Effect of pay for performance on the quality of antenatal care in Zimbabwe: a controlled before-after study

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Declaration

I, Ashis Kumar Das, 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.

Ashis Das

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Abstract

Background: Pay for Performance (P4P) mechanisms to health facilities and providers are currently being tested in several low- and middle-income countries (LMIC) to improve maternal and child health (MCH). Though quality of care is necessary to improve MCH, the prevailing evidence on P4P's effect on MCH quality is limited. Zimbabwe implemented a P4P program from April 2012 to September 2014 to improve its adverse scenario on MCH indicators. This study explores the effect of the P4P program on the quality of antenatal care (ANC) on the following three dimensions – structural quality, process quality and client satisfaction.

Methods: The study design was a controlled before-after implementation evaluation in 16 matched pairs of rural districts. Intervention facilities (n=374) received P4P, while control facilities (n=331) continued with the routine government program. Out of these, a subset of 77 randomly selected health facilities and the ANC clients attending these facilities were surveyed before implementation of P4P (385 clients) and after implementation (374 clients) to measure the impact of the program. The impact of P4P was estimated on an intention-to-treat basis by comparing the difference-in-difference in the indices of impact between the two arms of the study. Multilevel regression analyses were used to account for the hierarchical study design.

Results: All dimensions of quality showed significant improvements in the P4P arm – structural index was 0.595 standard deviations (SD) higher (p=0.023), process index 0.556 SD (p=0.001) and client satisfaction index 0.6 SD (p=0.001) higher than the mean of the respective index in the control group. Clients consulting a nurse or a male healthcare provider reported higher process quality and satisfaction, whereas those visiting a nurse midwife had lower process quality and client satisfaction. Women with lower levels of wealth and education reported lower process quality but higher satisfaction in the P4P arm.

Discussion: The Zimbabwe P4P showed improvements in the quality of ANC. However, there is a need for further exploration of the contextual factors to understand the mechanisms of these improvements.

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Acronyms

AIC – Akaike Information Criterion
ANC – Antenatal care
BIC – Bayesian Information Criterion
BP – Blood pressure
CBA – Controlled before-after studies
CCT – Controlled clinical trials
c-RCT – Clustered randomized controlled trials
df – degrees of freedom
DH – District hospital
DHE – District Health Executive
DHS – Demographic and Household Survey
DO – Direct clinical observations
DRC – Democratic Republic of Congo
EmONC – Emergency obstetric and neonatal care
EPOC – Cochrane Effective Practice and Organization of Care group
FANC – Focused antenatal care
GDP – Gross domestic product
GoZ – Government of Zimbabwe
Hb – Hemoglobin
HIV – Human immunodeficiency virus
ICC – Intra cluster correlation coefficient
IoM – Institute of medicine
IPT – Intermittent preventive treatment for malaria
ISCTRN – International Standard Randomized Controlled Trial Number
LMIC – Low- and middle-income countries
LMP – Last menstrual period
LSHTM – London School of Hygiene and Tropical Medicine
MCH – Maternal and child health
MDG – Millennium development goals
MeSH – Medical subject heading
MICS – Multiple Indicator Cluster Survey
MLM – Multi-level modeling
MMR – Maternal mortality ratio
MoHCC – Ministry of Health and Child Care
NCD – Non-communicable diseases
NGO – Non-governmental organizations
NHS – National Health Strategy
NIHFA – National Integrated Health Facility Assessment
OOPS – Out-of-pocket payments
P4P – Pay for performance
PCA – Principal component analysis
PHC – Primary healthcare
PhD – Doctorate of philosophy
PMTCT – Prevention of mother to child transmission of HIV/AIDS

PNC – Postnatal care
PPP – Purchasing power parity
QoC – Quality of care
QoF – Quality and Outcomes Framework
RBF – Results based financing
RCT – Randomized controlled trials
RDT – Rapid diagnostic test for malaria
RH – Rural hospital
RHC – Rural health center
RPR – Rapid plasma reagin for syphilis
SD – Standard deviation
SE – Standard error
SP – Standardized patients
SSA – Sub-Saharan African
TT – Tetanus toxoid vaccine
UNDP – United Nations Development Program
WHO – World Health Organization

Chapter 1: Introduction

1.1 Overview

This chapter explains key concepts related to pay for performance (P4P) and quality of health care. It gives an overall conceptual understanding, goals, functioning, impact and challenges of P4P, and describes the concept of quality of care across various dimensions and methods to measure quality of care.

1.2 Pay for performance: an overview

P4P has been experimented as an innovative strategy to improve availability, quality, utilization and cost-effectiveness of essential healthcare services in both low- and high-income countries.[1] P4P is a supply-side mechanism in which financial incentives are provided to facilities and/or providers conditional upon meeting certain performance targets.[2] Results to be achieved and incentives to be received are usually mutually agreed upon and laid down in contractual agreements between different actors in the health system.[2,3] For example, the Ministry of Health at the national level (purchaser) can have contracts with health facilities (providers) to deliver a set of services with pre-defined prices, incentives and measurements for those services.[4]

This type of purchasing healthcare services through 'output-based financing' differs from the classic type of 'input based financing' in which participants (health facilities and providers) receive funding based on pre-defined annual plans and budgets.[4] P4P belongs to the category of innovative financing mechanisms that includes similar type of performance-oriented payment systems such as results-based financing, performance-based financing, performance-based contracting and output-based aid.[1] The approach to define P4P varies upon the context, especially on the goal of programs, stakeholders involved, type of contract for providers, and purchase and payment for services.[5] Box 1 gives different definitions of P4P from a few development agencies who were pioneers in experimenting with P4P programs globally.

Box-1.1

Definitions of P4P

- "The use of payment methods and other incentives to encourage quality improvement and patient focused high value care." (*Centers for Medicare and Medicaid Services, USA*)
- "The general strategy of promoting quality improvement by rewarding providers (physicians, clinics or hospitals) who meet certain performance expectations with respect to health care quality or efficiency." *(RAND Corporation, USA)*
- "A range of mechanisms designed to enhance the performance of the health system through incentive- based payments." (The World Bank)
- "P4P introduces incentives (generally financial) to reward attainment of positive health results." (USAID)

Source: Allen, T et al. 2014[5]

1.2.1 Economic Theory behind financial incentives

Financial incentives, especially P4P is postulated to solve the principal-agent problem in the health system functioning.[5] In a situation where the principal–agent problem prevails, one party (the agent) is required to act on behalf of another (the principal), with varying utility-maximizing objectives for each party.[5–10] Typically, it is postulated that the principal tries to win over the situation if there are uncertainties for profit gain and there are likelihoods of the agent loosing.[9] Thus, there are possibilities of persistent conflicts and uncertainties in the routine healthcare system functioning.[5] For instance, the main objective of a Provincial Health Authority may be reducing maternal death, while providers would like to retain their salary regardless of the level of maternal mortality. Providers may also want to retain their workload.[9] When it comes to assessing providers' effort, health outcomes are only a proxy for their effort or behavior.[9] This is because health outcomes are also affected by certain unobservable phenomena.[9] Health outcomes are not purely within the control of providers.[9] For example, patient behavior is a key determinant of health outcomes.[5,9] This situation where it is not easy to identify provider's effort may lead to potential misalignment of provider behavior.[9] Finally, there can be conflicts between the health authorities and the providers as a principal-agent problem.[5]

P4P tries to solve this principal-agent problem by providing the agent (providers) with a financial incentive to perform the delegated duties.[5,8,10] Since the agent intends to maximize utility, P4P tries to meet certain conditionalities.[8,10] For instance, the utility of the agent created by the incentives needs to be larger than the decrease in the agent's utility resulting from performing the delegated workload. This situation is called the "incentive compatibility constraint".[5] Also, the increment in the agent's utility created by the incentive needs to be more than the utility obtained from not performing the delegated work. This situation is known as the "participation constraint".[7] P4P in principle, through the incentive tries to align the interests of both the agent and the principal.

As per Allen et al. 2014, in the health sector, the underlying theories of P4P cannot be applied without adaptation.[5] This limited application of the mainstream theories is due to four reasons; 1) dual agency, 2) measurement difficulties, 3) team production, and 4) intrinsic motivation.[5]

Dual agency occurs as the agent (physician) needs to act on behalf of two principals, who are the patient and the health authority.[5] Since the interests of the principals differ from each other, it is necessary for the physician to please both.[5] Similarly, measuring the level of physician effort is difficult in health care.[5,9] In P4P, it is essential to measure certain outcomes such as patient health, but this is often a combined effect of the provider effort and the patient compliance. Provision of health care is more of a team effort and not solely by an individual provider.[5,8] Therefore, performance payment is often targeted at teams, mainly with a purpose that incentive structure should not induce free-riding.[5] In free-riding, there is a possibility of an individual provider reducing the effort because performance is measured at the group level.[8] Intrinsic motivators such as altruism or professionalism can be important under P4P, as providers receive utility from their own salary, incentive and the reputation.[9]

Theories also postulate a few potential unintended consequences for financial incentives.[5,10] P4P allocates risks across both the principal and the agent, and faces the problem of observability.[5] However, since providers (agents) are required to perform multiple tasks, they may narrow-down their focus to a few measurable tasks (e.g. waiting time) than non-measurable duties (e.g. patient compliance or experience).[5] Under P4P, there is also chance for diversion of effort, but this can be prevented if different tasks can be easily delegated to separate agents.[10] The other postulated harmful effects of P4P are as follows – (1) tunnel vision (diversion of effort away from non-incentivized activities); (2) sub-optimization (disconnect between agents' objective from overall organizational objectives); (3) myopia (short-termism); (4) measure fixation (focus on measures of success and not underlying objectives); (5) misrepresentation (manipulation of measures such that reported performance exceeds actual performance); (6) gaming (changing actual behavior to make the scheme suitable for the agent): e.g. carefully choosing patients who need less P4P procedures to reduce providers' effort; and (7) ossification (organizational paralysis and innovation stifling caused by narrow targets).[5,10]

