casual employment / piecework	Y	N		piecew
21.	selling own agricultural produce (crops and livestock)	Y	N		Farm
22.	selling own fish (locally or with transport?)	Y	N		Fish
23.	Preparing & selling food or beverages	Y	N		snacks
24.	selling own manufactured goods	Y	N		manuf
25.	buying & selling other peoples product	Y	N		trade
26.	Gathering natural products (grass, wood,...)	Y	N		gather
27.	letting of property/ land/ houses/ oxcarts	Y	N		letting
28.	providing a service	Y	N		service
29.	from outside relatives	Y	N		supportf
30.	from outside organisation or non-relative	Y	N		support
31.	Unclassifiable	Y	N		othinc

Food and nutrition security, and availability of soap for bathing

32.	How many meals were served to household members during the previous 2 days?			meal2days
33.	Normally, how many meals do members of your household eat in a day?			mealnom

During the last 7 days, were the following foods served in a main meal eaten by the household:

34.	Nsima (maize)	Y N		Nsima (cassava)		Y N			Rice		Y N	maize cassava rice
35.	Tomatoes	Y N	Number of days	Vegetables (incl.cassava and potato leaves)	Y N	Number of days		Fish (incl. usipa)	Y N	Number of days		tomyn tomnum vegyn vegnum fshyn fshnum

During the last 2 weeks, were the following foods served in a main meal eaten by the household?

36.	Chicken	Beef/goat/pig	Beans/ Pigeon pea/ Cowpea	Eggs	Milk (Fresh and sour)	chicken meat
	Y N	Y N	Y N	Y N	Y N	beans eggs milk

37.	Since this time last year, has there been a time when there was not enough food for the household to have its normal meals? (fewer meals per day, and/or smaller meals, and/or less variety of foods)	Y N		foodenough

38.	Have there been times when the household did not have money to buy bathing soap?	Last 4 wks Y N	Last 12 mths Y N	soap4wk soap12mon

Possessions. Does anyone in the household possess the following?

39.	mosquito net (number)	Y N	Number		Mobile phone	Y N	mosnetyn mosnetnum phone

40.	Field staff code			Coder / L1 checker			rcdr codr, chkr

A3.6 Extract from CAPS baseline household survey

| LSTM **Cooking and Pneumonia Study** | Household ID # | |_|_|_| |_|_|_|_|_| |
| | Cluster ID # | |_|_|_| |_|_|_| |

| **Form 01 - CAPS Baseline** |

A. Consent section		
1.	Date of interview	dd/mmm/yy |_|_| ||| |_|_| ||| |_|_|
2.	Collect household GPS co-ordinates.		|_|_|_|_|_|_|_|_|
3.	Has consent been obtained for the household to participate in the study? *(if N go to Q5)*	Y/N |_|
4.	Scan the completed consent form. *(Go to section B)*	
5.	Why couldn't you obtain consent?	1=No one/under 4.5 years home; 2=No respondent available; 3=Postponed; 4=Refused; 10=Other |_|
6.	Specify Other reasons	
If Q3=N and Q4=4 then household not eligible, otherwise revisit the household later – Go to section F

B. Household Exclusion Criteria		
1.	Is electricity or gas the only cooking source for this household?* *(if Y go to Q7)*	Y/N |_|
2.	Are there any children under the age of 4.5 years living in this household?* *(if N go to Q7)*	Y/N |_|
3.	How many children under the age of 4.5 years live in this household?	|_|_|
4.	Will all the children under the age of 4.5 living in this household participate in CAPS? *(if Y go to Section C)*	Y/N |_|
5.	How many children under the age of 4.5 living in this household will NOT participate in CAPS?	|_|_|
6.	Give the reasons for why each child under the age of 4.5 living in this household will not participate CAPS *(if Q3 minus Q5=0 go to Q7)*	
7.	*Exclude the household and go to section F.	

C. Household Information			
1.	Enter or scan the cluster ID		|_|_|_| |_|_|_|
2.	Is this household in the intervention (Philips cookstove) or the control (open fire) group?		1=Intervention; 2=Control |_|
3.	What fuel is regularly used to cook food at your home? *(Y=Yes; N=No)*			
	a. Electricity	|_|	b. Kerosene|paraffin	|_|
	c. Liquid Petroleum Gas (LPG)|gas	|_|	d. Wood	|_|
	e. Charcoal	|_|	f. Dung	|_|
	g. Crop residues	|_|	h. Others	|_|
3.1.	Specify Other			
4.	During the dry season is most of the cooking at	1=Outside in a separate structure with a roof only; 2=Outside in a separate structure with walls and a	|_|

			Household ID #	|___|__|___|___|___|
LSTM	**Cooking and Pneumonia Study**		Cluster ID #	|___|__|___|___|

your home done	roof; 3=Outside in the open air; 4=Outside on the veranda (khonde); 5=Inside in a separate room (kitchen); 6=Inside in a living room	
b. During the rainy season is most of the cooking at your home done	1=Outside in a separate structure with a roof only; 2=Outside in a separate structure with walls and a roof; 3=Outside in the open air; 4=Outside on the veranda (khonde); 5=Inside in a separate room (kitchen); 6=Inside in a living room	|__|
6. How many people in your household if any smoke regularly?		|__|

7. Apart from cooking, are you exposed to any other sources of fire or smoke on a daily or almost every day basis? (Y=Yes; N=No)

a.	Burning rubbish	|__|	b.	Making beer	|__|
c.	Cooking for others/as a business	|__|	d.	Making bricks	|__|
e.	Kerosene lamps	|__|	f.	None	|__|
g.	Mosquito coil	|__|	h.	Other	|__|

7.1. Specify:	....
8. What toilet facilities are there?	1=None; 2=Simple pit latrine; 3=Ventilated Improved Pit (VIP); 4=Water toilet |__|

9. What is the source of water for drinking?

a.	Tap to house	|__|	b.	Covered well	|__|
c.	Shared communal tap	|__|	d.	Open well	|__|
e.	Bore hole	|__|	f.	Lake or river	|__|
g.	Others	|__|	9.1. Specify:		

10. Does anyone in the household possess the following? (Y=Yes; N=No)

a.	Working watch or clock	|__|	b.	Bed	|__|
c.	Working radio	|__|	d.	Bicycle	|__|
e.	Bank account or bank book	|__|	f.	Canoe	|__|
g.	Charcoal iron	|__|	h.	Oxcart	|__|
i.	Working sewing machine	|__|	j.	Motorbike	|__|
k.	Mobile phone	|__|	l.	Car	|__|
m.	Mosquito net	|__|	n.	Mattress	|__|
o.	None of the above	|__|			

|		
11. Since this time last year, has there been a time when there was not enough food for the household to have its normal meals? (fewer meals per day, and/or smaller meals, and/or less variety of foods)	Y/N	|__|
12. Since this time last year have there been times when the household did not have money to buy bathing soap?	Y/N	|__|

