



Investing in school systems: conceptualising returns on investment across the health, education and social protection sectors

Stéphane Verguet ¹, Pratibha Gautam,¹ Iman Ali,² Arif Husain,³ Stefan Meyer,³ Carmen Burbano,³ Edward Lloyd-Evans,³ Margherita Coco,⁴ Martin Mphangwe,⁴ Albert Saka,⁵ Meseret Zelalem,⁶ Boitshepo Bibi Giyose,⁷ Zhihui Li,⁸ Agnes Erzse ⁹, Karen Hofman,⁹ Céline Giner,¹⁰ Sylvie Avallone,¹¹ Heli Kuusipalo,¹² Elizabeth Kristjansson,¹³ Linda Schultz,¹⁴ Donald A P Bundy,¹⁴ Noam Angrist^{15,16}

To cite: Verguet S, Gautam P, Ali I, *et al*. Investing in school systems: conceptualising returns on investment across the health, education and social protection sectors. *BMJ Glob Health* 2023;**8**:e012545. doi:10.1136/bmjgh-2023-012545

Handling editor Seye Abimbola

Received 10 April 2023
Accepted 4 September 2023

ABSTRACT

Public policies often aim to improve welfare, economic injustice and reduce inequality, particularly in the social protection, labour, health and education sectors. While these policies frequently operate in silos, the education sphere can operate as a cross-sectoral link. Schools represent a unique locus, with globally hundreds of millions of children attending class every day. A high-profile policy example is school feeding, with over 400 million students worldwide receiving meals in schools. The benefits of harmonising interventions across sectors with a common delivery platform include economies of scale. Moreover, economic evaluation frameworks commonly used to assess policies rarely account for impact across sectors besides their primary intent. For example, school meals are often evaluated for their impact on nutrition, but they also have educational benefits, including increasing attendance and learning and incorporating smallholder farmers into corporate value chains. To address these gaps, we propose the introduction of a comprehensive value-for-money framework for investments toward school systems that acknowledges the return to a common delivery platform—schools—and the multisectoral returns (eg, education, health and nutrition, labour, social protection) emerging from the rollout of school-based programmes. Directly building on benefit-cost analysis methods, this framework could help identify interventions that yield the highest gains in human capital per budget expenditure, with direct implications for finance ministries. Given the detrimental impact of COVID-19 on schoolchildren and human capital, it is urgent to build back stronger and more sustainable welfare systems.

INTRODUCTION

Wealth inequality and poverty are major concerns globally.¹ The COVID-19 pandemic has further deepened these disparities across as well as within countries.^{1 2} To address

SUMMARY BOX

- ⇒ While public policies often operate in silos, the education sphere can operate as a cross-sectoral link. Schools represent a unique locus, with globally hundreds of millions of children attending class every day.
- ⇒ We introduce a comprehensive value-for-money framework for investments toward school systems that acknowledges the return to a common delivery platform—schools—and the multisectoral returns emerging from the rollout of school-based programmes.
- ⇒ Building on benefit-cost analysis methods, the framework could help identify interventions with the highest gains in human capital per budget expenditure, with direct implications for finance ministries.

inequality and improve welfare, public policies often focus on redistributive mechanisms, namely in the social protection, labour, health and education sectors,^{3 4} which are closely linked. Yet, these policies often operate in silos. A series of efforts have aimed to bridge this gap. For instance, the 2030 Sustainable Development Goals (SDGs) adopted by the United Nations (UN) in 2015 emphasise the need to end poverty and other deprivations alongside strategies that improve health and education, reduce inequality and spur economic growth.⁵ To capture the performance of countries across multiple human achievement domains at once, the UN has used the Human Development Index (HDI), which is a summary composite measure of three basic human development indicators including life expectancy at birth, mean years of schooling and income.⁶ Another



© Author(s) (or their employer(s)) 2023. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Professor Stéphane Verguet; verguet@hsph.harvard.edu

recent example of composite measures includes the World Bank's Human Capital Index (HCI), which draws from measures of child and adult survival, the quantity and quality of education and stunting.⁷ Both the HDI and HCI represent a substantial advance, aggregating national-level indicators; yet most rigorous evaluations of specific policies still only report impact in a single sector. For example, while school meals are often evaluated for their impact on nutrition, they also have educational benefits, including increasing attendance and learning and often incorporate smallholder farmers into corporate value chains. To address this gap, we propose the introduction of a comprehensive value-for-money framework for investments toward school systems that acknowledges the multisectoral returns (eg, education, health and nutrition, labour and social protection) emerging from the rollout of school-based programmes.

In designing publicly financed policies aiming at increasing welfare and equity, we must emphasise the interdependencies and leverage the integrated features of various sectors. Impact evaluation of these policies should document the multisectoral returns of a policy, which in turn will reveal the maximum achievable return on investment. Schools represent a unique locus and opportunity, with hundreds of millions of children attending class every day globally.⁸ A high-profile policy example is school feeding, with over 400 million students worldwide receiving meals in schools.⁹ Additional examples of health interventions successfully delivered in schools at scale include education on sexually transmitted infection prevention, oral hygiene, deworming treatment, immunisations, vision and eye health screening.⁹⁻¹¹ These examples demonstrate that the education sector plays an instrumental role in not only fostering learning, but in improving the health status of the learners. This also includes instilling long-term healthy habits and behaviours (eg, hygiene and hand washing, abstinence from tobacco consumption or drinking of sugar-sweetened beverages). Moreover, school health programmes have been shown to not only enhance health outcomes, but also educational outcomes.¹² A randomised trial of school feeding found positive effects on learning outcomes in Ghana¹³; and in Kenya deworming improved educational attendance, and future earnings.¹⁴

However, multisectoral benefits do not end with the education and health spheres. School-based programmes, for instance school retention can promote women empowerment and equity by preventing the most vulnerable from health hazards (eg, sexually transmitted infections),¹⁵ and it can also ensure targeted food safety nets for malnourished and poor children.¹⁶ By keeping girls in school, we can also avert early childhood marriages or break deeply embedded societal cultural beliefs.¹⁷ Importantly, school feeding programmes, which reach hundreds of millions of schoolchildren every day, potentially span benefits across at least the four sectors of education, health and nutrition, social protection and agriculture including local food systems.¹⁸⁻²⁰

Although numerous scholarly efforts have documented the impact, benefits and cost-effectiveness of education and health interventions,²¹⁻²³ with education benefits accruing from health interventions and health benefits accruing from education interventions, the economic evaluation framework used would not systematically account for the multiple cross-sectoral effects.