1.2.2 Context and target for P4P in health systems

Countries have experimented several strategies to improve the coverage, quality and efficiency of healthcare services from time to time, such as input based financing, global budgeting and grant-based financing for health facilities and providers.[11] P4P is a new strategy in the category of innovative health sector reforms which is multi-pronged in its aims and trajectory, unlike the conventional strategies of financing health services.[12] For instance, P4P envisages a strict monitoring of the performance of health facilities and providers.[13] However, its target performance indicators are not focused on provider performance alone.[14] On the contrary, P4P also considers provider performance indicators which are linked to patient-side such as client satisfaction.[13] Thus, in a way P4P intends to integrate both demand- and supply-sides by using appropriate indicators to monitor performance. P4P aims at close interaction with different levels of health system, as it involves each of them with different roles.[13] For instance, health facilities and physicians are usually the providers, higher level authorities at the national or provincial levels in the healthcare system are purchasers of care, while a third party (e.g. community-based organizations) can be the verifier of performance.[14]

One of the major reasons for introducing P4P was the sup-optimal performance of healthcare delivery system, especially on its productivity and efficiency dimensions.[12] For example, in high-income countries, coverage had increased considerably, yet the services were delivered at low quality and at higher costs.[5,12] Therefore, it was necessary to ensure the quality of services along with cost minimizations and optimal provider motivation.[12] In low-income countries, due to the weak status of healthcare system (e.g. limited infrastructure, supplies and skilled providers), coverage of services has been a key challenge.[14] In addition, providers were less motivated to perform mainly due to the limited financial capacity with the Government leading to under-payment and inferior working environment.[15] Thus, it was necessary to improve the status of healthcare system along with provider performance to improve the usage and quality of services.[14] Governments in these countries felt the need for a comprehensive strategy such as P4P to address the essential health goals such as millennium development goals (MDG).[16]

Although P4P has been operational since the 1990s, it gained more world-wide popularity only once it obtained a bigger scale across the USA during the 2000s.[17] Another break-through for P4P was the implementation of the large-scale Quality and Outcomes Framework (QOF) for primary care in the UK in the 2000s.[18] Although P4P is currently being implemented in countries of all income levels, the primary target of P4P mechanisms varies between low- and high-income countries. In high-income countries, the focus is predominantly on improving quality of services along with efficiency indicators.[19,20] In contrast, targets of P4P can be primarily multipronged in low- and middle-income countries (LMICs), as they aim to achieve unmet goals such as millennium development goals (MDG) 4 and 5 on maternal and child health (MCH) while focusing on coverage, quality and out-of-pocket expenditure for services.[3,13,21] In short, irrespective of their level of income, under P4P, countries can aim at systematic improvements and health gains by improving provider and health facility performance through a number of ways. As explained in Box-2, P4P incentivizes broadly the following aspects in a healthcare system.

Box -1.2

Targets of P4P programs

Pay for quality – Under this, P4P program aims at improved quality of care. Quality elements are assessed in multiple ways through structure, process and outcome or coordination of care measures. They can also use composite measures to quantitatively combine measures into metrics.

Pay for reporting – Here, P4P programs pay providers for accurate reporting of service usage and quality. The program may also develop checklist for data collection and reporting.

Pay for efficiency – In this, P4P rewards providers for cost reduction or cost containment. Multiple cost reduction measures such as reducing usage of secondary and tertiary services and expensive services can be applied.

Pay for value – Under this, P4P targets both quality and cost measures. In other words, providers are rewarded if they improve the quality of services while keeping the cost constant or reduced.

Source: Cashin et al. 2014[4]

1.2.3 Functioning of P4P

P4P envisages a strict distribution of the three categories of functions, i.e. purchase, service provision and regulation.[4,12] In other words, purchaser, provider and regulator of services are different in a P4P program. Usually the Ministry of Health, insurer or equivalent is the purchaser in P4P programs, while regulator is a Ministry approved independent agency. Providers are health facilities, group of physicians or individual physicians from public and private sectors. This separation of functions and split of responsibilities aim at transparency and build in sufficient checks and balances to guarantee high quality service delivery.[4] All parties involved have an independent role that comes with own tasks and responsibilities. Typically, in most of the existing P4P programs, especially in LMICs there is a separate verification mechanism under the Regulator to monitor the purchase and payment of services.[22]

1.2.4 Limitations of P4P

The major noted challenge with P4P is that lack of valid and reliable performance indicators can adversely affect the measurement of performance in the program.[23] For instance, often, physicians, patients, healthcare system and environmental factors can influence quality of care.[10] Therefore, it is difficult to assess the marginal contribution of a provider organization or physician to a given process or outcome.[10] Availability of reliable data also limits the accurate measurement of performance.[23] P4P programs often lack comprehensive performance indicators.[12] Therefore, providers may cherry pick incentivized indicators alone by neglecting non-incentivized services.[12] If such non-incentivized services are essential for the population, it may adversely affect the overall population health gains.[5]

P4P is projected to fetch certain unintended consequences such as motivating unintended behaviors, distortions, gaming, corruption, cherry-picking, widening the resource gap between rich and poor, dependency on financial incentives, demoralization, and bureaucratization.[24] Distortions mean ignoring important tasks that are not rewarded with incentives, gaming implies improving or cheating on reporting rather than improving performance and cherry-picking indicates picking patients that make it easier to reach targets and earn bonuses and ignoring more difficult patients.[24–26] For example, in order to meet process quality performance targets, providers can ignore high-risk patients.[24] Further, for the same reason, providers can undertake expensive treatment procedures, incurring higher costs for the patients.[24]

Behavioral economic assessments indicate that P4P in the long run may reduce health workers' intrinsic motivation as incentives will excessively motivate them to perform for financial gains.[8] Gradually, quality of care can be adversely affected under P4P.[27]

Evaluations of existing P4P programs in LMICs (explained further in chapter 2) also reflect that incentives can motivate providers to perform more on incentivized indicators.

As far as quality of care is concerned, the evidence from high-income countries suggests that P4P can have positive externality, i.e. it can improve the overall quality of services in a facility than only that of incentivized services.[28] The literature shows that though provider incentives can fetch unintended effects, ultimately these undesirable effects depend on the design, package of services and implementation of programs.[24]

1.3 Quality of healthcare

The concept and definition of 'quality of health care' (QoC) vary among different studies and context. Institute of Medicine (IOM) defines quality in healthcare as the "degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge".[29] Donabedian describes healthcare service delivery as a continuum which includes structures, processes, and outcomes, and asserts quality of care is an end product when the structures are translated to outcomes through the processes.[30]

1.3.1 Structural quality

It consists of human and key material resources such as infrastructure, equipment, drugs, commodities, communication, and transport.[30] To deliver optimal QoC, material resources need to be put to practice by adequately skilled and motivated human resources.[30]

1.3.2 Process quality

Process quality means whether services are provided optimally and safely following the standards of service delivery through technical and non-technical performance.[30] Technical performance entails delivering technologically and scientifically proven services at the appropriate time. For instance, during routine antenatal visit, a woman should undergo certain necessary procedures such as weighing and testing of blood and urine samples, and remedial action should be taken if any abnormality is detected. Non-technical performance relates to interpersonal relationship, provider behavior, privacy, and confidentiality.[6,31–33]

1.3.3 Outcomes

Key consequences of service delivery such as morbidity, mortality, out-of-pocket expenses, and client satisfaction constitute the outcomes.[34] Morbidity and mortality are difficult to attribute to QoC delivered, as many factors such as severity and pre-existing illnesses, delayed care seeking, and non-adherence to treatment would affect these outcomes.[35] Settings where the cost of health care is not completely covered either through a prepayment mechanism such as insurance or completely made free by the provider, patients do incur costs on consultation, diagnosis, treatment procedures, and/or medicines.[36] In addition, there could be indirect expenses related to travel to the health care provider, caring for the sick and loss of wages.[36] Patient satisfaction is a summary of their different perceptions and values.[37] These perceptions are patients' beliefs about occurrences i.e. how they are being examined, diagnosed with a health condition, treated, counseled and respected in the continuum of care.[38] Patients reflect the extent to which they consider a given occurrence is worthy, anticipated, or essential.[38]

1.4 Measuring Quality of care

Several methods have been reported to assess technical and non-technical quality of care as explained further below.[39]

a. ***Vignettes:*** Vignettes are used to assess knowledge of health workers on various aspects of care through a *case scenario* description and administered through written tests or direct elicitation from the provider.[39,40] Vignette is a tool for measuring technical quality of physician care through competence assessment in terms of history taking, physical examination, ordering tests, diagnosis, and prescribing treatment.[41]

b. ***Direct Observation (DO):*** DO enables an assessment of both structural and process elements of QoC in the presence of a silent observer through a checklist.[41–43] Through this checklist, it is possible to compare what is present against what physicians are supposed to do and what structural elements (e.g. equipment and infrastructure) are necessary.[41–43] On process quality (both technical and non-technical elements), there is a possibility of physicians becoming aware of being observed and change their behavior (i.e. Hawthorne effect), leading to a bias in measurement.[44]

c. ***Exit interviews:*** Patient exit interviews are used to assess both technical and non-technical aspects of quality.[45,46] They can reduce the potential response bias as patients are interviewed immediately upon receiving the care and relatively cheaper than household surveys.

d. ***Chart abstraction (Register/Record Reviews):*** A review of hospital patient records and registers can provide information on the treatment practices, time for treatment and cost of care to assess technical QoC.[42] If a chart abstraction is intended, ideally a clinical expert would be required to collect data.

e. ***Simulated or standardized patients (SP) Methods:*** An SP is an individual who is extensively coached to portray historical, physical and emotional features of an actual patient accurately and in a standardized and consistent manner.[47,48] Simulated or standardized patients are considered to be the 'gold standard' method of assessing provider communication skills and behavior.[39] However, a standardized patient cannot simulate crucial signs of certain illnesses and health conditions such as pregnancy, heart murmurs or lung sounds.[39]

f. ***Combination approaches:*** As mentioned earlier, since no method is absolute to measure the technical quality of care, a combination of different approaches can give more reliable measures for QoC, especially in P4P programs.[49]

1.5 Measuring quality of antenatal care

As the focus of this study is on quality of antenatal care, the following section gives an account of measuring this aspect, based on the existing literature. When it is restricted to assessing quality of antenatal care, existing studies have utilized the three elements of quality, i.e. structure, process and client satisfaction (an element of outcome) in various combinations.[30] Majority of studies have focused on process element,[50–59] while studies in Uganda and Sri Lanka considered all three elements,[50,55] and studies in Indonesia and Tanzania have used the structure and process elements.[51,56,57] Table 1.1

presents the ANC quality elements mentioned in these studies. The following sections describe the measures in details by element of quality.