A3.7 Extract from CAPS follow-up household survey

LSTM **Cooking and Pneumonia Study**	**Household ID #**	|__|__| |__|__|__|
	Cluster ID #	|__|__| |__|__|__|

C. Fire Sources			
1.	Is there any evidence of recent usage of three stone fire? (Observe)	Y/N	|___|
2.	How often do you use three stone open fire?	1=None; 2=Some (At least one meal); 3=About half; 4=Most (2 to 3 meals); 5=All meals	|___|
3.	Why do you use the three stone fire?	1= Philips stove not working; 2= Philips stove too small; 3= I prefer three stone fire; 9= Other	|___|
3.1. Specify Other *(Complete if Q3=9)*		....	
4.	For what activities do you prefer to use the three stone fire?	1= Brewing; 2= Boiling water; 3= Large pot; 9=Other	|___|
4.1. Specify Other *(Complete if Q4=9)*		....	
5.	Are the Philips cookstoves used for all the households cooking needs?	Y/N	|___|
6.	Approximately how much of the household's day to day cooking is done using the Philips cookstoves?	1=None; 2=Some (At least one meal); 3=About half; 4=Most (2 to 3 meals); 5= All cooking and water boiling is done on the stove	|___|
7.	Why don't you use the cookstove for all of your cooking?		
i.	The stoves are too small to use for all of my cooking	Y/N	|___|
ii.	My pots do not fit on the stove	Y/N	|___|
iii.	The stove is broken or does not work well	Y/N	|___|
iv.	I don't know how to use it/I don't feel comfortable using it	Y/N	|___|
v.	I am unable to find fuel	Y/N	|___|
vi.	The battery has died	Y/N	|___|
vii.	Food doesn't taste the same	Y/N	|___|
viii.	I am afraid my child will burn himself/herself	Y/N	|___|
ix.	Other	Y/N	|___|
7.1. Specify Other *(Complete if Q7=9)*		....	

Figure A.1 Map of Karonga HDSS catchment area and locations of IDI and FGD communities

270
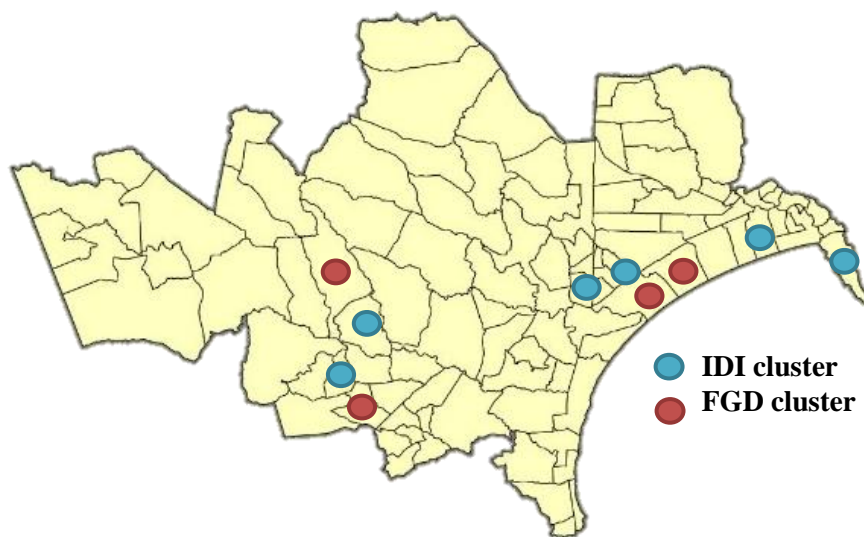
In-depth interview with primary school children – English topic guide

Introductory/'ice breaker' questions:

- *Information about the household: How many are you? Who do you live with? What is your house like? What does the household head do for work?*
- *Information about the participant: What are your favourite things to do? What do you like to eat most? What is your favourite football team?*
- *Information about participant's schooling history: What school do you go to? What age did you start school? Have you repeated any grades? Why did you repeat?*
- *Information about participant's school: How many standards does it teach? How many teachers does it have? What are the school hours? Does it operate single or double shifts? About how many pupils are in the participant's class? Does the participant go for extra lessons?*

Thank you for taking part in this interview. The first questions I will ask you have to do with your feelings towards going to school.

- What are the best parts about going to school? What are the worst parts?
- How many years do you want to stay in school? Until you have finished what standard/form? Why do you want to reach this level (or why do you not want to progress further)? What do you want to do when you finish school?
- Tell me about your journey to school *[Probe about distance, time, with whom the participant travels]*. Are there parts that are difficult or dangerous? In what way(s)?

Now I would like to ask you about some times you might have missed school.

- Think about your attendance over the course of a school year. Are there particular times of the year that you miss school more than others? [*Possible probe: for example, a season or month, or the time surrounding a particular holiday?*] Why is this the case?
- Would you say that you miss school on some days of the week more than other days? Why is this the case?
- How many days of school have you missed in the past 4 weeks that school was in session? *[Note: since it has now been 1 month since the Easter holidays, this can just refer to absences during the third term]*
- Now think about the last time you were absent from school. When was this? How many days of school did you miss? Why didn't you go to school during that period?
- Since the start of the school year, have you ever missed school because you were feeling ill? *If yes*: Tell me about the last time you missed part or all of a school day because of illness. What happened? How much school did you miss? [*Probe about type of illness, etc*.]

- Would you say that you frequently arrive late or leave early from school? [*Probe for how often: every day, every week, once in a while, never*] Why does this happen?

Now I'd like to find out more about all the things you do during the day. These could be things that you do at home, at school, or just for fun.

Activity 1 (see separate sheet)

- *For each activity listed in Activity 1 (except homework and time at school), ask:*
  - When you do **[activity name]**, what kinds of things do you do? Is it always your responsibility to do **[activity name],** or are there others in the household who also do **[activity name]**?
  - Since this school year started, have you ever done **[activity name]** during school hours? *If no*: how do you manage to combine **[activity name]** with school attendance?
  - *If yes*: Tell me about the last time you missed part or all of a school day because of **[activity name]**. What happened? How much school did you miss? Was it possible to catch up on the lessons you missed?
- *For activities that the participant did not report undertaking in Activity 1, ask:*
  - You said that you did not do **[activity name]** yesterday. When was the last time you did **[activity name]**? Whose responsibility is it in the household to do **[activity name]**? [*If more than one year ago or never, move on to next activity; if school or homework, move on to next activity*]
  - When you do **[activity name]**, what kinds of things do you do?
  - Since this school year started, have you ever done **[activity name]** during school hours? *If no*: how do you manage to combine **[activity name]** with school attendance?
  - *If yes:* Tell me about the last time you missed part or all of a school day because of **[activity name]**: What happened? How much school did you miss?
- Did you do any other activities yesterday that we haven't talked about?
  - *If yes*: What else did you do?
  - Since this school year started, have you ever done **[activity name]** during school hours?
  - *If yes*: Tell me about the last time you missed part or all of a school day because of **[activity name]**: What happened? How much school did you miss? Was it possible to catch up on the lessons you missed?
- *Specific activity questions*
  - What cooking methods do you use in your household? Do they differ according to what foods you eat? What is the kitchen like [*Possible probe: inside, outside, separate to the house, attached to the house]*? How regularly are you involved in cooking, or in the kitchen while others are cooking? What about your siblings?