We support and argue for the need to conceptualise and apply a comprehensive value-for-money framework for investments in the rollout of school-based programmes in low- and middle-income countries (LMICs). This value-for-money framework will acknowledge and integrate multisectoral returns for education, health and nutrition, labour and social protection. It will enable us to identify interventions that yield the highest gains in human capital per budget expenditure in LMICs. Many features of our proposed framework are similar to those in traditional benefit-cost analysis (BCA). Indeed, our value-for-money framework emulates BCA methods which have long been developed and applied in many sectors (eg, environmental sector) and across sectors.²⁴⁻²⁸ Here, we especially emphasise and describe the multiple outcomes, the multisectoral impact and benefits of school-based programmes.

MULTISECTORAL RETURNS OF SCHOOL-BASED PROGRAMMES

We describe the school-based interventions from the published literature that have shown an impact on educational, health, social protection or labour outcomes, in LMIC settings. We begin by listing those interventions that have demonstrated an impact on education outcomes, as quantified by the recently developed metric of learning-adjusted years of schooling (LAYS),²⁹ which captures both quantity and quality components of education. We then report on those interventions that have shown an effect on health outcomes, whether mortality or morbidity outcomes or as quantified via the constructed disease burden metric of disability-adjusted life years (DALYs).³⁰ Lastly, we briefly present selected interventions that can impact other outcomes, in particular social protection and labour outcomes.

Returns on education outcomes

We present interventions that have shown a direct impact on improving access and learning outcomes (as captured by LAYS). We exhibit summary findings from a recent review by Angrist and colleagues,²³ which assessed the value for money of interventions in terms of LAYS gained per dollar spent, in LMICs.

LAYS adjusts the quantity of schooling for the quality of learning in each year of school. For example, in South Africa, the average child can be expected to receive 12 years of schooling. A LAYS can be interpreted as a high-quality year of schooling according to global benchmarks and be considered an analogy to DALYs (as estimated in the Global Burden of Disease study³¹) for education, enabling value-for-money comparison across a range of

outcomes. For example, if children in South Africa learn only about half as much as children in high-performing countries, such as Singapore (as measured by international achievement tests such as PISA (Programme for International Student Assessment)³² and TIMSS (Trends in International Mathematics and Science Study)³³), the LAYS measure is discounted by about half, yielding six LAYS. Alternative high-performance benchmarks can be used as well, such as regional high performers (eg, Kenya in sub-Saharan Africa). To construct LAYS on a global scale, a recent effort by the World Bank harmonised learning outcomes globally.²²

When examining specific policies in terms of LAYS, a recent review found that nearly half of education interventions did not affect education, including very popular approaches, such as general-skills teacher training or increasing teacher salaries. This reveals the importance of correctly identifying and implementing the most appropriate interventions, with an acute understanding of contextual barriers in LMIC settings. To improve education, it is also necessary to understand the real needs of society to define the skills that learners must master regardless of their age at leaving school. Integrating these elements into education programmes makes it possible to train people who are most useful to society and to facilitate

their professional integration, especially in settings with high unemployment rates.

The most effective interventions yielded just over one LAYS, showing that most education policies do not seem to work. When accounting for costs, we see approaches such as structured pedagogy and teaching at the right level yielding three to five LAYS per US\$100, closing large education gaps at low cost. Estimates ranged from 140 LAYS gained per US\$100 spent for providing information on the return to education to the government of Madagascar to 0.01 LAYS gained per US\$100 spent for a conditional cash transfer in Malawi (table 1). These results show the importance of value-for-money calculations, with multiple orders of magnitude differences in the returns even among effective policies. These findings can help governments prioritise specific policies to improve the quality of education. There are also several other interventions that can have a large impact on improving school attendance and academic performance. The primary intent of some of them is not necessarily to improve educational outcomes but to improve health (see examples provided in table 2). Indeed, some school-based health interventions can rank among the most cost-effective for education programmes, with, for example, up to six LAYS gained per US\$100 spent (table 1).

Table 1 Estimated return on learning-adjusted years of schooling (LAYS) per budget expenditure for selected school-based interventions

Intervention category	Treatment	Country	LAYS	LAYS per US\$100
Additional inputs alone (textbooks, class size, grants, libraries, etc)	Adding libraries to schools	India	#	#
Additional inputs alone (textbooks, class size, grants, libraries, etc)	Double teacher salary	Indonesia	#	#
Additional inputs alone (textbooks, class size, grants, libraries, etc)	Providing laptops to students	Colombia	#	#
General-skills teacher training (in-service)	Preschool teacher training	Malawi	#	#
Cash transfers	Conditional transfers	Malawi	0.05	0.01
School-based health programmes	Vitamin A and deworming	India	0.01	0.44
School-based health programmes	Deworming	Kenya	0.05	5.68
Early childhood development	Early child stimulation	Bangladesh	0.13	1.84
Interventions to target teaching instruction by learning level, not grade	Teaching at the right level (government-led)	India	0.17	3.84
Giving information on education benefits, costs and quality	Providing information on earnings	Madagascar	0.25	140.99
Giving merit-based scholarships to disadvantaged children and youth	Merit scholarships for girls	Kenya	0.34	1.73
Targeted intervention to reduce travel time to school	Village schools	Afghanistan	0.74	2.66
Structured lesson plans with linked materials and ongoing teacher monitoring and training	Tusome (Early Literacy Programme) and PRIMR (Primary Mathematics and Reading Initiative)	Kenya	1.04	4.9
Angrist and colleagues. ²³ #Indicates no effect.				

Table 2 Selected school-based interventions, whose primary intent is not necessarily to improve educational outcomes, but yet can positively impact school attendance and academic performance