1.5.1 Structure Measures

Level of structural quality of care is directly related to the levels of process quality of care.[60] Structural measures assess the infrastructure of health care facilities.[59,61] These measures broadly include availability and capacities of staff and availability of resources (e.g. drugs, equipment and other amenities) within facilities. However, the specific factors to be assessed under these broad measures are usually context-specific, depending upon country context and health condition under consideration as equipment and drugs required for each health condition could be different.[59] The existing literature on quality of ANC shows certain structural measures are necessary to ensure a minimum level of process quality of ANC.[50,51,55–57,59–64] They are classified broadly into five elements.

Table 1.1: Quality elements in antenatal care from published literature

Quality elements	Tanzania 2003[51]	Indonesia 2007[56]	Sri Lanka 2007[55]	Mexico 2007[53]	India 2008[54]	Mexico 2009[52]	Brazil 2009[58]	Tanzania 2011[57]	Uganda 2012[50]	Zambia 2012[59]
Structure										
Human resources									✓	
Infection control facilities									✓	
Physical infrastructure	✓								✓	
Equipment	✓	✓						✓	✓	
Essential drugs	✓							✓	✓	
Furniture		✓	✓							
Vaccines		✓	✓							
Linen			✓							
Stationery			✓							
Record keeping			✓							
Toilets			✓							
Electricity			✓							
Water		✓	✓							
Waste disposal			✓							
Process										
History taking	✓			✓		✓		✓	✓	
Physical examination	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lab tests for blood and urine	✓	✓	✓	✓	✓	✓	✓			✓
Counselling for risk factors	✓			✓	✓	✓	✓	✓	✓	✓
Prescribing drugs	✓	✓		✓	✓	✓	✓	✓		✓
TT vaccination		✓	✓	✓	✓	✓	✓			✓
Explanation about treatment offered	✓								✓	

Satisfaction		
Distance	✓	
Infrastructure	✓	
Waiting time		✓
Cleanliness		✓
Privacy		✓
Availability of medicines	✓	✓
Cost of service		✓
Provider attitude	✓	✓
Time spent with provider	✓	

Note: ticked cells indicate inclusion of element in the study

First, **physical infrastructure** including waiting area, examination room with privacy, toilet with provision of water, wash basin with soap and water, availability of electricity and light and cleanliness. Second, **availability of trained staff** to provide the essential components of ANC. Third, **availability of diagnostics** including urine dipsticks for protein and glucose, RPR test, blood grouping, and HIV test kits. Fourth, **availability of drugs** mainly iron tablets, folic acid tablets, antimalarials, tetanus toxoid, one broad spectrum antibiotic, and PMTCT drugs. Lastly, **availability of functional equipment** including tape measure, adult weighing scale, couch, fetoscope, stethoscope, sphygmomanometer, thermometer, speculum, and hemoglobin meter.

1.5.2 Process quality of care

Generally, measures to assess process quality of antenatal care are context-specific.[65] This is due to the fact that clinical standards for ANC are usually based on causes of maternal morbidity and mortality, ante natal care seeking patterns, competence and skills of providers and status of service delivery.[65] However, certain clinical practice standards on ANC are already set globally by the World Health Organization, which are also essentially prescribed guidelines for any country setting.[66] Thus, the currently used focused ante natal care (FANC) guideline is prescribed by WHO based on the results of a multi-center clinical trial that tested the effectiveness of a new model (i.e. visits are less in numbers, but at regular intervals) versus the standard model of ANC (i.e. frequent visits) in Argentina, Cuba, Saudi Arabia and Thailand.[67,68] The concept of FANC was developed based on three key findings from this trial; 1) frequent ANC visits without proper adherence to clinical guidelines will not benefit women, rather fetch physical and financial distress, 2) as majority of pregnancies do not develop complications, providers should treat all pregnant women and help reduce complications, and 3) high-risk women may not often develop complications, while low-risk women may often do so without much preparations.[67,68] FANC was recommended based on the trial finding suggesting that even with fewer ANC visits, by following the protocol of FANC, maternal and perinatal outcomes can be improved.[66,69] With the assumption that every pregnant woman is at risk for complications, FANC aims at ensuring the same basic care and monitoring for complications for every woman.[67,68] The earlier standard ANC focuses on risk assessment and more frequent visits. FANC focuses on quality, help women in maintaining normal pregnancy, prevent complications and facilitate early detection and treatment of complications with a maximum of four ANC visits.[67,68]

FANC has five components as part of ANC provision. They are (1) history taking; (2) physical examinations; (3) laboratory investigations (screening and testing); (4) health promotion; and (5) prophylaxis and treatment.[70] History taking mostly includes collecting history on medical procedures, surgery, pregnancy, sexually transmitted diseases and last menstrual period. Physical examinations primarily include measurement of weight, height, blood pressure, fundal height and abdominal palpation, and fetal heart monitoring. Laboratory investigations are for blood and urine to assess hemoglobin, syphilis and blood grouping, and screening for HIV and malaria depending on the epidemiological setting. Health promotion is usually counseling on family planning, pregnancy complications, institutional delivery, preparations for delivery, diet and voluntary testing for HIV. Prophylaxis and treatment involves prescribing iron tablets and folic acid to prevent and/or treat anemia, preventive care and vaccination for tetanus, presumptive treatment for hookworm and prevention of mother to child transmission of HIV (PMTCT) and preventive treatment for malaria depending on the epidemiological context.

In the literature, several studies have used these FANC indicators to measure process quality of antenatal care. Studies in Tanzania and Mexico have collected information on all five FANC components.[51–53] While other studies have used a lesser comprehensive list of FANC components.[50,54–59]

1.5.3 Client Satisfaction

The existing literature affirms a direct relationship between the level of client satisfaction and levels of quality of care.[71,72] However, there is no consensus on defining the concept of client satisfaction in healthcare.[37] Donabedian defines patient satisfaction as primarily a patient reported outcome measure, however patient's experience on elements of structural and process quality can be measured as well.[30] There is another concept that patient satisfaction represents patient's attitude towards care or particular aspects of care.[71] Patient satisfaction also can be based on patients' emotions, feelings and their perception of received care.[73] There is also a belief that patient satisfaction is a judgment between patient's expectations of ideal care and perceptions of what he/she received in practice.[71] Kravitz defines patient satisfaction as a distillation of perceptions and values.[37] Perceptions are typically what a patient believes about occurrences, while values are the weights a patient gives for occurrences. Values express the degree to which a patient thinks occurrences to be desirable, expected, or necessary.

Although measures to assess client satisfaction in general and that on ANC in specific are context-specific, certain structural and process quality of care elements such as inter-personal communication ability of providers, provider competence, health outcomes, and cost of care have been used as the measures of client satisfaction.[71–74] Some authors believe that satisfaction measures should include dimensions of technical, interpersonal, social, and moral aspects of care.[71,73,74] There are wide variations in the literature on variables incorporated under the above mentioned broad measures.[71] For instance, under satisfaction on structural quality some included only availability of drugs and equipment, while some also considered other infrastructure (e.g. living room amenities in the hospital and toilet facilities). As per the existing client satisfaction surveys reported in the literature, operation hours, cleanliness, privacy, waiting time, availability of medicines and equipment are necessary to assess patient's satisfaction on structural quality.[71,73,74] Similarly, how much a patient spent out-of-pocket on services is also a common component of client satisfaction surveys.[37] On provider aspects, interpersonal communication skills of physicians in terms of their attitude towards patient, history taking, explanation of conditions, respect of patient preferences, duration of consultation, emotional support and counselling, are usually assessed.[71–74] Waiting time including the time needed for outpatient registration is also reported as a measure of client satisfaction by some authors.[71,73,74]

Client satisfaction assessments are predominantly quantitative in nature.[71] Standardized questionnaires (either self-reported or interviewer-administrated or by telephone) are the most used tools in quantitative assessments. However, certain subjective experience and patient's suggestions are explored in qualitative manner as well.