- o What fuel do you use for cooking (e.g. firewood, charcoal, agricultural produce)? Where does your household source this cooking fuel? Who normally collects the cooking fuel? How long does this take?
- o How would you describe the health of the people living in your household? Since the school year started, has anyone been sick? *If yes*: What was he/she suffering from? Who looked after him/her or performed his/her normal household chores?

In this last part of the interview, I would like to ask you about how you decide whether or not to go to school. *[Note that this is not the last section for cookstove recipients]*

- The last time you were absent, did someone else tell you not to attend school or did you decide on your own? Did your siblings (or anyone else from the household) also miss school on that day?
- Since this school year started, were you ever told to stay home from school on a day that you wanted to go? Who told you to stay home and why?
- Since this school year started, have you ever skipped school when your parents/guardians thought you were there? What did you do instead of going to school? Was anyone else with you [*Possible probes: for example, your friends, your siblings, your boyfriend/girlfriend*]?
- Now think about your teacher at school. Have there been any days since the school year started when your teacher has not come to school? When was the last time this happened? What did you do when your teacher wasn't there?
- Is there anything about your current school, your classmates, or your teacher that stops you going to school some days? *If yes:* Tell me about the last time this happened.
- Do you have enough time in your day to spend on school and homework? If you could spend less time on work/chores, how would you use the extra time in your day?

*Extra questions for **CAPS intervention group only:***

- Since receiving the new cookstove, have you noticed any difference in the amount of cooking fuel the household needs for meals?
- Since receiving the new cookstove, have you noticed any difference in the amount of time it takes to cook meals? Is the amount or type of food your household makes the same or different than before?
- Aside from cooking, do the cookstove or cookstove parts have any other uses?
- Since receiving the new cookstove, have you noticed any changes in your own health, or of someone in your household? *If yes*: what kind(s) of changes?
- Since receiving the new cookstove, have you noticed any changes in how much you miss school or arrive late?

Thank you very much for taking part in this study.

A3.9 IDI timeline activity

Activity 1: Timeline (during IDIs with primary school students)

<u>Materials</u>

Illustrated paper timeline, indicating morning, afternoon, evening and night

Pictures illustrating the following activities:

- Collecting water
- Collecting firewood
- Farming/gardening
- Fishing
- Selling/buying goods (e.g. at the market)
- Caring for family members (older or younger)
- Going to school
- Doing homework
- Cooking
- Playing

18 stones, beans or other local material

<u>Instructions</u>

Instruct the participant to think about how he/she spent the previous day (or the last school day). In particular, did the participant spend time doing any of the pictured activities? He/she should pick out from the list of 10 activities the ones that he/she engaged in the previous day (or the last school day). For each activity identified, the participant should place the image of the activity along the timeline according to what time of day he/she carried that activity out. If the participant is unsure, probe: "Was it in the morning, in the middle of the day, in the evening, or throughout the day?" Multiple copies of each image are available in the event that the participant undertook the activity more than once in the day. Repeat the process for each activity pictured.

Once the timeline is complete (the participant does not have to include all the activities if he/she did not do them the previous day), ask him/her to divide up the 18 stones across each activity to indicate how long he/she spent doing that activity. Note that it may help to think about each stone as representing approximately 1 hour, but the objective is to determine the *relative* time spent on each activity so activities that take a long time (e.g. attending school) should have more stones than shorter activities (e.g. cooking).

Record the timeline the participant has created using the accompanying form.

Notes about activities

Collecting water

Participants should mention every time the previous day they went to fetch water from a source outside the immediate household. Be sure to include water collection both at home and at school. If the participant's household has piped water, note this on the Activity Sheet.

Collecting firewood

Participants should mention every time the previous day they went to collect firewood, or other similar material for cooking (e.g. charcoal, agricultural produce).

Farming/gardening

Participants should describe the time spent the previous day working in the farm or garden, whether for their own household or for someone else.

Fishing

Participants should describe the time spent the previous day engaging in fishing, whether on a boat, diving, or from the shore. This could also include activities related to fishing such as repairing nets.

Buying/selling goods

Participants should describe the time spent the previous day selling goods or services, or taking part in other similar income-generating activities not otherwise mentioned, either for their own household or on behalf of someone else. This could include both formal and informal work. This activity can also include purchasing goods or services for the household; the nature of the activity (whether buying or selling) should be specified on the Activity Sheet.

Caregiving

Participants should describe the time spent the previous day looking after someone else. This could include minding a younger sibling or providing care to an ill relative (older or younger).

Going to school

Participants should indicate whether they attended school the previous day, and whether it was for the whole day or part of the day. If they participated in any other activities during the school day, these should be listed separately.

Doing homework

Participants should describe the time spent doing homework the previous day. Time spent helping others with their homework should also be included, but should be indicated in the Notes section of the Activity Sheet.

Cooking

Participants should describe the time spent the previous day engaging in cooking-related activities, including food preparation, cooking, and washing up.

Playing

Participants should mention every time the previous day they engaged in leisure activities. These include but are not limited to: playing sports or games; talking with friends; participating in singing, dancing or drama; watching TV; listening to the radio; swimming, etc.

If there are any doubts about how to classify a particular activity, use your judgment and make notes on the Activity Sheet

Activity 1

1. Once the participant has completed his/her timeline, copy the sequence of activities onto the grid below. Start with 1 for the activity the participant did earliest in the day, then count upwards for each subsequent activity. If the participant did two activities at the same time, ask which one he/she started first, but make notes below of any overlaps (e.g. collected water while at school; looked after siblings while doing homework). If the participant did an activity more than once in the day, list each episode separately (e.g. cooking: 2, 7). If the participant did not do an activity, mark it with an X.
2. List the number of beans the participant placed over each activity. If the activity was repeated multiple times in the day, list all relevant options. Ensure that the total sums to 18.
3. Complete the third column of the table to indicate when the participant last completed the activity before yesterday, using the options below:
   a) Yesterday/last school day *(Activity should appear in timeline)*
   b) Within past week
   c) Within past month
   d) Since the start of the school year
   e) More than one year ago/never

   For activities that appear in the participant's timeline, make sure to use option a). For activities the participant did not undertake yesterday, return to the interview topic guide and probe about the last time before yesterday that the activity was undertaken.
4. In the last column, indicate (by writing Yes or No) whether the participant missed all or part of a school day since the start of the school year as a result of carrying out the listed activity.
5. Label the timeline with the participant's ID number using the tape and marker provided and take a photo of it before clearing it up. Note that you may have to take the photo in two parts, so ensure that both sides of the timeline are labeled.