Intervention	Country	Programme objectives	Effect size	Source(s)
School enrolment				
Childhood measles vaccination	Bangladesh	To examine the effect of childhood measles vaccination on school enrolment in Matlab, Bangladesh.	Vaccination increases the probability that a boy has enrolled in school by 7.4 pp; no effect on girls.	74
Progresa social assistance programme	Mexico	To assess how Progresa affects the schooling of youths in Mexico.	Primary school: 0.86 pp. Secondary school: 9.17 pp.	43
Social risk mitigation project	Turkey	To increase school attendance rates for the poor, or decrease dropout rates.	Primary school: 3.00 pp. Secondary school: 7.13 pp.	43
School attendance				
School-based deworming programme	Western Kenya	To assess the impact of school-based drug and educational intervention and its benefits regarding worm infection and school attendance.	Increase school attendance by 7.5% in treated children.	75
Menstrual health intervention	Uganda	To assess the effectiveness of multicomponent menstrual health intervention to improve menstrual health and hygiene and school attendance in Uganda.	<ul style="list-style-type: none"> ▲ APR [adjusted prevalence ratio] associated with missing school on period-days decreased from 1.84 (95% CI: 1.46 to 2.21) at baseline to 1.16 (0.97 to 1.38). ▲ APR associated with not attending all classes on period-days decreased from 1.79 (1.47 to 2.17) at baseline to 1.15 (0.99 to 1.32). 	76
Educational outcomes/assessments				
Intermittent preventive treatment of malaria	Western Kenya	To understand the effect of intermittent preventive treatment (IPT) in reducing anaemia and improving classroom attention and education achievement in semi-immune schoolchildren in high perennial transmission area.	<ul style="list-style-type: none"> ▲ IPT intervention group scored higher in class-based tests of sustained attention and reported a mean increase in code transmission and counting sounds test (6.05 and 1.80). 	77
Iron supplement and treatment for intestinal parasites	Democratic Republic of the Congo	To understand improvements in cognitive performance in schoolchildren, following an iron supplement and treatment for intestinal parasites.	Cognitive ability : Performance on Mental Processing Composite of K-ABC 1 month after treatment resulted in successful classification of 74%. Overall hemoglobin increased to 11.3 g/dL (SE≥0.71) from 10.3 g/dL (SD=0.86) after the intervention.	78
Childhood measles vaccination	South Africa	To estimate the causal effect of childhood measles vaccination on educational attainment among children in South Africa born between 1995 and 2000.	On average measles vaccination increases school grade attainment by 0.188 grades.	79

Continued

Table 2 Continued

Intervention	Country	Programme objectives	Effect size	Source(s)
<i>Haemophilus influenzae</i> type b (Hib) vaccination	India	To study the association between Hib vaccination and child anthropometry, cognition and schooling outcomes in India.	<ul style="list-style-type: none"> ▲ Children who received Hib vaccination were reported to have 0.25 higher height for age (HAZ), scored 4.09 pp higher in English test and 4.78 in mathematics test and attained 0.16 more schooling grades compared with unvaccinated children at age 11–12 years. ▲ Children who received Hib vaccination were reported to have 0.18 higher HAZ, scored 3.63 pp higher in English test and 3.22 in mathematics test and attained 0.15 more schooling grades compared with unvaccinated children at age 14–15 years. 	80
Gender impacts				
Conditional cash transfers	Malawi	To provide evidence on the effectiveness of conditionality for schooling among adolescent girls.	<ul style="list-style-type: none"> ▲ 10 pp increase in enrolment rates. ▲ Programme reduced dropout rate by >40%. 	63
Social risk mitigation project (social assistance; conditional cash transfer)	Turkey	The specific objectives are to increase school attendance rates for the poor, decrease dropout rates, increase immunisation coverage and enhance usage of health facilities for the beneficiaries. The programme uses an indicator-based administrative targeting method to identify ultra-poor households with children aged 0–6 years, school-aged children 6–17 years and childbearing-age women.	<ul style="list-style-type: none"> ▲ 3 pp increase in primary school enrolment after introduction. ▲ Programme raises secondary school enrolment for girls by 10.7%. ▲ Transfers from the programme led to an increase of 13.6% in the full-immunisation rate for preschool children. 	81
Cash transfer programme to boost schooling among young women in sub-Saharan Africa	Malawi	One-year schooling impacts from a conditional cash transfer experiment among teenage girls and young women in Malawi.	<ul style="list-style-type: none"> ▲ Re-enrolment rate increased by two and a half times. ▲ Dropout rate decreased from 11% at baseline to 6% after the induction of this programme. 	82
Tayssir (cash transfer programme for children; social assistance)	Morocco	To increase rural primary and secondary school participation and completion rates.	<ul style="list-style-type: none"> ▲ On average the girls and boys benefiting from this programme are 1.8 pp and 1 pp less likely to drop out of from schools, respectively. ▲ Overall, the enrolment increased by 4.5 pp, substantial increase in enrolment for girls (7 pp) with the introduction of this programme. 	83
pp, percentage points.				

Table 3 Selected school-based health interventions along with their estimated annual cost per child per year and cost per DALY averted, in low- and middle-income countries

Intervention	Cost per child per year (2012 US\$)	Cost per DALY averted
School meals	44	
Micronutrient powder supplementation	3	
Deworming: mass drug administration	0.35	3–7
Malaria: intermittent parasite clearance	2–4	24
Malaria: insecticide-treated bednets	0.40	20–50
Refractive error screening	2–3	84
Toothbrush provision	0.50	
Human papillomavirus vaccine	5–9	4500–9000
Tetanus toxoid vaccine	0.40	4

Bundy and colleagues (2017)⁹; Fernandes and Aurino (2017).³⁴ DALY, disability-adjusted life years.

Returns on health outcomes

We briefly summarise a list of potential interventions that can directly improve health outcomes, reduce mortality, morbidity and DALYs, with estimated cost and cost-effectiveness, as discussed in the *Disease Control Priorities*, third edition exercise.^{9 21 34 35} This brief excerpt from what might be an essential package of school-based health interventions could include low-cost and highly cost-effective interventions like mass drug administration for deworming, as well as immunisations like the human papillomavirus (HPV) vaccine (table 3). Furthermore, exposing schoolchildren to healthy meals can help increase optimal dietary behaviour in childhood and beyond.³⁶ School curricula which include home economics, health education and model gardens for boys and girls can positively impact health literacy and lead to sustainable healthy lifestyles. Schools are uniquely positioned to augment the reach and quality of health systems via integrated service delivery platforms and multisectoral approaches toward jointly improved health and social systems.³⁷

Returns on other outcomes

Beyond the education and health impacts, school-based interventions can also yield additional positive outcomes for other sectors. The COVID-19 pandemic disrupted food systems, supplies and security for the most vulnerable and the ongoing Russian-Ukraine war has further exacerbated the severity of food insecurity globally. Governments can use schools to improve the social protection of households by delivering in-kind transfers and strengthening safety nets.^{38–41} For example, school

feeding programmes potentially enable families to save money and reduce their vulnerability to economic fluctuations that affect food procurement and cost.^{19 42} In addition, by providing preventive health interventions, schools can prevent both communicable and non-communicable disease onset among children. Conditional cash transfer (CCT) programmes that are focused on school enrolment can increase non-employment household income and enable families to invest in the education and human capital of their children. CCTs allow households to maximise welfare by freeing child and parental time, and market resources. Hence, a higher transfer will result in greater gains in human capital production via increased school enrolment and attendance.^{43 44}