The existing literature poses several challenges in the reliability of client satisfaction measures in assessing quality of care elements. First of all, client satisfaction assessments can be complex as they have multiple cross-cutting dimensions (satisfaction, engagement, perceptions, and preferences).[75]

Patient satisfaction can be subjective as it depends on each patient's expectations, current state of mind and normative judgments.[75] For a question directly asking if the patient is satisfied with a specific aspect of care (e.g. time a provider spent with you), the responses may be in relation to the patient's expected standards of care. In this case, even if the provider behavior was perfect, but the patient's expected standards were high, then the level of patient satisfaction will be low and vice versa. Several studies suggest that assessing health outcomes with an exclusive focus on client satisfaction measurement may be biased.[37,73,74] This bias may be due to the fact that health outcomes also depend on patients' basic health status and adherence to treatment. Manary *et* al. argue that patient feedback on process quality measures may not be credible as most patients lack formal medical training.[76] Patient experience measures may also reflect fulfillment of patients' immediate desires.[76]

As far as measuring client satisfaction on antenatal care is concerned, only two studies report these.[50,56] The components of satisfaction they present are the following – satisfaction on distance, infrastructure, waiting time, cleanliness, privacy, availability of medicines, cost of service, provider attitude and time spent with provider.

1.6 Summary of the background and overview of the thesis

This chapter shed light on the key concepts of P4P, its functioning and limitations. Further, it presented the definition of quality of care and its measurement methods in general and specifically for antenatal care. The rest of the thesis is structured in the following manner.

Chapter 2 presents a review of literature on the effects of P4P in high income countries followed by low- and middle-income countries in general and on maternal and child health care in particular including quality of care. This chapter concludes with the rationale of this study, research question and objectives.

Chapter 3 explains the study setting with key social, demographic and health systems characteristics. It also describes the intervention along with relevant stakeholders and incentives.

Building on to the literature and description of intervention, the methods chapter (**Chapter 4**) begins with a conceptual framework. The framework describes the causal pathways of the intervention and how is the research placed within the context. This chapter also describes the study design, sampling, data collection, data analysis plan, ethical considerations and the role of the doctoral candidate in this research.

Chapters 5, 6 and 7 present the results addressing the three research objectives set out in the conceptual framework. Each results chapter explains the research objective, methodology, descriptive and inferential statistics (impact estimates). **Chapter 5** deals with structural quality, while **chapters 6 and 7** present process quality and client satisfaction respectively.

The concluding chapter (**Chapter 8**) reflects on the summary of findings, strengths and limitations of the research, contributions to the global evidence base, implications for policy and areas of future research.

Chapter 2: Review of Literature

2.1 Overview

This chapter presents the existing evidence including those from systematic reviews showcasing P4P programs' effects on healthcare and quality in high, middle and low income countries. Then, it presents a systematic review of the literature that was conducted as part of this doctoral research to assess the effects of P4P on quality of MCH care in low- and middle-income countries. Finally, it presents the rationale for this doctoral research followed by study objectives.

2.2 P4P's effect on quality of care in high-income countries

The prevailing evidence of P4P in the high income countries primarily emanates from the evaluations of P4P programs in the UK and the USA.[5,12] In high-income countries quality of care has been primarily assessed in terms of providers' adherence to standardized clinical guidelines.[5] In some studies intermediary outcomes such as changes in blood pressure that indicate changes in population health status were included.[5] Patient experience and provider responsiveness were also considered as elements of quality, though measuring them was found to be expensive and difficult at times.[5] This review by Allen and colleagues highlight lack of reliable data on quality of care.[5] The findings of the studies of the effect of P4P on quality of care had mixed results.[5,12,25,77,78,98,99] P4P has been effective to improve quality of care on chronic conditions, but not consistently.[12,25] Prevailing higher quality of care before the introduction of P4P programs has been suggested as a possible reason for the lack of P4P's positive effect on quality.[5,12] However, there is some evidence suggesting that P4P has the potential to improve quality, only at higher costs to health system.[12] There is also evidence of cherry-picking and gaming within P4P programs, reported from the UK and USA.[25,26,77] An evaluation study of a P4P program in Spain did not show any significant improvement in patient satisfaction.[79]

A systematic review of 44 studies on P4P program in the UK showed that quality of managing chronic diseases and preventive care had improved under P4P.[5] However, the overall positive effect varied with the baseline medical quality and practice size. P4P also brought in issues such as inequity, patients' dissatisfaction and increasing medical cost. Performance increases on quality were accelerated in the first year of the scheme, however gradually returned to pre-P4P rates. In the first year of P4P, quality of care improved more in deprived areas indicating that P4P could address inequity initially as there were more scope for improvement in such areas. Performance on quality remained at the same level, even after incentives were removed. This reflects that investments during P4P would have improved structural quality and it would have motivated providers to perform better. There was evidence of risk selection and gaming by providers. There were mixed results on provider motivation – some studies reflected no effect on intrinsic motivation. On the contrary, a few studies have reported that under P4P, providers' autonomy came down and it undermined providers' sense of professionalism. Results also indicate the better performance of P4P if incentives are directed at individuals compared to large groups. P4P was also effective if it adopted absolute targets instead of relative ones. P4P also fetched better results if there was a higher level of provider engagement. One of the reasons for P4P not considerably improving quality of hypertension care was that pre-P4P quality was already high. A systematic review conducted by Langdown et al. on 11 studies also establishes that P4P could improve quality of care for certain health conditions initially, but it fell gradually to the pre-existing trend.[80] Another systematic review by Gillam found that nurses and physicians reportedly felt a decrease in the person-centeredness of consultations and treatment continuity.[78] Also, patients' satisfaction with continuity fell down with little change in other domains of patient experience.

Houle et al. conducted a systematic review of four randomized controlled trials, five interrupted time series, three controlled before-after studies; one nonrandomized controlled study; 15 uncontrolled before-after studies; and two uncontrolled cohort studies in the UK.[81] This review showed that the effects of P4P on quality of care among individual practitioners are uncertain.

The experiences of P4P in the USA also show a mixed picture with studies giving contradicting conclusions. Rosenthal et al., 2007 remarked that there was only a little association between the amount of incentives paid and the success of the schemes.[20] A WHO report asserts that the evidence is not robust enough to conclude that financial incentives might enhance documentation of processes of care such as immunization status.[12] However, there are indications of patients' experience of primary care services improved with incentivized providers. An evaluation by Glickman in 2007 revealed that P4P hospitals outperformed non-P4P hospitals on achieving improvement in clinical outcomes of chronic conditions.[82]

In summary, there is inconclusive evidence of the effects of P4P on quality of care in high-income countries. Most of the evidence is centered on process quality of chronic conditions. While, quality improved initially for certain services, it gradually came down to baseline values. There was a perceived reduction in the person-centeredness and continuity of treatment practices, and patient satisfaction under P4P.

2.3 P4P in Low- and Middle-Income Countries

Several LMICs in Asia and Africa have experimented P4P in the last few decades. P4P programs in LMIC have predominantly aimed at improving maternal and child health (MCH).[14,20] The key objectives of these P4P programs were improving coverage and quality of services by incentivizing health facilities and providers. Health systems in these LMICs face challenges in funding, skilled human resources and managerial capacities resulting into poor quality of care, lower utilization of services and dismal health indicators.[83–85] Staffs' performance is sub-optimal and disproportionate to their qualifications and skill set.[43,86] Not linking results with payments to health centers and salaries to health workers is one of the major reasons for low productivity and poor quality of services.[87] In this context, P4P is expected to potentially enhance productivity based on the notion that incentives motivate individuals towards better performance.[13]

Experimental and quasi-experimental evaluations in Cambodia, Democratic Republic of Congo (DRC), Burundi, Rwanda and Haiti have shown that P4P could enhance service utilization, and financial and management capacities.[2,88–93] P4P programs in DRC and Cambodia have shown improvements in utilization of antenatal care (ANC).[88,89] In Haiti, there was a quarterly increase in utilization of consultations for infants by 9.4% points over 12 quarters.[91] In Rwanda and Burundi institutional delivery increased by 8% points and 21% points respectively.[90,94] The P4P program in Rwanda improved the probability of a pregnant woman receiving tetanus vaccination by 5% points.[94] In Burundi, pregnant women had more chance of having institutional delivery by 21% points, ANC access by 7% points, and utilization of modern family planning services by 5% points.[95] In the Philippines, P4P program enhanced patient reported health measure for under-five children by 7.37% points.[96]

In contrast, the Rwandan P4P program did not impact on the utilization of ANC.[14] In the DRC program, under-five children did not experience any improvements in their weight-for-height z-score and longevity.[89] In the Philippines, the program did not observe any significant changes in acute infection or reduction in anemia among sick children after 6 to 10 weeks of discharge from hospital.[96]

As regards to unintended effects, a systematic review of P4P programs in LMICs found some evidence on P4P's unintended effects but concluded that there is lack of rigorous evaluation of unintended effects.[24] In Taiwan, the providers in a P4P program neglected elderly and high-risk diabetes patients.[97] In DRC, providers reported reduced intrinsic motivation under the P4P program.[98] However, this happened in a setting where the overall facility income went down. Thus, attributing reduced motivation only on the P4P program might not be justified. In the Rwandan P4P program, provider performance was the highest on incentivized indicators or on those services requiring the least effort.[99] Institutional deliveries had relatively higher incentives than ante-natal care, eventually, the former increased by more than 20 percentage points. In a Kenyan school meal program, incentivizing improved pupil malnutrition rates, subsidized meal preparation crowded out teaching time by 15%.[22] In a Chinese P4P program, giving incentives to primary school principals for reductions in student anemia reduced teaching effort, leading to lower test scores in some cases.[100]

2.4 Effect of pay for performance to improve quality of maternal and child care in low- and middle-income countries: a systematic review

This systematic review was conducted by the PhD candidate as part of the doctoral research.