Activity	Sequence (start from 1 and count upwards)	Number of beans (total=18)	Last time undertaken (codes from 3 above)	Missed school this year? (Yes/No)
A - Collecting water				
B - Collecting firewood				
C - Farming/gardening				
D - Fishing				
E - Selling/buying goods				
F - Caregiving				
G - Attending school				
H - Doing homework				
I - Cooking				
J - Playing				
Notes:				

Early morning: wake up – 8:00   **Late morning: 8:00-12:00**   **Afternoon: 12:00-16:00**   **Evening/night: 16:00-sleep**
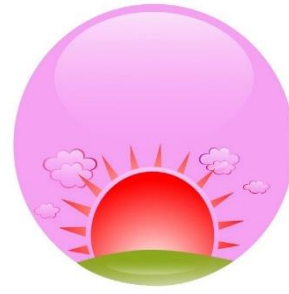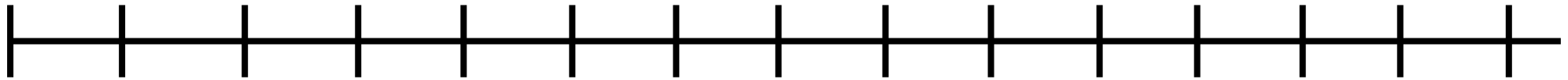
Use the following letters to indicate the placement of each activity along the timeline (in the case of multiple episodes of the same activity, the same letter may be used more than once):

A – Collecting water   F – Caregiving

B – Collecting firewood   G – Going to school

C – Farming/gardening   H – Doing homework

D – Fishing   I – Cooking

E – Selling/buying goods   J – Playing

A3.10 Focus group discussion topic guide

Focus group discussion with primary school children

Thank you for taking part in this discussion today. We are interested in hearing your opinions and experiences about going to school in this community. We also understand that there are some days when children are not able to go to school so we would like to hear about the reasons you think this happens. Everything you say is important to us, so please try to take turns speaking and make sure everyone in the group has a chance to share. Please also avoid using real names during the discussion.

Ice breakers

- *What are your favourite activities that happen in this community? (e.g. dances, sporting events)*
- *Tell me about your school. How many teachers does it have? How many classrooms?*
- *What are your favourite foods?*
- *What sports/teams do you like?*
- *Etc.*

Now let us discuss your views about going to school in this community.

- What are the best parts about going to school?
- What are the worst parts about going to school?
- What level of education should children achieve? Is this the same for boys and girls? [*Probe for similarities and differences*]
- Do parents talk to children in this community about how far they would like their children to go with education? *If yes:* What level of education do parents in this community think children should reach? [*Note similarities and differences between parents' and children's aspirations*]
- Do most children your age go to primary school in this community? *If no*: why not? How common is it for children in this community to proceed to secondary school? What stops children from going to secondary?
- If a family doesn't have enough money to send all its children to school, what criteria should it use to decide which ones should go?
- Is it important that children attend school every day or is it enough that they attend sometimes?

Now I will give each of you a piece of paper and pencils. Imagine a day when you or someone you know was absent from school. Please draw a picture of what this person was doing during the day that he/she wasn't at school. Afterwards we will talk a bit about your drawings. [*Allow approximately 10 minutes for drawing*]

- What did you draw and why? Do boys and girls miss school for the same reasons? [*Probe for similarities and differences*]
- How often are children absent from school in this community? [*Possible probes: Regularly? Sometimes? Rarely? Never?*] Would you say absenteeism is a big problem? Why or why not?
- Is it more important that children help their households or attend school?
- What do you think can be done to reduce absenteeism at school?
- How often are teachers absent from school in this community? Would you say teacher absenteeism is a big problem? What happens to lessons when teachers miss school?

- Do teachers ever ask students to do personal errands (e.g. fetch water)? *If yes*: Do students miss lessons because of these errands?

Now I would like to ask some questions about how easy or hard it is for students to keep up at school after they are absent.

- Is it difficult to keep up with lessons after missing school? How can absent students catch up when they return to school?
- Imagine your class at school has 60 pupils, but today there are only 50 because 10 are absent. What are the advantages and disadvantages for the 50 pupils who have come? Do they learn any differently to when the whole class is there? In what way(s)?
- Should students be punished for being late or absent? Should students be excluded from school or have to repeat their standard if they are absent too much? Why or why not?

[*CAPS intervention group only:*] Finally, I would like to ask you a few questions about the cookstoves your household received as part of another KPS research study.

- What are the best parts about the new cookstoves? What are the downsides?
- Would you and your household like to continue using these cookstoves in the future? Why or why not?
- Aside from cooking, do the cookstove or cookstove parts have any other uses?

Thank you very much for taking part in this study.

Appendix to Chapter 4

Table A.2 Distribution of pupils across six chosen socioeconomic indicators and assessment of potential multicollinearity

	Household wealth										Chi-squared test		Spearman's rho		Variance Inflation Factor (VIF)
	Lowest		2		3		4		Highest						
Agricultural wealth	n	%	n	%	n	%	n	%	n	%	909.5	***	0.236	***	1.17
Lowest	678	**34.4**	396	**19.9**	244	**12.4**	244	**12.4**	397	**20.4**					
2	500	**25.4**	435	**21.8**	466	**23.6**	274	**13.9**	288	**14.8**					
3	403	**20.4**	467	**23.5**	362	**18.3**	430	**21.8**	317	**16.3**					
4	270	**13.7**	405	**20.3**	473	**24.0**	472	**23.9**	363	**18.7**					
Highest	121	**6.1**	288	**14.5**	428	**21.7**	552	**28.0**	578	**29.7**					
Household head occupation											>1800	***	0.310	***	1.20
Subsistence farmer/herder	1630	**82.7**	1509	**75.8**	1434	**72.7**	1275	**64.7**	763	**39.3**					
Fisherman	90	**4.6**	123	**6.18**	128	**6.5**	82	**4.2**	58	**3.0**					
Other non-skilled	136	**6.9**	201	**10.1**	257	**13.0**	347	**17.6**	421	**21.7**					
Skilled	54	**2.7**	102	**5.12**	113	**5.7**	214	**10.9**	684	**35.2**					
Not working	62	**3.1**	56	**2.81**	41	**2.1**	54	**2.7**	17	**0.9**					
Maternal education											558.9	***	0.227	***	1.17
None/primary	1835	**93.1**	1800	**90.4**	1737	**88.0**	1568	**79.5**	1342	**69.1**					
Post-primary	137	**6.9**	191	**9.59**	236	**12.0**	404	**20.5**	601	**30.9**					
Paternal education											872.3	***	0.294	***	1.24
None/primary	1563	**79.3**	1453	**73.0**	1201	**60.9**	1069	**54.2**	736	**37.9**					
Post-primary	409	**20.7**	538	**27.0**	772	**39.1**	903	**45.8**	1207	**62.1**					
Household credit access											462.8	***	0.203	***	1.07
No	1748	**88.6**	1711	**85.9**	1549	**78.5**	1544	**78.3**	1227	**63.1**					
Yes	224	**11.4**	280	**14.1**	424	**21.5**	428	**21.7**	716	**36.9**					

*** $p<0.001$

Notes: Chi-squared tests and Spearman's correlations were performed using pairwise comparisons of each SES indicator against the household wealth index. VIF values result from performing collinearity diagnostics on all SES indicators in combination. The VIF for household wealth was 1.36.