Education can also contribute to the development of local communities and economies, with the learning of traditional and indigenous knowledge in a child's formative years and by creating work opportunities for community members through various school activities. Notably, community health workers or nurses could be hired to deliver health interventions within schools. Similarly, school feeding programmes can create local jobs for cooks or food handlers, but also more skilled employment in areas like management, monitoring and quality control.⁴² Furthermore, home-grown school feeding (HGSF) programmes, which solely rely on domestically sourced food, can stir the demand for local food with multiple impacts on agricultural value chains in LMICs.^{45 46} Depending on the context, the food can be procured at the communal, district, regional or national level.⁴⁷ For instance, supply agreements with farmers or agricultural organisations can sustain farming jobs, promote diversified production systems to include nutrient-dense horticultural products and stabilise wages in rural areas.^{48–50} The structuring of local producers' organisations can enable small family farmers to respond collectively to canteen orders in terms of volume and quality level. Their connection to public orders can help stabilise their income and promote the development of local economies. Local processors, traders and the transportation sector can also benefit from continued orders of HGSF programmes.⁵¹ HGSF programmes can trigger the development of diversified value chains in rural areas and thereby improve access to nutritious food for other community members.⁵² Lastly, if marginalised groups, such as smallholder farmers, benefit from the programmes, this could ultimately reduce poverty and contribute to social protection.⁵³ In sum, these programmes can strongly engage local communities and empower them in a long-term sustainable manner.

Equity and gender impact

School-based interventions have a strong potential to yield the greatest gains to those who are most in need and are further behind at the outset.⁵⁴ Even though reaching out to and retaining those poorest children may come with higher costs, the distributional impact can be substantial, across socioeconomic groups and

subnational geographical regions, of school-based programmes. Depending on the precise context, these programmes should be designed to either be universal or to target specific population subgroups (eg, poor children, orphans, children with special needs and students with learning disabilities). However, programmes that do not target all children at school can create stigma, thus in the long run should be avoided. For example, both well-off and worse-off children have to learn health literacy including how to avoid foods and drinks with harmful health effects.

Likewise, because young women and girls are often the most vulnerable students, school-based interventions are likely to demonstrate a strong pro-girl impact. In many instances, young girls face higher risks of disease and hunger, male dominance and gender-based violence, and remain over-represented among school dropouts; this is especially true for the poorest girls.^{55–57} As such, ensuring the retention of adolescent girls at schools may yield large education and health benefits, along with possibly preventing multiple harmful consequences (eg, domestic violence, teenage pregnancy, early marriage and ensuing financial vulnerability^{17 58–62}).

For instance, CCT programmes enable households to invest in young women. They can reduce school dropouts and increase regular school attendance, thereby delaying marriage and childbearing.⁶³ In addition, certain programmes such as the female secondary school stipend programme in Bangladesh can promote mutually dependent goals like universal access and gender equality in the context of improved quality education. Such programmes can offer stipends to keep girls in school, which results in a range of positive spillovers on girls' lives such as delayed age at marriage and childbearing and higher employment and income levels.⁶⁴

In sum, the pro-poor and pro-female intents are intrinsically linked to the objectives, design and delivery of education systems and their school-based interventions. This is crucial in LMIC settings with limited financial resources but should be seen as temporary on the path to the long-term universalist vocation of school systems.

CONCEPTUALISING THE VALUE FOR MONEY OF SCHOOL-BASED INVESTMENTS

As detailed above, the value of school-based programmes covers multiple sectors. Any return on investment from school-based interventions should thus capture the full suite of impacts across sectors (eg, LAYS gained, DALYs averted, number of poverty cases avoided, number of jobs created) with multiple outcomes potentially improving simultaneously. Depending on the school-based intervention considered, there can be either large or small returns on those outcomes. For example, one additional year of education has been consistently associated with 8–12% increased future earnings⁶⁵; while school health packages can bring significant returns toward mortality

reductions from infectious diseases (eg, malaria, measles, HPV) for instance.^{34 35}

Moreover, because of the strong equity and gender potentials of school-based interventions, these outcomes, benefits and costs, should be examined across various socioeconomic groups (eg, by wealth or income quintile) and by gender (eg, girls vs boys). As a result, in addition to highlighting what might be the most cost-effective interventions (say, in terms of aggregate value for money), such disaggregation will enable prioritisation and sequencing of those interventions that are also likely to be pro-poor or pro-girl.

Furthermore, economic evaluations of school-based interventions should encompass both short-term and long-term impacts. There are rapid effects that occur on a short time scale that will be easy to track as they are simple to document: for example, the prevention of endemic infectious diseases, the improvement in school attendance and educational achievement, the in-kind transfers of meals or the local food supply and production that materialise into wages. There are also long-term effects that are more difficult to capture but should be considered: for instance, the intergenerational benefits of improved education and health to young girls toward their future working lives and the future upbringing of their children, the long-lasting benefits of lifestyle behaviour habits on the prevention of future risk factors (eg, obesity, smoking) and associated non-communicable diseases with costly treatments.

In sum, the analyst could generate a dashboard of outcomes (see^{66–68} for some illustrations for the health sector) for the quantification of school-based investments (figure 1). The empirical validity of this dashboard must be contextualised. While aiming for comprehensiveness is desirable, collecting a wide array of outcomes from school-based interventions might be difficult practically (eg, adding data collection burden and requiring financial resources). Quantifying some of these outcomes (figure 1) might necessitate hard-to-source inputs, such as longitudinal data on the linkages between educational attainment and future professional development, which might be hard to monitor in LMIC settings where informal sectors are predominant.

We can apply this value-for-money framework in practice and yield new insight and novel priority setting. Take the example of school feeding programmes, where one would quantify across wealth quintiles, women and men and regions of a country, the following outcomes (per given budget expenditure)¹⁹: the nutritional benefits and disease burden (eg, anaemia cases, worm infections) averted among schoolchildren; the additional days of education gained via retention in schools; the monetary value of a free school meal for families, especially for the poorest ones; and the translation of increased food production via school meals into stable prices and markets for local farmers. As such, the dashboard of outcomes would capture the full range of multisectoral returns conveyed by school meals, potentially enabling