2.4.1 Background

The literature from high-income settings shows that the effects of P4P on quality of care is varied. The evidence of P4P's effect on quality of care is in LMIC settings is very limited .[14] However there are number of reports of P4P programs in LMICs that have evaluated the effect of P4P on maternal and child health. Thus, a systematic review of the effects P4P quality of MCH care in LMIC was needed. There were particularly two compelling reasons to undertake a systematic review as part of this PhD thesis. First, the earlier systematic reviews did not comprehensively explore the effects of P4P on quality of care by its various dimensions (e.g. structure, process and outcomes). Secondly, results from several new studies were available to enrich the evidence base. Therefore, a systematic review of literature was conducted to explore the effect of P4P on quality of maternal and child healthcare in LMICs.[101]

Clinical evidence shows that quality of MCH care is a pre-requisite to reduce maternal and child mortalities.[102] An increased uptake of MCH services such as skilled birth attendance and newborn care without adequate quality cannot guarantee an improved MCH status.[34] Studies conducted in Cambodia, Democratic Republic of Congo, Burundi, Rwanda, Haiti have demonstrated improvements in maternal and child healthcare service utilization and to some extent better financial and management capacities with health facilities. However, there is no synthesized evidence supporting the positive effect of P4P on quality of care in LMIC. In addition, a systematic review conducted on P4P in LMICs asserts that the evidence is weak to conclude the impact of provider incentives on quality of care.[14] Specifically, most studies had inappropriate design to account for contextual factors and inadequate power to assess the effects of P4P on health outcomes.[14] If P4P positively impacts only service utilization without corresponding improvements in quality of care, current investments on P4P in low-income countries may not be cost-effective to improve MDGs 4 and 5.[103] This systematic review assessed the effect of supply-side pay for performance on the quality of maternal and child health services in LMICs. While identifying the knowledge gaps in this area, it also explored the appropriateness of methods adopted by different studies to measure quality of MCH care under P4P.

2.4.2 Methods

2.4.2.1 Selection of studies

Studies from low- and middle-income countries as defined by the World Bank income criteria were included.[104] I (AD) and a colleague, Saji Gopalan (SG) from the Department of Global Health and Development, LSHTM independently searched the literature, screened abstracts and retrieved full papers. Final selection of studies against the inclusion criteria was done independently by SG and me, and disagreements were resolved through a consultative process.

Inclusion criteria

1. Evaluation reporting results of any supply-side (i.e. facility/provider) P4P on a quantitative measure of MCH care quality
2. Study conducted in low- and middle-income countries
3. Published in English between January, 1990 and June, 2014. This selection is based on the fact that P4P programs started from the 1990s.
4. Presence of at least one comparison group
5. Study reporting statistical significance of the intervention than only descriptive analysis
6. Study meeting a minimum quality score of six, defined by the two reviewers

Exclusion criteria

1. Study presenting the impact of P4P on only access to and usage of MCH care without any quality of care measures
2. Qualitative study or review
3. Study on P4P presenting non-MCH care
4. Study reporting only descriptive analysis
5. Study with a quality score of less than six

Type of studies

Studies were selected if they met the criteria used by the Cochrane Effective Practice and Organization of Care group (EPOC).[105] The EPOC study designs are: randomized controlled trials (RCTs), clustered randomized controlled trials (c-RCT), controlled clinical trials (CCT), controlled before-after studies (CBAs) and quasi-experimental studies including interrupted time series. Given the dearth of literature on P4P and quality of MCH care, in addition studies having at least one intervention and one comparison group were included.

Types of participants

Study population comprised of women during pregnancy and post-partum period; children younger than five years; and health workers under assessment for a P4P program.

Type of interventions

P4P interventions in public or private sector, providing conditional financial incentives to facilities and/or providers to achieve certain performance measures on MCH services including quality were selected.

Operational definitions

Maternal health care included any routine or illness care received during the antenatal, delivery and postpartum period. Child health care included any care received from birth up to five years of age for any routine or illness conditions. Health workers were defined as medically trained personnel (doctors, clinical officers, midwives, and nurses) working at a primary or secondary care level in LMIC settings.

Outcomes of Interest

Primary outcome of interest was quality of MCH disaggregated into structural quality, process quality and outcomes. Under structural quality, the following elements were considered – availability of health facility infrastructure, skilled staff, equipment, commodities, and drugs. For process quality, adherence to standard protocols and guidelines for management of health conditions were included. Morbidity, mortality, out-of-pocket expenses for medical services in the healthcare facility, and client satisfaction constituted the outcomes.

2.4.2.2 Information Sources and Search

Records were searched in several electronic search engines and databases namely MEDLINE, EMBASE, Global Health, PsycINFO, Econlit and Web of Science. Additionally, Google Scholar was searched electronically. Websites of key organizations involved in P4P programs (World Bank, DFID and NORAD) were purposively searched for published articles or working papers. A hand search enabled to retrieve certain relevant papers from the selected records. Contacts were made to authors and scholars in the field of P4P to identify additional studies.

The literature search was conducted during May-August 2014. Records published between January, 1990 and June, 2014 were selected. Each database had different search words as a combination of MeSH (medical subject heading) and non-MeSH terms using Boolean operators "AND" and "OR". The search algorithm was developed based on a preliminary search in PubMed and Google Scholar. The thematic search words are given in box 2.1.

Box 2.1 Search strategy

Thematic Search

"provider performance" OR "provider incentives" OR "pay for performance" OR "performance-based financing" OR "performance-based incentives" OR " supply-side incentive" OR "provider performance" OR "results-based financing"

AND

"quality of care" OR "clinical standards'' OR "structural quality'' OR "process quality"

AND

"Maternal health/" [MeSH] OR "ante natal/pre natal" OR "post natal/postpartum" OR "child birth/delivery/institutionalized" OR "newborn/neonatal" OR "immunization/vaccination" OR "children/child" OR "nutrition/stunting/anemia"

Adjunct Search

"Developing countries/less developed nations/third world countries"[MeSH] OR "developing health Systems" [MeSH] OR Africa/sub-Saharan Africa" [MeSH] "Central/south/latin america"[MeSH] OR "asia/central/south east Asia"[MeSH] OR "commonwealth of independent states"[MeSH] OR "indian ocean islands"[MeSH] OR "eastern europe"[MeSH] OR "south asia" OR "low income countries/low and middle income Countries"

2.4.2.3 Data items and Extraction

Country and year of study, study settings and design, sample size, type of incentive (recipient, conditionality and frequency), comparison groups, outcome measures, and quality element of the outcome measures were extracted using data extraction form. I extracted the data and SG validated the process.

2.4.2.4 Summary measures and Data Synthesis

Where possible either odds ratio or coefficient along with the confidence interval are presented. Net effects of the interventions were calculated as the difference between intervention and control groups at baseline and follow up, and presented as percentage points, coefficients or absolute numbers in natural units. An outcome was considered statistically significant at 5% level ($p<0.05$). The reported outcomes were presented by the elements of quality, i.e. structure, process and outcomes. Due to heterogeneity of studies and presentation of results, no meta-analysis could be performed.

2.4.2.5 Appraising methodological and reporting quality of included studies

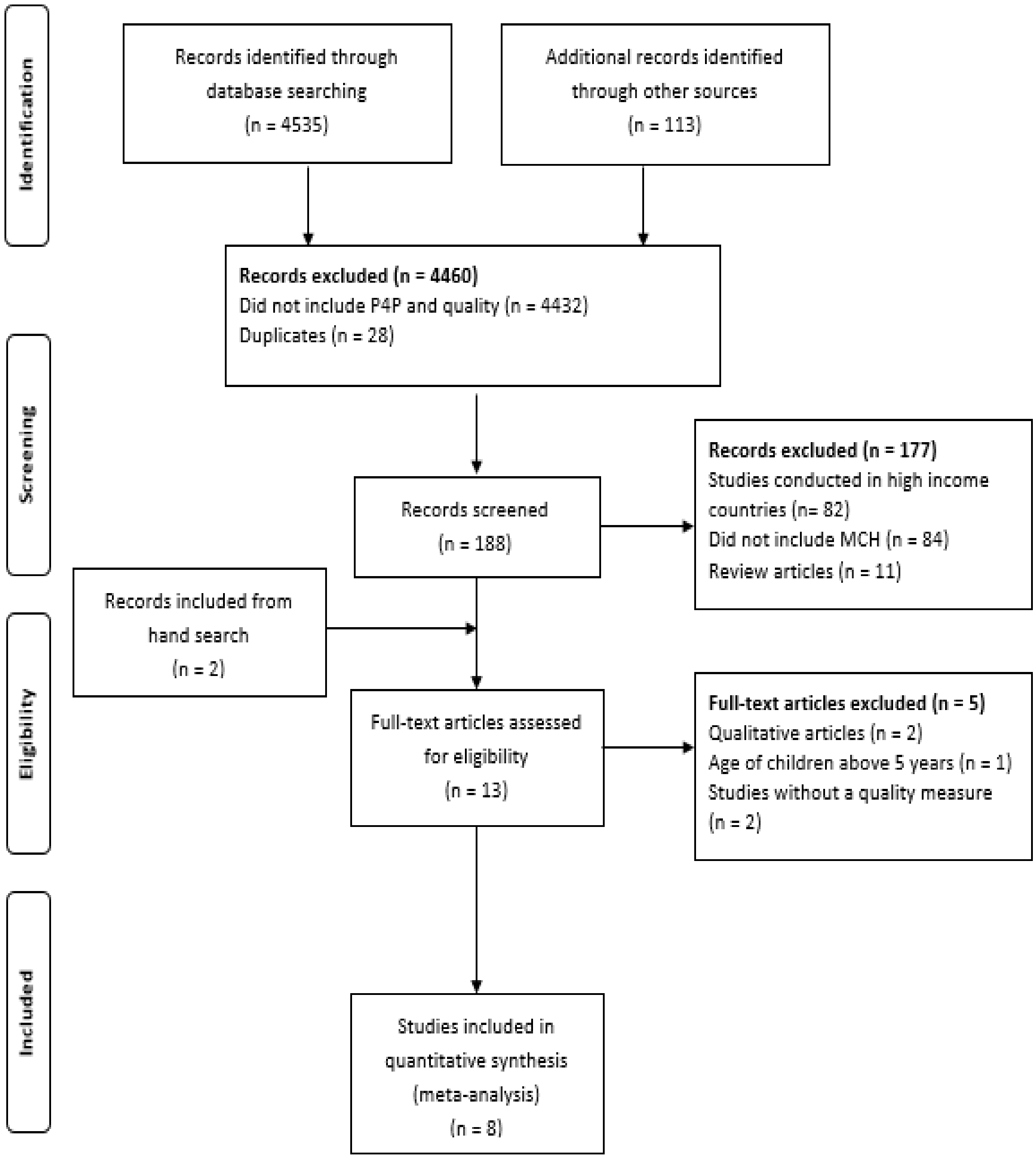
A customized quality assessment tool for appraising methodological quality of studies was developed by adapting the tool used by Downs and Black.[106] The quality tool takes into account methodological quality (randomization, baseline balance of key variables), external validity (representativeness of study sample, contamination of interventions), and reporting quality (clear description of objectives, interventions, outcomes, power calculations, findings). The primary changes made were reflected in scoring various types of studies with the highest score assigned to RCTs, replacing representativeness of patients with facilities, and removal of items related to blinding of randomization and patient adverse events. There were eighteen quality indicators for RCTs and seventeen for CBAs and each indicator had an indicative score. Wherever the description did not include a particular item mentioned in the quality assessment tool or it was unclear, then that item was scored zero. Because of the variation in scoring between studies (i.e. RCT and CBA), the absolute scores were standardized to percentage to ensure comparability. Based on the aggregate quality score, studies were ranked as low (<34%), moderate (34-66%) and high (>66%). SG and I independently assessed the quality of studies, with any disagreements resolved through discussions.