Table A.3 Results from two-level logistic regression models estimating primary school absenteeism in the past four weeks, excluding interviews conducted within four weeks of a school holiday, by sex

	Absent past 4 weeks; n(%)	Model 1: Unadjusted OR (95% CI)	Model 2: Adjusted SES only AOR (95% CI)	Model 3: Adjusted All factors AOR (95% CI)
Boys (N=3164)				
<u>**Socioeconomic factors**</u>				
Household wealth quintile		0.91 (0.81-1.03)	0.86 (0.74-1.00) *	0.92 (0.79-1.07)
Lowest	129 (20.4)			
2	121 (19.1)			
3	131 (19.7)			
4	116 (17.7)			
Highest	100 (17.3)			
Agricultural wealth quintile		1.28 (1.13-1.45) ***	1.32 (1.15-1.52) ***	1.23 (1.06-1.43) **
Lowest	80 (14.5)			
2	111 (17.1)			
3	109 (17.4)			
4	151 (22.0)			
Highest	146 (22.5)			
Household credit access				
No	521 (20.7)	1	1	1
Yes	76 (11.8)	0.35 (0.22-0.56) ***	0.37 (0.23-0.60) ***	0.41 (0.25-0.67) ***
Father's education				
None/primary	392 (20.1)	1	1	1
Post-primary	205 (16.9)	0.71 (0.51-0.99) *	0.80 (0.55-1.16)	0.88 (0.60-1.29)
Mother's education				
None/primary	491 (18.6)	1	1	1
Post-primary	106 (20.0)	1.11 (0.73-1.68)	1.49 (0.94-2.34) †	1.59 (0.99-2.55) †
Occupation of household head				
Subsistence farmer/herder	438 (19.9)	1	1	1
Fisherman	17 (12.7)	0.40 (0.16-1.01) †	0.49 (0.19-1.23)	0.76 (0.28-2.08)
Other non-skilled	77 (18.3)	0.82 (0.49-1.36)	1.15 (0.68-1.95)	1.06 (0.61-1.86)
Skilled	55 (16.0)	0.67 (0.38-1.19)	1.17 (0.63-2.17)	1.07 (0.57-2.03)
Not working	11 (14.7)	0.60 (0.19-1.90)	0.64 (0.21-2.01)	0.72 (0.21-2.40)
<u>**Individual variables**</u>				
Age (years)				
5-11	352 (18.5)	1		1
12-14	148 (20.2)	1.17 (0.84-1.62)		1.03 (0.65-1.63)
≥15	97 (18.4)	1.12 (0.76-1.64)		1.22 (0.64-2.31)
Current standard				
1-4	365 (19.0)	1		1
5-7	192 (20.8)	1.34 (0.99-1.82) †		1.24 (0.78-1.97)
8	40 (12.6)	0.56 (0.33-0.95) *		0.46 (0.21-0.97) *
Repeated current standard				
No	375 (18.0)	1		1
Yes	222 (20.6)	1.33 (0.98-1.78) †		1.32 (0.97-1.81) †
Father died				
No	526 (19.0)	1		1
Yes	72 (17.8)	0.85 (0.54-1.34)		1.09 (0.64-1.86)

Table A.3 continued Results from two-level logistic regression models of primary school absenteeism in the past four weeks, excluding interviews conducted within four weeks of a school holiday, by sex

	Absent past 4 weeks; n(%)	Model 1: Unadjusted OR (95% CI)	Model 2: Adjusted SES only AOR (95% CI)	Model 3: Adjusted All factors AOR (95% CI)
Boys (N=3164)				
Mother died				
No	579 (19.3)	1		1
Yes	18 (11.5)	0.39 (0.18-0.86) *		0.48 (0.21-1.09) †
Relationship to household head				
Child	463 (19.9)	1		1
Step-child	17 (21.8)	1.07 (0.42-2.71)		1.15 (0.44-3.03)
Grandchild	87 (15.9)	0.67 (0.44-1.04) †		0.79 (0.48-1.29)
Other	30 (14.2)	0.53 (0.28-1.01) †		0.56 (0.28-1.11) †
Economic participation in past 4 weeks				
No	450 (17.5)	1		1
Yes	147 (24.7)	1.86 (1.28-2.70) **		1.72 (1.14-2.58) **
Household variables				
Number of household members				
1-4	92 (18.5)	1		1
5-8	442 (20.5)	1.21 (0.78-1.87)		1.16 (0.69-1.94)
≥9	63 (12.4)	0.47 (0.25-0.89) *		0.47 (0.22-1.01) †
Number of younger residents				
0-1	237 (19.0)	1		1
2-3	260 (18.8)	0.95 (0.70-1.29)		0.84 (0.59-1.19)
≥4	100 (18.6)	1.08 (0.71-1.65)		0.94 (0.54-1.62)
Sex of household head				
Male	497 (19.4)	1		1
Female	101 (16.7)	0.72 (0.46-1.11)		0.93 (0.55-1.58)
Distance to school (km)				
<1 km	311 (18.3)	1		1
1-2 km	200 (17.7)	1.02 (0.71-1.45)		0.76 (0.51-1.13)
>2 km	86 (25.5)	1.80 (1.09-2.98) *		1.19 (0.67-2.11)
Interview variables				
Season of interview				
Hot (Sept-Nov)	168 (22.4)	1		1
Wet (Dec-Apr)	354 (18.5)	0.63 (0.42-0.94) *		0.81 (0.46-1.43)
Cool (May-Aug)	75 (14.9)	0.38 (0.21-0.67) **		0.08 (0.01-0.59) *
School fixed effects		No	No	Yes
sigma_u			2.28 (1.91-2.71)	2.22 (1.85-2.67)
rho			0.61 (0.53-0.69) ***	0.60 (0.51-0.68) ***

† p<0.1 * p<0.05 ** p<0.01 *** p<0.001
Notes: All models include household random effects. Model 3 additionally includes a dummy School ID variable. Nine observations from three schools drop from model 3 for predicting failure perfectly. Sigma_u and rho not shown for unadjusted models.