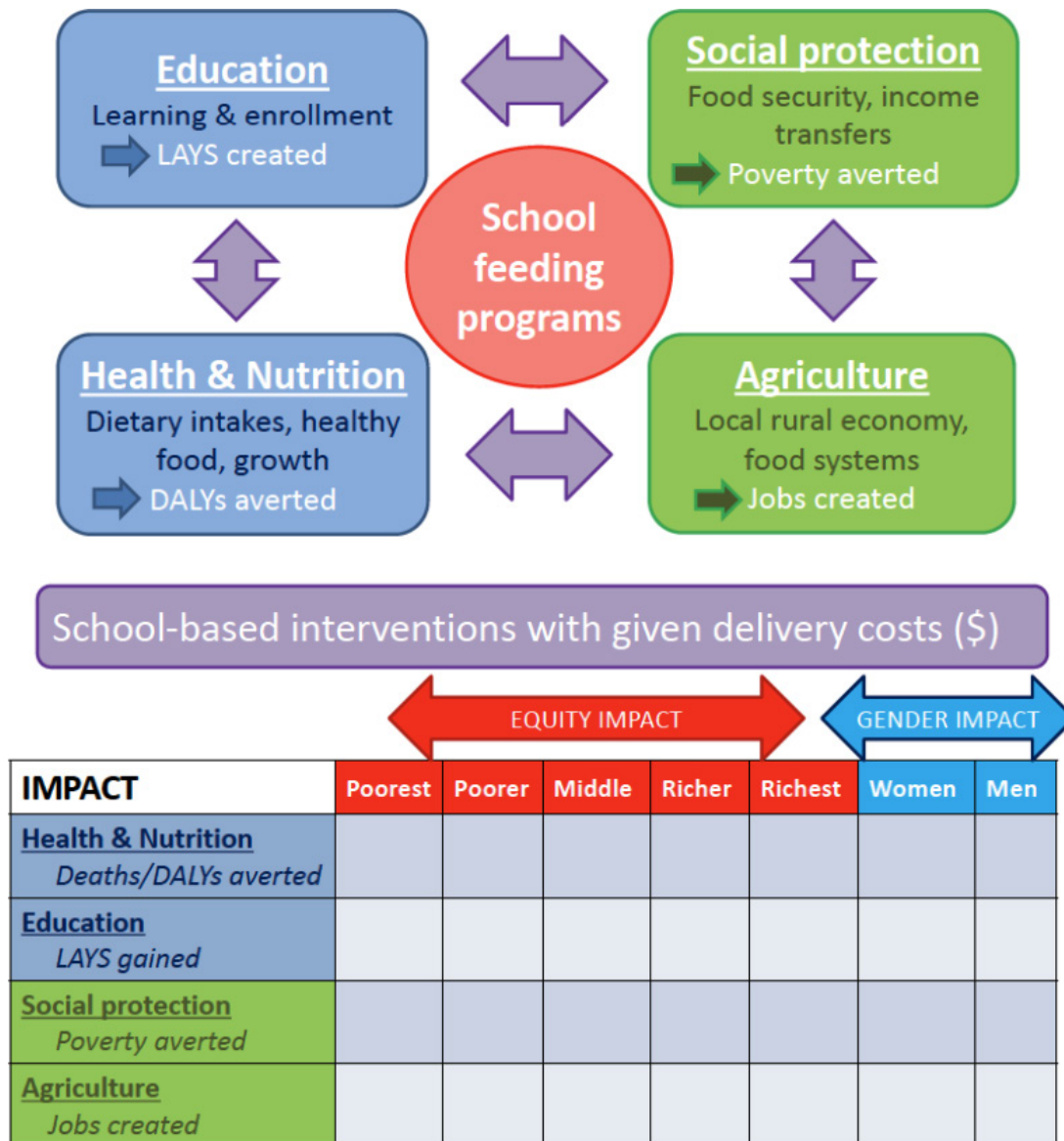


Figure 1 Conceptualisation of an analytical dashboard for assessing the value for money of school-based interventions, with the illustrative example of school feeding programmes. DALY, disability-adjusted life years; LAYS, learning-adjusted years of schooling.

the involvement of the key sectors and stakeholders charged with priority setting and policy implementation.

SUSTAINABILITY AND FINANCING

The most relevant audience for multisectoral impacts would ultimately involve ministries of finance, and offices of presidents and prime ministers, as well as donors and funding agencies. These entities can often ensure cross-sectoral coordination so that the most effective and cost-effective integrated approaches are implemented.

Moreover, when considering expanding or making new programme investments and reviewing evidence on returns on investment, ministries of finance will need to examine in detail the running costs, fixed and marginal costs associated with the implementation of those programmes. In addition, the question—and

opportunity cost—remains regarding which sectoral or cross-sectoral budgets should be mobilised to fund school-based interventions. An implication of our value-for-money framework is that an optimal budget could resource programmes across multiple sectors, rather than the more typical approach of single-sector budgeting and involve multisectoral stakeholders, depending on where the benefits and costs of the school-based interventions are incurred sector-wise.^{69 70}

Take school feeding programmes as an illustration. For many countries, it will be critical to evaluate the future costs of fully decentralising and transferring the delivery (hence operating costs) of those programmes to the local communities and administrative districts. As a result, linking school-based programme investments to public budget expenditure and financing is essential. In many

countries, the scale-up of school-based programmes will need to be effectively tied to the national political economy of donor versus domestic financing, as well as considerations of private sector financing and eventually linked to the path toward economic growth and 'graduation from aid'.

Furthermore, the coordination and management of school-based programmes can also benefit from assessments relying on the value-for-money framework. Ministries of education are often the custodian of school-based programmes,⁷¹ but joint evidence of impacts on health, labour and social protection can convince the respective ministries to contribute to the implementation and develop co-financing models.^{72 73} Depending on the type of programme and the range of outcomes, the list of potentially participating ministries can be even longer. For example, the ministry of agriculture and local governments should be involved in HGSF programmes. A multisectoral collaboration of ministries has various advantages. First, due to un-siloed programme development, experts from different ministries can contribute with their sectoral knowledge to harness synergies and thereby make programme implementation cost-effective. For example, school feeding programmes can be designed to be cohesive with other social assistance tools in a country.⁷² Second, collaboration can reduce implementation costs. Third, compared with programmes managed by an individual ministry, a consortium will be in a stronger position to advocate for sustainable funding of school-based programmes with the ministry of finance, which can also be beneficial when negotiating the funding size of a programme. Finally, a broad ministerial involvement in school-based programmes can push for the programmes being written in policies and thereby achieve their political sustainability. For example, with the aim of securing their continuance, school feeding programmes have been documented in sectoral policies, and in some cases, national school feeding policies have been designed or school feeding laws adopted by parliaments.⁷² However, there remains a need to have a unified comprehensive, and cohesive school-feeding policy that pulls all the sectors together to de-silo the approach to school feeding planning, implementation, monitoring and accountability. Most importantly, regarding implementation, focusing on community involvement and the importance of local leaders will be decisive for strong community engagement and promotion of the sustainability of HGSF programmes.

CONCLUSIONS

Accelerating progress toward the 2030 SDGs requires investment in the next generation of learners. We need to reach children and their families most effectively and cost-effectively. School-based interventions represent a unique opportunity to deliver multiple types of policies and programmes and to improve human capital sustainably in LMICs. In addition, many school-based

programmes have impacts across sectors, including health and education. This implies that economic evaluations of public policies must expand to demonstrate return on investment making it more likely that governments and donors will be willing to provide financing. The proposed value-for-money framework is one possible tool to help researchers, policymakers and funders to address the limitations of current evaluation approaches, foster multisectoral collaboration to accelerate progress toward the SDGs.