2.4.3 Results

2.4.3.1 Study selection

Search from the databases identified 4535 records, and an additional 113 records were retrieved from other sources and personal communications with researchers. Screened records were 188 after removing duplicates and excluding records that did not mention P4P and quality. From 13 articles eligible for full-text assessment, only eight were included in the review. Details of the study selection are given in the Figure 2.1.

Figure 2.1 Flow diagram for selection of articles



2.4.3.2 Study characteristics and Settings

There were four CBAs, three cluster RCT and one case control with post-intervention comparison of P4P programs on MCH care in Burundi, Democratic Republic of Congo (DRC), Egypt, the Philippines, and Rwanda (Table 2.1). [15,89,96,98,107–110] Five studies took place in primary care health centers, [15,89,107,110] two reported results from district level hospitals [96,109] and one was conducted in both primary and secondary level facilities.[98]

Two cluster randomized trials of performance based salary bonus to health care providers were reported from the Philippines.[96,109] In these two RCTs, 30 district hospitals from districts matched by socio-economic, demographic and health profile were randomized to one of the two intervention arms or to the control arm. In the cluster randomized trial in DRC,[96] health facilities in one district were randomly assigned to intervention and control arms;[98] the intervention arm received performance-based incentives, while control arms only input-based financing.

The CBA in Rwanda randomly assigned 80 health facilities from 12 districts to receive a P4P intervention and 86 health facilities from seven districts to receive an equivalent input-based financing.[15] The CBA of a P4P program in DRC allocated two districts to receive performance-based incentives and compared the outcomes with another two districts having similar socio-economic characteristics.[89] From Egypt, a post-test only comparison study that assessed a P4P program in primary health centers, who received incentives for more than two years was reported.[110] Comparison groups received equivalent additional incentives as salary top-off without any performance conditionality. Two studies of P4P program were reported from Burundi. One study used a CBA for the pilot phase[95] and the second study compared population level outcomes on quality of antenatal care between P4P and non-P4P provinces in the nation-wide roll-out phase.[107]

2.4.3.3 Characteristics of performance measures and payments on quality of care

Studies described diverse performance measurement and payment mechanisms for quality of care. Performance mechanisms included achieving a certain level of volume and quality of MCH services. Three programs incentivized quality of care with limited set of indices.[15,96,111] Three others utilized a composite index including availability of human and material resources, compliance to national standards, proper record keeping, and client satisfaction.[89,98,110]

Payment systems included payment for individual health workers [96,109,110] or for facilities.[15,89,95,107] Incentives accounted for 5% of physician's salary in the Philippines[96] and 275% times the base salary of a primary health facility staff in Egypt.[110] In DRC, the monthly payments to facilities ranged from $200 to $4000.[89]

In DRC, apart from incentivizing utilization of MCH services, the program offered a bonus of up to 15% of the subsidies to facilities on quality of care.[89] Performance indicators in Egypt consisted of preventive, curative and quality of care measures (completeness of medical records, patient satisfaction and waiting time) on MCH.[110] The Rwandan program incentivized facilities on a combination of service volume and quality for MCH.[15] The P4P facilities in the Philippines received incentives linked with the average clinical competence scores of physicians, facility caseload, and average utilization of services (quantity) and adherence to national standards and protocols (quality).[109] This adherence to P4P guidelines was assessed for vaccinations, family planning, tuberculosis, HIV and antenatal care.

Huntington et al. examined receipt of particular MCH services in Egypt from exit interviews of clients.[110] Soeters et al. illustrated patient perceived quality of care (e.g. staff behavior, availability of drugs and waiting time) from household surveys whereas professional quality of health centers was assessed from quality surveys.[89] Peabody et al. presented physician knowledge measured through clinical performance vignettes and health status of under-five children hospitalized for diarrhea or pneumonia.[96,109] Basinga et al. reported a composite prenatal quality index based on receipt of services (reported in the household surveys) according to the national clinical guidelines.[94] Bonfrer et al. demonstrated patient's perceptions on the quality of services and facility quality score.[95,107] Huillery and Seban assessed patient perceived technical quality of care, patient understanding on managing health conditions and patient satisfaction through exit interviews.[98] In addition, this study examined quality of facility infrastructure and equipment through direct observation.

2.4.3.4 Reporting of quality of care in studies

Studies adopted different methods to report quality of care outcomes. Generally, quality was reported either objectively (direct observation of availability and receipt of services as per national standards of care) or reported by patients (e.g. receipt of services, perceptions on staff attitude, waiting time, quality of services). Means of verification of quality were through exit and household interviews (patient perception and experiences), review of records, direct observation (infrastructure, drugs and equipment) and vignettes. Six studies utilized household interviews to measure quality,[15,89,95,96,98,107] while two studies each employed exit interviews,[98,110] review of records,[89,95] and direct observations.[89,95] Only one study applied vignettes as a means of verification.[109]

2.4.3.5 Risk of bias across studies

The mean quality of studies score was 63.8% with a range of 41% to 88%. Two RCTs were of high quality with a score of 78%[96,98] and one RCT had score of 72% (Table 1).[109] Among the five CBA studies, only one was of high quality, scoring 88%.[15] Two studies were of medium quality with a score of 53% and 59%.[95,107] Two CBA studies were of low quality with a score of 41%.[89,110]

Five studies did not report baseline participant characteristics, representativeness of the participants or facilities, estimates of random variability and actual probability values.[89,95,98,110] Three CBAs did not mention the matching criteria for control and intervention sites.[111,89,15] Studies with selection bias did not consider the use of instrumental variable techniques to identifying P4P effects. Seasonality might have confounded the outcomes in the DRC study as the surveys were conducted at two different seasons.[89]

Table 2.1: Study characteristics and Quality score

Author, year; Country	Study Design	Program setting	Incentives			Comparison Group	Outcome measures	Quality element	Methodological Quality score (%)
			Recipient	**Conditionality**	**Frequency**				
Peabody et al., 2011; Philippines[109]	CRT	30 District hospitals (DH)	Providers	physician competence score, case load and patient satisfaction	Quarterly	DHs from matched districts without P4P	Quality of care, utilization of services of children under-five	Process quality	13(72)
Peabody et al., 2014; Philippines[96]	CRT	30 District hospitals	Providers	physician competence score, case load and patient satisfaction	Quarterly	DHs from matched districts without P4P	Quality of care, utilization of services of children under-five	Clinical outcomes for under-five children	14(78)
Huillery and Seban 2014; DRC[98]	CRT	152 Facilities (primary and secondary level)	Facilities	utilization of services	Monthly	Facilities in control districts receiving equivalent fixed payment	User fees, service accessibility, service quality and utilization, population health status, health facility revenue, health workers' satisfaction, anxiety, motivation	Patient perceived quality and structural quality	14(78)
Basinga et al., 2011; Rwanda[15]	Controlled before and after	Rural health centers - 80 in intervention and	Facilities	utilization of 14 key MCH services and quality of services delivery	Quarterly	Facilities under input-based financing received funds equivalent to	Prenatal visits, institutional delivery, quality of ANC, child preventive	Process quality of ANC	15(88)