Table A.3 continued Results from two-level logistic regression models of primary school absenteeism in the past four weeks, excluding interviews conducted within four weeks of a school holiday, by sex

	Absent past 4 weeks; n(%)	Model 1: Unadjusted OR (95% CI)	Model 2: Adjusted SES only AOR (95% CI)	Model 3: Adjusted All factors AOR (95% CI)
Girls (N=2800)				
Socioeconomic factors				
Household wealth quintile		0.89 (0.77-1.02) †	0.82 (0.70-0.97) *	0.87 (0.73-1.03)
Lowest	100 (19.2)			
2	112 (20.1)			
3	126 (20.6)			
4	96 (16.7)			
Highest	82 (15.4)			
Agricultural wealth quintile		1.38 (1.19-1.60) ***	1.45 (1.23-1.69) ***	1.42 (1.20-1.69) ***
Lowest	75 (14.1)			
2	78 (13.7)			
3	113 (19.2)			
4	123 (21.2)			
Highest	127 (23.9)			
Household credit access				
No	441 (20.1)	1	1	1
Yes	75 (12.4)	0.44 (0.26-0.72) **	0.48 (0.29-0.81) **	0.57 (0.34-0.97) *
Father's education				
None/primary	325 (19.1)	1	1	1
Post-primary	191 (17.4)	0.86 (0.59-1.25)	1.21 (0.81-1.83)	1.29 (0.84-1.97)
Mother's education				
None/primary	440 (18.9)	1	1	1
Post-primary	76 (16.1)	0.76 (0.47-1.25)	0.96 (0.57-1.62)	1.07 (0.62-1.84)
Occupation of household head				
Subsistence farmer/herder	378 (19.7)	1	1	1
Fisherman	12 (11.2)	0.36 (0.12-1.06) †	0.50 (0.17-1.47)	0.71 (0.22-2.24)
Other non-skilled	64 (18.2)	0.89 (0.49-1.60)	1.36 (0.74-2.48)	1.47 (0.77-2.80)
Skilled	48 (13.6)	0.44 (0.23-0.84) *	0.78 (0.39-1.53)	0.75 (0.37-1.53)
Not working	14 (19.2)	0.72 (0.22-2.43)	0.90 (0.27-2.95)	1.12 (0.32-3.91)
Individual variables				
Age (years)				
5-11	330 (18.0)	1		1
12-14	124 (18.4)	1.11 (0.76-1.61)		1.14 (0.67-1.95)
≥15	62 (21.5)	1.53 (0.92-2.54)		1.18 (0.55-2.51)
Current standard				
1-4	321 (18.8)	1		1
5-7	151 (17.4)	0.95 (0.67-1.34)		0.92 (0.55-1.53)
8	44 (20.0)	1.51 (0.83-2.74)		1.36 (0.59-3.15)
Repeated current standard				
No	357 (17.8)	1		1
Yes	159 (20.0)	1.51 (1.05-2.16) *		1.45 (1.01-2.09) *
Father died				
No	463 (18.8)	1		1
Yes	53 (15.7)	0.67 (0.38-1.18)		0.85 (0.46-1.60)

Table A.3 continued Results from two-level logistic regression models of primary school absenteeism in the past four weeks, excluding interviews conducted within four weeks of a school holiday, by sex

	Girls (N=2800)			
	Absent past 4 weeks; n(%)	Model 1: Unadjusted OR (95% CI)	Model 2: Socio-economic factors AOR (95% CI)	Model 3: Multivariable AOR (95% CI)
Mother died				
No	495 (18.5)	1		1
Yes	21 (17.5)	0.66 (0.28-1.52)		0.81 (0.34-1.93)
Relationship to household head				
Child	384 (19.6)	1		1
Step-child	23 (22.3)	1.38 (0.58-3.28)		1.41 (0.58-3.45)
Grandchild	88 (17.3)	0.80 (0.50-1.30)		1.05 (0.60-1.83)
Other	21 (9.2)	0.28 (0.14-0.58) **		0.32 (0.15-0.67) **
Economic participation in past 4 weeks				
No	421 (18.1)	1		1
Yes	95 (20.2)	1.25 (0.80-1.96)		0.91 (0.56-1.47)
Household variables				
Number of household members				
1-4	71 (16.4)	1		1
5-8	389 (20.2)	1.47 (0.88-2.45)		1.00 (0.55-1.82)
≥9	56 (12.8)	0.59 (0.28-1.23)		0.36 (0.15-0.86) *
Number of younger residents				
0-1	193 (17.3)	1		1
2-3	239 (18.6)	1.15 (0.82-1.63)		1.06 (0.71-1.58)
≥4	84 (21.2)	1.59 (0.97-2.62) [†]		1.69 (0.89-3.22)
Sex of household head				
Male	426 (18.9)	1		1
Female	90 (16.5)	0.73 (0.44-1.20)		1.05 (0.57-1.92)
Distance to school (km)				
<1 km	239 (15.6)	1		
1-2 km	218 (21.7)	1.75 (1.17-2.62) **		1.67 (1.07-2.60) *
>2 km	59 (22.3)	1.97 (1.06-3.67) *		1.72 (0.85-3.47)
Interview variables				
Season of interview				
Hot (Sept-Nov)	108 (17.8)	1		1
Wet (Dec-Apr)	349 (20.0)	1.23 (0.76-1.99)		1.93 (0.95-3.91) [†]
Cool (May-Aug)	59 (13.3)	0.54 (0.28-1.05) [†]		0.60 (0.12-3.06)
School fixed effects		No	No	Yes
sigma_u			2.52 (2.06-3.07)	2.49 (2.02-3.06)
rho			0.66 (0.56-0.74) ***	0.65 (0.55-0.74) ***

[†] $p<0.1$ * $p<0.05$ ** $p<0.01$ *** $p<0.001$

Notes: All models include household random effects. Model 3 additionally includes a dummy School ID variable. Four observations from three schools drop from model 3 for predicting failure perfectly. Sigma_u and rho not shown for unadjusted models.