Author affiliations

¹Department of Global Health and Population, Harvard TH Chan School of Public Health, Boston, Massachusetts, USA

²Tufts University, Medford, Massachusetts, USA

³World Food Programme, Rome, Italy

⁴World Food Programme, Lilongwe, Malawi

⁵Ministry of Education Science and Technology, Lilongwe, Malawi

⁶Maternal, Child and Adolescent Health Lead Executive Officer, Ethiopia Ministry of Health, Addis Ababa, Ethiopia

⁷FAO/AUDA-NEPAD (African Union Development Agency – New Partnership for Africa's Development), Johannesburg, South Africa

⁸Tsinghua Vanke School of Public Health, Beijing, China

⁹SAMRC Wits Centre for Health Economics and Decision Science PRICELESS SA, University of Witwatersrand School of Public Health, Johannesburg, South Africa

¹⁰Organization for Economic Cooperation and Development, Paris, France

¹¹QualiSud, Univ Montpellier, Institut Agro, CIRAD, Avignon Université, Université de La Réunion, Montpellier, France

¹²National Institute for Health and Welfare, Helsinki, Finland

¹³University of Ottawa, Ottawa, Ontario, Canada

¹⁴Research Consortium for the School Meals Coalition, London School of Hygiene and Tropical Medicine, London, UK

¹⁵University of Oxford, Oxford, UK

¹⁶Youth Impact, Gaborone, Botswana

Twitter Stéphane Verguet @StephaneVerguet, Sylvie Avallone @SylvieAvallone and Noam Angrist @angrist_noam

Acknowledgements We are grateful for the support of the Research Consortium for School Health and Nutrition, an initiative of the School Meals Coalition of 95 countries and 112 organizations (as of November 2023) which have committed to rebuilding and strengthening national school health and nutrition programmes affected by the COVID pandemic. The Research Consortium was created by the Coalition to provide national policymakers and programme designers with evidence-based programmatic guidance, and currently receives principal support from: Dubai Cares, UAE; the Federal Ministry for Economic Cooperation and Development, Germany; the International Development Research Centre, Canada; NORAD, the Norwegian Agency for Development Cooperation; the Novo Nordisk Foundation, Denmark; the Rockefeller Foundation, USA; and the World Food Programme, Rome. The Secretariat of the Research Consortium is hosted by the London School of Hygiene & Tropical Medicine. AE and KH are supported by the SAMRC/Wits Centre for Health Economics and Decision Science - PRICELESS SA (grant number 23108). We thank two anonymous reviewers for their valuable comments.

Contributors SV, NA and DAPB conceptualised and designed the report. PG conducted data collection with inputs from IA. SV wrote the original draft with inputs from PG, IA, NA and DAPB. PG, IA, AH, SM, CB, EL-E, MC, MM, AS, MZ, BG, ZL, AE, KH, CG, SA, HK, EK, LS, DAPB and NA reviewed and edited the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Stéphane Verguet <http://orcid.org/0000-0003-4128-0849>