		86 in control				P4P payments	care visits and immunization		
Bonfrer et al., 2014; Burundi[107]	Controlled before and after	700 facilities	Facilities	obtaining quality and quantity of services	Monthly for quantity and quarterly for quality	Households in the provinces where P4P was not implemented	Utilization and quality of MCH services	Process quality of ANC	10(59)
Bonfrer et al., 2014; Burundi[108]	Controlled before and after	700 facilities	Facilities	obtaining quality and quantity of services	Monthly for quantity and quarterly for quality	Facilities in control districts receiving normal input financing and salary bonus	Maternal and under-five services	Structural and process quality	9(53)
Soeters et al 2011; DRC[89]	Controlled before and after	Two districts	Facilities	utilization of services	Monthly for quantity and quarterly for quality	Two control districts with characteristics similar to intervention districts receiving essential drugs, equipment and fixed staff performance bonuses	Not mentioned	Patient perceived quality, structural and process quality	7(41)
Huntington et al., 2010; Egypt[110]	Case control post-test only	Primary health centers	Providers	Quantity and quality of preventive, curative and quality of MCH services	Monthly	Primary care providers in control arms got flat rate salary supplements	Quality of ANC, child care services and family planning care	Process quality of ANC, family planning and child care	7(41)

2.4.3.6 Effects of interventions

Structural quality

Studies gathered results on structural quality from direct observation and review of records. Four studies described the effect of P4P on elements of structural quality (Table 2.2). The availability of qualified staff increased by 15% points and patient perceived availability of drugs improved by 37% points in DRC[89] compared to pre-intervention period. In the Philippines, P4P improved physicians' knowledge to manage under-five diarrhea and pneumonia (coefficient 1.6; $p < 0.001$).[96] However, another study showed some negative effects of P4P on structural quality in DRC.[98] These negative effects were observed on overall structural quality index and availability of drugs and vaccines in the facility. Patient perceived availability of drugs decreased (coefficient -308.33; p<0.001). There was a decline in structural quality index based on interviewers' observation (coefficient -0.525; p= 0.014), equipment index (coefficient -0.639; p=0.026) and vaccine availability (coefficient -0.744; p=0.034). In this study, P4P did not show any effect on patient perceived equipment quality, infrastructure index and the number of types of drug currently available. Patient perceived availability of drugs in Burundi (coefficient 0.04; p=0.492) and equipment quality in DRC (coefficient 0; p=0.997) did not change under the P4P program.[95,98]

Table 2.2: Effect on Structural Quality

Variable	Net P4P effect	P value
Qualified staff in facilities[£]	15	<0.05
Sufficient drug availability (patient perceived)[$]	0.04	0.492
Provider clinical knowledge on child health (Mean Vignette score)[*]	1.6	<0.001
Patient perceived availability of drugs (%)[£]	37	<0.001
Patient perceived equipment quality[@]	0	0.997
Structural quality index based on interviewers' observation[@]	-0.525	0.014
Infrastructure index[@]	0.184	0.372
Equipment index[@]	-0.639	0.026
Number of types of vaccine currently available[@]	-0.744	0.034
Number of types of drug currently available[@]	0.236	0.646

[£] Soeters et al. 2011; [$] Bonfrer et al. 2014; [*] Peabody et al. 2011; [@] Huillery and Seban 2014

Process Quality

Studies reported process quality results from direct observation and review of records. Four studies presented P4P's impact on various elements of process quality (Table 2.3). One study reported P4P's effect on history taking and examination of pregnant women during ANC.[110] Two studies reported the effect on prescription and treatment of pregnant women and under-five children.[98,110] Three studies mentioned about patient reported process quality on MCH services.[96,107,112] The study in Egypt showed the P4P increased the chances of a provider asking about parity (coefficient 11.4; $p < 0.05$) and past illness (coefficient 16.4; $p<0.01$) during ANC visits.[110] But, the treatment did not significantly influence the chance of a provider enquiring about a pregnant women's name, age and last menstrual cycle. In this study, P4P increased likelihood of measuring blood pressure (coefficient 8.4; $p<0.01$), testing blood (coefficient 12; $p<0.01$) and urine (coefficient 20; $p<0.01$) during ANC visits. However, P4P program did not influence the chances of being weighed or fetal heart rate checked. The P4P increased providers' adherence to explaining medicine intake for children under five years (coefficient 11.1; $p<0.05$), follow-up treatment (coefficient 24.2; $p<0.05$) and medicines (coefficient 10.5; $p<0.05$). Yet, the program could not improve provider practices on treatment, prescribing iron, injections, vitamins, and tetanus toxoid for ANC visits. In Rwanda P4P increased the ANC quality index in primary health centers (coefficient 0.157; $p = 0.02$).[15] In DRC P4P improved patient's perceived quality of care index (coefficient 15; $p<0.05$) and professional quality score of facilities on MCH services (coefficient 26; $P<0.001$).[89] Patient perceived overall quality of care index is the aggregate score given by the patient for various dimensions of provider behavior and competence (e.g. how provider explores the case scenario, how provider explains the health condition, how much respect a provider gives for the patient, etc.) Professional quality score of the facility is a composite score consisting of structural and process elements as shown by both studies in DRC and Burundi. However, P4P program did not influence provider's adherence to standardized medical procedure for any MCH service (coefficient -0.015; $p=0.695$).[98]

Table 2.3: Effect on Process Quality

Variable	**Net P4P effect**	**P value**
History taking		
Asked name during ANC visit[@]	4.3	NS
Asked age during ANC visit[@]	4.5	NS
Asked parity during ANC visit[@]	11.4	<0.01
Asked date of last menses during ANC visit[@]	2.9	NS
Asked past illnesses during ANC visit[@]	16.4	<0.01
Examination		
Examined weight during ANC visit[@]	5.8	NS
Examined blood pressure during ANC visit[@]	8.4	<0.01
Examined fetal heart rate during ANC visit[@]	10.9	NS
Prescription and treatment		
Asked for blood test during ANC visit[@]	12	<0.01
Asked for urine analysis during ANC visit[@]	20	<0.01
Explained intake of tetanus toxoid during ANC visit[@]	-8.4	NS
Explained intake of Vitamins during ANC visit[@]	5	NS
Explained medicine intake for under-five (%)[@]	11.1	p<0.05
Overall treatment procedures (patient perceived) during ANC visit[@]	-5.5	NS
Drugs prescribed to pregnant women without examination[$]	0.02	0.66
Children received injection (%)[@]	-6	p<0.05
Children received follow up (%)[@]	2.4	p<0.05
Children given medicine (%)[@]	24.2	p<0.05
Overall process quality		
Compliance rate with medical procedure, any service[$]	-0.015	0.695
ANC process quality score[£]	0.157	<0.001

NS – Not significant; [@] Huntington et al. 2010; [$] Huillery and Seban 2014; [£] Basinga et al., 2011

Quality outcomes

Studies obtained results on quality outcomes from review of records, exit interviews, household interviews and vignettes. Five studies demonstrated the effect of P4P on patient knowledge on managing health conditions, morbidity, mortality, out-of-pocket expense and client satisfaction (Table 2.4).[89,96,98,110]

Patient Knowledge: Number of pregnant women knowing the usage of pre-natal drugs increased in Egypt (coefficient 12; p<0.05), while patient's knowledge on drug intake decreased in DRC (coefficient -0.072; p=0.039).[98,110]

Health outcomes: In the Philippines there was a small improvement in patient reported health measure for under-five (coefficient 7.37; p = 0.001).[96] However, P4P had no effect on the prognosis of acute infections or on the incidence of anemia among sick children after 6 to 10 weeks of discharge from hospital. Under-five children did not experience any improvements in their weight-for-height z-score (coefficient -0.347; p=0.306), longevity (coefficient -0.012; p=0.55) or infants' survival (coefficient -0.01; p=0.093) in the DRC program.[98]

Out-of-pocket expenses: In DRC,[98] P4P reduced patient out-off-pocket expenses on purchase of drugs at facilities (coefficient -1106.16, p = 0.005). On the contrary, there was no significant effect on fee paid for immunization, delivery and ANC and PNC visits.

Client satisfaction: Three studies reported how P4P could influence patient satisfaction on consultation time, provider behavior, waiting time, user fee, welcome quality, overall quality of care and cure. In the DRC program, no improvement on provider attitude towards patients (coefficient 12; p <0.10) was observed.[89] Patients' chance of feeling cured was higher under P4P program in Burundi (coefficient 0.09; p=0.012).[95] The DRC P4P program did not affect the level of client satisfaction on adequacy of consultation time, overall quality of care, user fee and welcome quality.[98]

Overall quality of care

Two studies demonstrated the effect of P4P on overall quality of care of MCH services considering structure, process and outcome measures (Table 4). The P4P program in DRC could enhance the total professional quality score of health centers (coefficient 26; p<0.001) and patient perceived overall quality index (coefficient 25; p<0.05).[89] However, the facility quality score in Burundi though improved, it was not statistically significant (coefficient 17.24; p =0.062).[95]

Table 2.4: Effect on Quality outcomes

Variable	Net P4P effect	P value
Patient Knowledge		
Women knew medicine-use in prenatal period[@]	12	<0.05
Women knew medicine-use in prenatal period[$]	-0.072	0.039
Health outcomes		
CRP negative for under-five[£]	0.84	0.497
Not anemic under-five[£]	-4.87	0.253
Good GSRH for under-five[£]	7.37	0.001
Weight-for-height z-score of under-five[$]	-0.347	0.306
Number of under-five deaths last year in households[$]	12	0.55
Out-of-pocket expenses		
Fee paid for the delivery[$]	301.24	0.762
Fee paid for the last postnatal visit[$]	-71.637	0.35
Fee paid for the last prenatal visit[$]	-112.969	0.125
Fee paid for the last immunization shot[$]	-22.096	0.237
Cost of drugs purchased by the patient at facilities[$]	-1106.16	0.005
Client Satisfaction		
Felt cured (pp)*	11	NS
Acceptable waiting time (pp) *	7	NS
Respect by staff (pp) *	12	<0.10
Felt cured (coefficient)[#]	0.09	0.012
Waiting time reasonable (coefficient) [#]	-0.12	0.318
Personnel respectful (coefficient) [#]	-0.02	0.718
Adequate consultation time (minutes) [$]	1.028	0.422
Pregnant women satisfied on user fees[$]	0.012	0.48
Pregnant women satisfied on welcome quality[$]	-0.027	0.442
Pregnant women dissatisfied on user fees[$]	0	0
Pregnant women dissatisfied on welcome quality[$]	0	0.946
Pregnant women satisfied on total care quality[$]	-0.005	0.671
Patient overall satisfied[$]	0.013	0.359
Overall quality of care		
Overall patient perceived quality score on ANC (pp) *	25	<0.05
Overall professional quality score of health centers (pp) *	26	<0.001
Total facility quality score (coefficient) [#]	17.24	0.062
Patient perceived quality of care (coefficient) [#]	0	0.924

NS – Not significant; [@] Huntington et al. 2010; [$] Huillery and Seban 2014; [£] Peabody et al., 2014; * Soeters et al 2011; [#] Bonfrer et al.2014; pp – percentage points

2.4.4 Discussion

2.4.4.1 Summary of evidence

This systematic review found that the current evidence indicating P4P's effect on quality of MCH in LMICs is skewed towards process quality and antenatal care. Feeble evidence showing P4P's impact on quality of MCH care was mainly due to three reasons; 1) program evaluations did not adequately explore quality of care; 2) evaluations were mostly not powered enough to examine quality elements; and 3) P4P could not affect quality of care to a large extent.