Appendix to Chapter 6

Table A.4 Association between student characteristics in one survey round and non-interview in the next

	AOR	95% CI	p-value
Absent past 4 weeks (any)			
No	1		
Yes	0.95	0.84-1.07	0.384
Sex			
Male	1		
Female	1.26	0.14-1.39	<0.001
Age group			
≤8	1		
9-11	0.91	0.79-1.05	0.207
≥12	1.22	0.92-1.62	0.162
Standard attended			
1-3	1		
4-5	1.00	0.84-1.19	0.988
6-8	0.81	0.55-1.20	0.292
Age started primary			
Early (age 5 or younger)	1		
On time (age 6)	0.99	0.89-1.09	0.917
Late (age 7 or later)	1.00	0.82-1.23	0.980
Father died			
No	1		
Yes	0.99	0.82-1.20	0.913
Mother died			
No	1		
Yes	0.87	0.62-1.22	0.417
Father's education			
None/primary	1		
More than primary	1.15	1.03-1.28	0.012
Mother's education			
None/primary	1		
More than primary	0.96	0.84-1.09	0.514
Household head occupation			
Subsistence farming	1		
Fishing	1.39	1.13-1.71	0.002
Other unskilled	1.11	0.96-1.29	0.168
Skilled	1.47	1.26-1.72	<0.001
Not working	1.34	0.96-1.89	0.088
Sex of household head			
Male	1		
Female	1.20	1.04-1.37	0.011
Number of household members			
1-4	1		
5-8	0.55	0.48-0.63	<0.001
≥9	0.44	0.36-0.55	<0.001
Number of younger members			
None	1		
1	1.30	1.13-1.49	<0.001
2	1.47	1.26-1.73	<0.001
≥3	1.40	1.15-1.70	0.001

Table A.4 continued Association between student characteristics in one survey round and non-interview in the next

	AOR	95% CI	p-value
Relationship to household head			
Child	1		
Step-child	2.58	2.03-3.27	<0.001
Grandchild	1.39	1.20-1.62	<0.001
Niece/nephew	2.71	1.94-3.77	<0.001
Other	3.21	2.56-4.02	<0.001
Month of interview (lagged)			
January	1		
February	0.92	0.72-1.19	0.534
March	0.94	0.72-1.22	0.625
April	0.97	0.73-1.29	0.836
May	0.58	0.43-0.80	0.001
June	0.83	0.59-1.15	0.254
July	0.62	0.45-0.86	0.004
August	2.37	1.73-3.26	<0.001
September	1.23	0.86-1.74	0.253
October	1.01	0.75-1.36	0.941
November	0.90	0.67-1.20	0.475
December	0.94	0.71-1.24	0.673
Survey round			
2008-09	1		
2009-10	0.87	0.67-1.13	0.281
2010-11	0.72	0.55-0.93	0.011
2011-12	0.61	0.47-0.79	<0.001
2012-13	0.61	0.48-0.79	<0.001
2013-14	0.57	0.45-0.73	<0.001
2014-15	0.86	0.68-1.09	0.218

Notes: Results from logistic regression model with individual random effects. N=25,164 representing 7,504 individuals contributing an average of 3.4 observations. Models also include a variable designating school attended (not shown). Sample restricted to students attending schools with at least 10 observations per round.

Table A.5 Adjusted association between student characteristics and any absenteeism in the past four weeks, among students with at least two consecutive interviews

	AOR	95% CI	p-value	p-value interaction
Lagged absenteeism in past 4 weeks (any)				
No	1			
Yes	1.14	1.03-1.25	0.009	--
Sex				
Male	1			0.448
Female	1.01	0.94-1.08	0.870	
Age group				
≤8	1			0.885
9-11	1.04	0.95-1.14	0.381	
≥12	1.25	1.06-1.48	0.008	
Standard attended				
1-3	1			0.416
4-5	0.79	0.71-0.88	<0.001	
6-8	0.65	0.53-0.80	<0.001	
Age started primary				
Early (age 5 or younger)	1			0.339
On time (age 6)	0.97	0.90-1.04	0.360	
Late (age 7 or later)	1.05	0.91-1.21	0.488	
Father died				
No	1			0.968
Yes	1.03	0.88-1.19	0.728	
Mother died				
No	1			0.878
Yes	1.09	0.85-1.40	0.482	
Father's education				
None/primary	1			0.908
More than primary	0.92	0.85-1.00	0.039	
Mother's education				
None/primary	1			0.327
More than primary	0.93	0.84-1.02	0.127	
Household head occupation				
Subsistence farming	1			0.923
Fishing	1.00	0.84-1.20	0.991	
Other unskilled	1.01	0.91-1.13	0.841	
Skilled	0.89	0.78-1.02	0.093	
Not working	1.20	0.89-1.62	0.234	
Sex of household head				
Male	1			0.682
Female	1.16	1.04-1.29	0.008	
Number of household members				
1-4	1			0.507
5-8	0.84	0.75-0.94	0.004	
≥9	0.67	0.57-0.78	<0.001	
Number of younger members				
None	1			0.739
1	1.03	0.92-1.15	0.659	
2	1.17	1.04-1.32	0.007	
≥3	1.31	1.15-1.50	<0.001	

Table A.5 continued Adjusted association between student characteristics and any absenteeism in the past four weeks, among students with at least two consecutive interviews

	AOR	95% CI	p-value	p-value interaction
Relationship to household head				
Child	1			0.672
Step-child	1.02	0.81-1.27	0.876	
Grandchild	0.92	0.81-1.03	0.156	
Niece/nephew	0.75	0.53-1.07	0.116	
Other	0.93	0.73-1.18	0.534	
Month of interview				
January	1			0.686
February	1.86	1.54-2.25	<0.001	
March	1.32	1.08-1.61	0.007	
April	1.21	0.98-1.49	0.079	
May	1.29	1.03-1.61	0.025	
June	1.43	1.14-1.81	0.002	
July	1.16	0.92-1.46	0.215	
August	0.93	0.72-1.18	0.538	
September	0.54	0.40-0.73	<0.001	
October	0.70	0.56-0.87	0.001	
November	1.02	0.82-1.27	0.843	
December	1.03	0.83-1.29	0.765	
Changed schools across rounds				
No	1			0.580
Yes	0.92	0.79-1.06	0.231	
Survey round				
2009-10	1			0.013
2010-11	1.03	0.82-1.30	0.802	
2011-12	0.95	0.76-1.18	0.642	
2012-13	0.86	0.69-1.07	0.185	
2013-14	1.28	1.03-1.58	0.023	
2014-15	1.83	1.48-2.26	<0.001	
2015-16	0.97	0.78-1.20	0.759	

Notes: Results from pooled random effects logistic regression models. N=21,834 representing 6,765 individuals contributing an average of 3.2 observations. Model also includes a variable designating school attended (not shown). Likelihood ratio tests were used to assess evidence for interaction between lagged absenteeism and background characteristics. Sample restricted to students attending schools with at least 10 observations per round.