Agnes Erzse <http://orcid.org/0000-0001-9303-9323>

REFERENCES

- Chancel L, Piketty T, Saez E, et al. World inequality report 2022. In: *World inequality report 2022*. World Inequality Lab, 31 December 2022.
- Miguel E, Mobarak AM. The Economics of the COVID-19 pandemic in poor countries. *Annu Rev Econ* 2022;14:253–85.
- Alesina A, Angeletos GM. Fairness and redistribution. *American Economic Review* 2005;95:960–80.
- Prasad N. *Policies for redistribution: the use of taxes and social transfers. Discussion Paper 194*. Geneva, Switzerland: International Institute for Labor Studies, 2008.
- United Nations. Sustainable Development Goals, Available: <https://sdgs.un.org/goals> [Accessed 23 Aug 2022].
- United Nations Development Programme. Human development index (HDI). Available: <http://hdr.undp.org/en/content/human-development-index-hdi> [Accessed 24 Jan 2022].
- World Bank. *The Human Capital Index 2020 Update: Human Capital in the Time of COVID-19*. Washington, DC: World Bank, 2020.
- World Bank, UNESCO and UNICEF. *The State of the Global Education Crisis: A Path to Recovery*. Washington D.C., Paris, New York: The World Bank, UNESCO, and UNICEF, 2021.
- Bundy DAP, Schultz L, Sarr B, et al. The school as a platform for addressing health in middle childhood and adolescence. In: Bundy DAP, et al, ed. *Disease Control Priorities Third Edition, Volume 8: Child and Adolescent Health and Development*. Washington, DC: World Bank, 2018.
- Appleby LJ, Tadesse G, Wuletawu Y, et al. Integrated delivery of school health interventions through the school platform: investing for the future. *PLoS Negl Trop Dis* 2019;13:e0006449.
- LaMontagne S, Cernushi T, Yakubu A, et al. School-based delivery of vaccines to 5- to 19- year-olds. In: Bundy DAP, et al, ed. *Disease Control Priorities Third Edition, Volume 8: Child and Adolescent Health and Development*. Washington, DC: World Bank, 2018.
- Snilstveit B, Stevenson J, Menon R, et al. *The impact of education programmes on learning and school participation in low- and middle-income countries. 3ie Systematic Review Summary 7*. London: International Initiative for Impact Evaluation (3ie), 2016. Available: https://www.3ieimpact.org/sites/default/files/2019-05/SR24-education-review_2.pdf
- Aurino E, Gelli A, Adamba C, et al. Food for thought? experimental evidence on the learning impacts of a large-scale school feeding program. *J Hum Resour Manag* 2020.
- Miguel E, Kremer M. Worms: identifying impacts on education and health in the presence of treatment externalities. *Econometrica* 2004;72:159–217.
- Jukes M, Simmons S, Bundy D. Education and vulnerability: the role of schools in protecting young women and girls from HIV in Southern Africa. *AIDS* 2008;22 Suppl 4:S41–56.
- Beegle K, Coudouel A, Monsalve E. *Realizing the full potential of social safety nets in Africa*. Washington, DC: World Bank, 2018.
- Oye M, Prritchett L, Sandefur J. *Girls' schooling is good, girls' schooling with learning is better. Background paper – the learning generation*. Washington, DC: Center for Global Development, 2016. Available: <http://report.educationcommission.org/wp-content/uploads/2017/01/Girls-Schooling-is-Good-Girls-Schooling-with-Learning-is-Better.pdf>
- Bundy DAP, de Silva N, Horton S, et al. Re-imagining school feeding: a high return investment in human capital and local economies. In: Bundy DAP, et al, ed. *Disease Control Priorities Third Edition, Volume 8: Child and Adolescent Health and Development*. Washington, DC: World Bank, 2018.
- Verguet S, Limasalle P, Chakrabarti A, et al. The broader economic value of school feeding programs in low- and middle-income countries: estimating the multi-sectoral returns to public health, human capital, social protection, and the local economy. *Front Public Health* 2020;8:587046.
- Organization for Economic Cooperation and Development (OECD). *Making better policies for food systems*. Paris: OECD, 2021. Available: https://www.oecd-ilibrary.org/agriculture-and-food/making-better-policies-for-food-systems_ddfba4de-en
- Disease Control Priorities, 3rd edition, Available: <http://www.dcp-3.org> [Accessed 24 Jan 2022].
- Angrist N, Djankov S, Goldberg PK, et al. Measuring human capital using global learning data. *Nature* 2021;592:403–8.
- Angrist N, Evans DK, Filmer D, et al. *How to improve education outcomes most efficiently? A comparison of 150 interventions using the new learning-adjusted years of schooling metric. Policy research working paper 9450*. Washington, DC: World Bank, 2020.
- Robinson LA, Hammitt JK, Cecchini M, et al. *Reference case guidelines for benefit-cost analysis in global health and development*. 2019. Available: <https://www.hsph.harvard.edu/wp-content/uploads/sites/2447/2019/05/BCA-Guidelines-May-2019.pdf>
- Robinson LA, Hammitt JK, O’Keeffe L. Valuing mortality risk reductions in global benefit-cost analysis. *J Benefit Cost Anal* 2019;10(Suppl 1):15–50.
- Copenhagen Consensus Center, Available: <https://www.copenhagenconsensus.com/> [Accessed 30 Mar 2023].
- Jamison DT, Jha P, Laxminarayan R, et al. Infectious disease. In: Lomborg B, ed. *Global problems, smart solutions: costs and benefits*. Cambridge, UK: Cambridge University Press, 2013.
- Jha P, Nugent R, Verguet S, et al. Chronic disease. In: Lomborg B, ed. *Global problems, smart solutions: costs and benefits*. Cambridge, UK: Cambridge University Press, 2013.
- Filmer D, Rogers H, Angrist N, et al. Learning-adjusted years of schooling (LAYS): defining a new macro measure of education. *Econ Educ Rev* 2020;77:101971.
- World Health Organization. Disability-adjusted life years (DALYs). 2023. Available: <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/158> [Accessed 24 Jan 2022].
- Institute for Health Metrics and Evaluation. Global Burden of Disease, Available: <https://www.healthdata.org/gbd/2019>
- National Center for Education Statistics. Program for International student assessment (PISA). Available: <https://nces.ed.gov/surveys/pisa/>
- National Center for Education Statistics. Trends in International Mathematics and Science Study (TIMSS), Available: <https://nces.ed.gov/timss/>
- Fernandes M, Aurino E. Identifying an essential package for school-age child health: economic analysis. In: Bundy DAP, et al, ed. *Disease Control Priorities Third Edition, Volume 8: Child and Adolescent Health and Development*. Washington, DC: World Bank, 2018.
- Jamison DT, Alwan A, Mock CN, et al. Universal health coverage and intersectoral action for health: key messages from disease control priorities, 3RD edition. *Lancet* 2018;391:1108–20.
- Organization for Economic Cooperation and Development (OECD). *The heavy burden of obesity*. Paris: OECD, 2019. Available: https://www.oecd-ilibrary.org/social-issues-migration-health/the-heavy-burden-of-obesity_67450d67-en [accessed 29 Aug 2022].
- Kruk ME, Lewis TP, Arsenault C, et al. Improving health and social systems for all children in LMICs: structural innovations to deliver high-quality services. *Lancet* 2022;399:1830–44.
- Gentilini U. Social protection in the “real world”: issues, models and challenges. *Dev Policy Rev* 2009;27:147–66.
- Gentilini U, Omamo SW. Social protection 2.0: exploring issues, evidence and debates in a Globalizing world. *Food Policy* 2011;36:329–40.
- Biscaye PE, Egger DT, Pape UJ. *Balancing Childcare: evidence from COVID-19 school closures and Reopenings in Kenya. Policy research working paper 9958*. Washington, DC: World Bank, 2022.
- Organization for Economic Cooperation and Development (OECD). *Looking beyond COVID-19: Strengthening family support services across the OECD*. Paris: OECD, 2021. Available: <https://www.oecd-ilibrary.org/docserver/86738ab2-en.pdf?expires=1661697526&id=id&accname=guest&checksum=526F6F5D9BF6C5C766A50E8464BC691D> [accessed 29 Aug 2022].
- World Food Programme. *State of School Feeding Worldwide 2020*. Rome: World Food Programme, 2021.
- García S, Saavedra JE. Educational impacts and cost-effectiveness of conditional cash transfer programs in developing countries: a meta-analysis. *Review of Educational Research* 2017;87:921–65.
- García S, Saavedra JE. *Conditional cash transfers for education. NBER Working Paper Series. Working Paper 29758*. 2022.
- Fernandes M, Galloway R, Gelli A, et al. Enhancing linkages between healthy diets, local agriculture, and sustainable food systems: the school meals planner package in Ghana. *Food Nutr Bull* 2016;37:571–84.

- 46 Singh S, Fernandes M. Home-grown school feeding: promoting local production systems diversification through nutrition sensitive Agriculture. *Food Secur* 2018;10:111–9.
- 47 FAO & WFP. FAO and WFP; Home-grown school feeding. Resource Framework. Technical Document Rome, . 2018 Available: <https://docs.wfp.org/api/documents/WFP-0000074274/download/> [Accessed 22 Jul 2023].
- 48 World Food Programme. *How school meals contribute to the Sustainable Development Goals - A collection of evidence*. Rome: World Food Programme, 2017. Available: <https://docs.wfp.org/api/documents/b91da1b2fa2344f6b9f4bad1cfbca40a/download/#:~:text=When%20the%20rations%20are%20appropriately,morbidity%2C%20and%20increased%20learning%20capacities> [accessed 22 Jul 2023].
- 49 World Food Programme. *Home-grown school feeding: a framework to link school feeding with local agricultural production*. Rome: World Food Programme, 2014.
- 50 Devereux S, Sabates-Wheeler R, Martinez AP. Home-grown school feeding and social protection. Partnership for Child Development, Working Paper no.216. Institute of Development Studies 2010, Available: https://www.researchgate.net/profile/Rachel-Sabates-Wheeler/publication/265220001_Home-Grown_School_Feeding_Social_Protection/links/54884ceb0cf268d28f08cfe0/Home-Grown-School-Feeding-Social-Protection.pdf [Accessed 22 Jul 2023].
- 51 Gelli A, Kretschmer A, Molinas L, et al. *A comparison of supply chains for school food: Exploring operational trade-offs across implementation models*. World Food Programme HGSF Working Paper Series no.7. 2013.
- 52 Gelli A, Donovan J, Margolies A, et al. Value chains to improve diets: diagnostics to support intervention design in Malawi. *Global Food Security* 2020;25:100321.
- 53 Giunti S, Aurino E, Masset E, et al. *Impact evaluation of home-grown school feeding programmes - Methodological guidelines*. Rome: FAO, 2022. Available: <https://www.fao.org/3/cb8970en/cb8970en.pdf> [accessed 22 Jul 2023].
- 54 UNESCO. *Global Education Monitoring Report 2020: inclusion and education*. Paris: UNESCO, 2020.
- 55 Bundy DAP. *Rethinking school health: a key component of education for all*. *Directions in Development*. Washington, DC: World Bank, 2011.
- 56 Burzynska K, Contreras G. Gendered effects of school closures during the COVID-19 pandemic. *Lancet* 2020;395:S0140-6736(20)31377-5.
- 57 UNESCO. *Global Education Monitoring Report - Gender Report: a new generation: 25 years of efforts for gender equality in education*. Paris: UNESCO, 2020.
- 58 Baird S, Chirwa E, McIntosh C, et al. The short-term impacts of a schooling conditional cash transfer on the sexual behavior of young women. *Health Econ* 2010;19 Suppl:55–68.
- 59 Verguet S, Nandi A, Filippi V, et al. Maternal-related deaths and Impoverishment among adolescent girls in India and Niger: findings from a Modelling study. *BMJ Open* 2016;6:e011586.
- 60 Psaki S, Haberland N, Mensch B, et al. Policies and interventions to remove gender-related barriers to girls' school participation and learning in low- and middle-income countries: a systematic review of the evidence. *Campbell Syst Rev* 2022;18:e1207.
- 61 Musadiqq T, Said F. Educate the girls: long run effects of secondary schooling for girls in Pakistan. 2021. Available: <https://socialprotection.org/discover/publications/educate-girls-long-run-effects-secondary-schooling-girls-pakistan> [Accessed 29 Aug 2022].
- 62 Sol L, Nillesen EE, Smeets P. Breaking down Menstrual barriers in Bangladesh. 2021. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3847266 [accessed 29 Aug 2022].
- 63 Baird S, McIntosh C, Ozler B. Cash or condition? evidence from a cash transfer experiment. *Q J Econ* 2011;126:1709–53.
- 64 Mahmud S. Female secondary school Stipend programme in Bangladesh: a critical assessment. Available: <https://unesdoc.unesco.org/ark:/48223/pf0000146803>
- 65 Psacharopoulos G, Patrinos HA. Returns to investment in education: a Decennial review of the global literature. *Educ Econ* 2018;26:445–58.
- 66 Verguet S, Norheim OF. Estimating and comparing health and financial risk protection outcomes in economic evaluations. *Value Health* 2022;25:238–46.
- 67 Verguet S, Hailu A, Eregata GT, et al. Toward universal health coverage in the post-COVID-19 era. *Nat Med* 2021;27:380–7.
- 68 De Neve J-W, Andriantavison RL, Croke K, et al. Health, financial, and education gains of investing in preventive chemotherapy for schistosomiasis, soil-transmitted helminthiases, and lymphatic filariasis in Madagascar: a modeling study. *PLoS Negl Trop Dis* 2018;12:e0007002.
- 69 Ramponi F, Walker S, Griffin S, et al. Cost-effectiveness analysis of public health interventions with impacts on health and criminal justice: an applied cross-sectoral analysis of an alcohol misuse intervention. *Health Econ* 2021;30:972–88.
- 70 Ramponi F, Nkhoma D, Griffin S. Informing decisions with disparate stakeholders: cross-sector evaluation of cash transfers in Malawi. *Health Policy Plan* 2022;37:140–51.
- 71 World Food Programme. *State of School Feeding Worldwide 2013*. Rome: World Food Programme, 2013.
- 72 World Food Programme. *Financing School Feeding. Levers to enhance national programmes*, . 2020 Available: <https://docs.wfp.org/api/documents/WFP-0000115689/download/> [Accessed 22 Jul 2023].
- 73 McGuire F, Vijayasingham L, Vassall A, et al. Financing Intersectoral action for health: a systematic review of Co-financing models. *Global Health* 2019;15:86.
- 74 Driessen J, Razzaque A, Walker D, et al. The effect of childhood measles vaccination on school Enrolment in Matlab, Bangladesh. *App Econ* 2015;47:6019–40.
- 75 Aiken AM, Davey C, Hargreaves JR, et al. Re-analysis of health and educational impacts of a school-based deworming programme in Western Kenya: a pure replication. *Int J Epidemiol* 2015;44:1572–80.
- 76 Kansime C, Hytti L, Nalugya R, et al. Menstrual health intervention and school attendance in Uganda (MENISCUS-2): a pilot intervention study. *BMJ Open* 2020;10:e031182.
- 77 Clarke SE, Jukes MC, Njagi JK, et al. Effect of intermittent preventive treatment of malaria on health and education in schoolchildren: a cluster-randomised, double-blind, placebo-controlled trial. *Lancet* 2008;372:127–38.
- 78 Boivin MJ, Giordani B. Improvements in cognitive performance for schoolchildren in Zaire, Africa, following an iron supplement and treatment for intestinal parasites. *J Pediatr Psychol* 1993;18:249–64.
- 79 Anekwe TD, Newell M-L, Tanser F, et al. The causal effect of childhood measles vaccination on educational attainment: A mother fixed-effects study in rural South Africa. *Vaccine* 2015;33:5020–6.
- 80 Nandi A, Deolalikar AB, Bloom DE, et al. Haemophilus influenzae type B vaccination and anthropometric, cognitive, and schooling outcomes among Indian children. *Ann N Y Acad Sci* 2019;1449:70–82.
- 81 Ahmed A, Gilligan D, Kudat A, et al. *Interim impact evaluation of the conditional cash transfer program in Turkey: A quantitative assessment*. Washington, DC: International Food Policy Research Institute, 2006.
- 82 Baird S, McIntosh C, Ozler B. Designing cost-effective cash transfer programs to boost schooling among young women in sub-Saharan Africa. *World Bank Policy Research Working Paper* 2009.
- 83 Gazeaud J, Ricard C. *Conditional cash transfers and the learning crisis: evidence from Tayssir scale-up in Morocco*. Universidade Nova de Lisboa, Nova School of Business and Economics, NOVAFRICA, 2021.