Table A.6 Adjusted association between lagged characteristics and current grade repetition, among students with at least two consecutive interviews

	AOR	95% CI	p-value	p-value interaction
Absenteeism (lagged)				
Below 95th percentile	1			--
Above 95th percentile	1.37	1.19-1.57	<0.001	
Sex				
Male	1			0.200
Female	0.79	0.75-0.84	<0.001	
Age group				
≤8	1			0.416
9-11	0.69	0.64-0.75	<0.001	
≥12	0.75	0.63-0.91	0.001	
Standard attended (lagged)				
1-3	1			0.899
4-5	1.09	0.99-1.21	0.174	
6-8	0.91	0.70-1.18	0.472	
Age started primary				
Early (age 5 or younger)	1			0.021
On time (age 6)	0.97	0.92-1.03	0.336	
Late (age 7 or later)	1.13	1.01-1.26	0.034	
Father died (lagged)				
No	1			0.224
Yes	0.99	0.87-1.13	0.920	
Mother died (lagged)				
No	1			0.202
Yes	1.01	0.82-1.24	0.921	
Father's education				
None/primary	1			0.194
More than primary	0.78	0.73-0.83	<0.001	
Mother's education				
None/primary	1			0.330
More than primary	0.73	0.67-0.79	<0.001	
Household head occupation (lagged)				
Subsistence farming	1			0.072
Fishing	1.09	0.95-1.25	0.240	
Other unskilled	0.94	0.86-1.03	0.184	
Skilled	0.76	0.68-0.84	<0.001	
Not working	1.01	0.78-1.29	0.965	
Sex of household head (lagged)				
Male	1			0.510
Female	0.94	0.86-1.03	0.207	
Number of household members (lagged)				
1-4	1			0.667
5-8	0.86	0.79-0.94	0.001	
≥9	0.82	0.73-0.93	0.002	
Number of younger members (lagged)				
None	1			0.780
1	1.18	1.09-1.28	<0.001	
2	1.22	1.12-1.34	<0.001	
≥3	1.20	1.08-1.34	0.001	

Table A.6 continued Adjusted association between lagged characteristics and current grade repetition, among students with at least two consecutive interviews

	AOR	95% CI	p-value	p-value interaction
Relationship to household head (lagged)				
Child	1			0.765
Step-child	0.98	0.81-1.18	0.831	
Grandchild	1.08	0.98-1.18	0.115	
Niece/nephew	0.86	0.65-1.14	0.290	
Other	1.08	0.89-1.31	0.442	
Month of interview (lagged)				
January	1			0.053
February	1.06	0.92-1.22	0.426	
March	0.97	0.84-1.12	0.658	
April	1.14	0.97-1.33	0.118	
May	1.00	0.84-1.18	0.992	
June	1.11	0.92-1.34	0.281	
July	1.08	0.90-1.29	0.397	
August	0.63	0.52-0.78	<0.001	
September	0.98	0.80-1.21	0.877	
October	0.88	0.75-1.04	0.138	
November	0.92	0.78-1.08	0.305	
December	1.18	1.01-1.38	0.032	
Changed schools across rounds				
No	1			0.337
Yes	1.09	0.98-1.21	0.096	
Survey round				
2009-10	1			0.136
2010-11	0.71	0.59-0.84	<0.001	
2011-12	0.94	0.80-1.11	0.459	
2012-13	0.75	0.64-0.88	0.001	
2013-14	0.80	0.68-0.94	0.006	
2014-15	0.79	0.68-0.93	0.003	
2015-16	0.77	0.66-0.90	0.001	

Notes: Results from pooled random effects logistic regression models. N=22,933 representing 6,960 individuals contributing an average of 3.3 observations. Models also include a variable designating school attended (not shown; p-value for interaction=0.426). Likelihood ratio tests were used to assess evidence for interaction between lagged absenteeism and background characteristics. Sample restricted to students attending schools with at least 10 observations per round.

Table A.7 Adjusted association between student characteristics and standard attended after six years, among students who entered the cohort in the first three rounds

	Adjusted coefficient	95% CI	p-value	p-value interaction
Cumulative absenteeism above 95% percentile (lagged)	-0.18	-0.27, -0.08	<0.001	--
Sex				
Male	1			0.945
Female	0.23	0.15, 0.32	<0.001	
Age started primary				
Early (age 5 or younger)	1			0.229
On time (age 6)	-0.03	-0.12, 0.06	0.525	
Late (age 7 or later)	0.02	-0.14, 0.18	0.772	
Father died				
No	1			0.851
Yes	0.06	-0.11, 0.23	0.497	
Mother died				
No	1			0.711
Yes	-0.07	-0.34, 0.20	0.594	
Father's education				
None/primary	1			0.017
More than primary	-0.24	-0.28, -0.19	<0.001	
Mother's education				
None/primary	1			0.226
More than primary	-0.23	-0.29, -0.18	<0.001	
Household head occupation				
Subsistence farming	1			0.470
Fishing	-0.01	-0.21, 0.18	0.892	
Other unskilled	0.04	-0.09, 0.16	0.573	
Skilled	0.21	0.05, 0.36	0.008	
Not working	-0.24	-0.54, 0.06	0.118	
Sex of household head				
Male	1			0.664
Female	0.06	-0.06, 0.19	0.331	
Number of household members				
1-4	1			0.092
5-8	0.15	-0.01, 0.31	0.065	
≥9	0.21	-0.01, 0.41	0.041	
Number of younger members				
None	1			0.189
1	-0.15	-0.30, 0.002	0.053	
2	-0.20	-0.35, -0.04	0.012	
≥3	-0.26	-0.42, -0.11	0.001	
Relationship to household head				
Child	1			0.767
Step-child	0.22	-0.08, 0.51	0.152	
Grandchild	-0.01	-0.15, 0.13	0.886	
Niece/nephew	-0.03	-0.40, 0.35	0.890	
Other	-0.09	-0.38, 0.19	0.519	
Survey round				
2013-14	1			0.806
2014-15	0.02	-0.08, 0.13	0.639	
2015-16	-0.02	-0.13, 0.09	0.715	

Notes: Results from linear regression model, N=2,075. Models also include a variable designating

school attended (not shown; p-value for interaction=0.883). Sample restricted to students attending schools with at least 10 observations per round.

Table A.8 Association between cumulative rounds of absenteeism over five years with total number of repeated grades over six years, among students who entered the cohort in the first three rounds

	Unadjusted IRR (95% CI)	p-value	Adjusted IRR (95% CI)	p-value
Model 1: Any absenteeism	1.06 (1.03-1.10)	<0.001	1.05 (1.01-1.09)	0.005
Model 2: Absenteeism >90 %tile	1.11 (1.06-1.17)	<0.001	1.09 (1.03-1.15)	0.001
Model 3: Absenteeism >95 %tile	1.12 (1.05-1.21)	0.001	1.11 (1.03-1.19)	0.006

Notes: Table shows results from Poisson regression model, N=2,075. IRR=incidence rate ratio. Sample restricted to students who entered the primary school cohort in the first three survey rounds, were interviewed continuously for six years, and attended schools with at least 10 observations per round for the duration of the period. Cumulative absenteeism measures the number of rounds that students' absenteeism breached the three respective thresholds. Adjusted model includes the same set of covariates shown in Table A.7.