The positive effect of P4P was observed only on limited aspects of MCH quality elements. Studies focused predominantly on antenatal care than delivery, EmONC, post-natal care and under-five child care. Strength of evidence on maternal and neonatal health outcomes and out-of-pocket expenses was also limited. P4P program fetched a few negative outcomes on structural quality such as a reduction in the level of availability of drugs and equipment.

Despite targeting to improve structural quality of facilities, P4P programs could only improve availability of skilled staff, drugs and provider's clinical knowledge. On the contrary, P4P negatively affected availability of equipment and vaccines.[98] The evidence was considerably positive on provider adherence to treatment protocols on ANC and child care. Patient out-of-pocket expenses on MCH did not reduce under P4P programs, though out-of-pocket costs on drugs were reduced. However, client satisfaction did not substantially improve under P4P.

2.4.4.2 Implications for Policy and Research

As P4P programs intend to reduce maternal and child deaths in LMICs, it is essential to demonstrate their potential to improve quality of MCH care comprehensively than process quality alone. Improving provider adherence to P4P guidelines on ANC alone cannot guarantee an improved maternal and child health. Clinical evidence suggests that quality of skilled birth attendance, EmONC and post-natal care are necessary to reduce maternal and neonatal deaths.[102] There could be a possibility of insufficient provider skills affecting the process quality on delivery, EmONC and post-natal care.[102] Thus, adequate attention should be given to evaluate the evidence on other aspects of MCH care.

Ensuring structural quality such as facility infrastructure, equipment, drugs and supplies is equally pertinent to offer quality care on MCH.[102] Absence of these minimum standards can affect patient satisfaction and in turn reduce demand for services in the long term.[102] Inadequate structural quality could be a reason for the poor client satisfaction in the studies.[102] Several P4P programs provided autonomy and funds to facilities to enhance structural quality. P4P programs in Egypt, Burundi, Rwanda and DRC also had routinely monitored structural quality. However, the prevailing positive evidence on structural quality is minimal. The DRC program faced negative effects on structural quality index, as facilities could not spend on infrastructure and equipment due to their reduced revenue under P4P. The adequacy of funds for infrastructural innovations under P4P programs needs to be investigated. Evaluations of P4P programs in high-income settings reflect that proportion of facility revenue is significant to improve quality of care.[78]

There could be also a possibility of limited motivation and capacity among health workers and managers restricting innovations on strengthening structural quality, as evident in many LMICs.[98] Currently, it is unknown if the prevailing complex procurement system and managerial bottlenecks in the service delivery system to improve structural quality are better under P4P programs. Otherwise, these inefficiencies could retard structural quality improvements under P4P.[98] In addition, if there was no incentive for structural quality improvement, it could have been neglected with a preference for other incentivized indicators (known as cherry picking).[98]

Studies reflect that providers are motivated to improve process quality of care by adhering to treatment guidelines. There could be numerous reasons for their elevated motivation such as financial incentives, regular supervision, patient feedback and improved facility functioning.[112] Several demand-side financing programs proved that increased patient load negatively affects provider efficiency to handle high volume of patients and this could potentially reduce process quality of care in due course of time.[112] Thus, specific attention to retain process quality under P4P programs through optimum provider-patient ratio is needed.

Some P4P programs did not intend to charge user fee, but patient out-of-pocket expense was not reported to be lesser under P4P. Additional research is needed to explore specific cost drivers for out-of-pocket expenses under P4P. In DRC, facilities could not offset the revenue loss from reduced user fee as there was not sufficient demand generation, negatively affecting quality of care.[98] Design of P4P programs need to approach the issue of utilization and quality of services comprehensively by addressing both demand- and supply-side challenges.

Partial positive effect of P4P on quality of MCH care asks for a deeper investigation into role of design, implementation and evaluation of P4P program. According to a review of P4P in high income countries, quality of care is the final outcome of the changes brought in by incentives at provider level, provider group level and health system level.[78] However, P4P programs in LMICs do not provide any similar evidence. Further, there could also be a possibility of preferential attention to P4P services at the cost of non-incentivized services or positive spillover from incentivized to non-incentivized services.[113,114] None of the studies reported effects on non-P4P services.

Morbidity and mortality are difficult to attribute to the quality of care delivered because various factors such as severity and pre-existing illnesses, delayed care seeking, and non-adherence to treatment would affect these outcomes.[14] Since most of the P4P programs were less than two years, their evaluations did not potentially have adequate statistical power to explore the impact on mortality. Also, results need to be interpreted considering contextual factors e.g. duration and design of interventions, size of incentives, frequency of payment, timing of evaluation, representativeness of intervention areas and presence of private providers. Study sites were small and in some, were not representative of the country. Effectiveness can be different if intervention is implemented exclusively on quality of care than many performance targets as shown in the studies.

A few studies with CBAs utilized matching of administrative areas such as provinces or districts.[89,98] However, within these administrative areas there were gross heterogeneity among facilities in terms of infrastructure, staffing, catchment population and service volume. These differences can be minimized during the analysis if further matching of facilities could be performed. Matching technique such as propensity score matching which allows for comparison of effects between similar units can be tried to strengthen the rigor of evidence.[115] Studies in Rwanda, Egypt and DRC have tried to balance the financial resource effect across intervention arms by providing equivalent financing.[15,98,110] However, none has attempted to balance the effects of additional supportive interventions such as supportive supervision, continuous quality measurement, and consistent use of checklists and operational plans that might have led to overestimation of P4P's effects. There could be a possibility of publication bias in this systematic review as studies with more positive results and/or statistically significant findings are more likely to get published.[116]

This systematic review showed that P4P is effective to improve process quality of ante natal care but not so effective on improving structural quality, customer satisfaction, out-of-pocket expenses and maternal and child health status. Several studies neither explored the effect of P4P on quality of MCH in-depth, nor were powered enough statistically. Further research is needed to understand P4P's impact on EmONC, delivery and post-natal care and their causal pathways in LMICs.

2.5 Rationale

One of the key objectives of P4P is to improve quality of services to improve population health. Several studies and systematic reviews have illustrated the effects of pay for performance in enhancing the quality of health care.[114,117,118] However, most of the studies have been conducted in high-income country settings focusing on the effect of

P4P on quality of care for chronic diseases and health conditions.[19,78,114,117] The existing evidence reflecting P4P's effect on quality of maternal and child health is limited. On the contrary, P4P is currently a widely experimented strategy to improve maternal and child health, especially in LMICs.[14]

Given the primary focus of P4P on improving usage of services, the attention on quality of care can be diluted in LMICs. The prevailing evaluation of P4P on maternal and child health in LMICs have primarily attempted to showcase its effectiveness on utilization of services.[94,96] A few studies also have reported that P4P's effect on quality of maternal and child care services is limited in LMICs.[15,40,119]

Maximizing utilization of services alone without any corresponding improvement in quality of care does not necessarily guarantee improved maternal health outcomes in any circumstance.[119] The evidence shows that if maternal healthcare interventions do not specifically address the quality of antenatal care, the subsequent effect on maternal health will be sub-optimal.[119] Quality of ANC is necessary to reduce premature birth and several pregnancy related complications.[119] However, only a few studies in LMICs show the effect of P4P on quality of ANC.[101] Further, none of the studies brings in P4P's effect on all dimensions of quality (structure, process and outcome) in ANC. The P4P program in Zimbabwe was chosen to study in-depth as it was one of the novel P4P interventions incentivizing both the health facility and individual health workers to improve coverage and quality of maternal and child health services.[120] Hence, the anticipated effects of P4P on quality of ANC in Zimbabwe were multi-faceted and this provides an opportunity to evaluate the effects of pay for performance on quality of ANC in an LMIC setting.

2.6 Research Question

What is the effect of pay for performance on quality of antenatal care in rural health facilities of Zimbabwe?

2.7 Objectives

The specific objectives of this thesis are:

1. To measure the effect of pay for performance on structural quality of antenatal care
2. To measure the effect of pay for performance on process quality of antenatal care
3. To measure the effect of pay for performance on client satisfaction of antenatal care

Chapter 3: Study Setting

3.1 Overview

This chapters presents the geographic, climatic and administrative features; demographic characteristics and economic context of Zimbabwe, the study setting. Then it describes Zimbabwe's health system, scenario of human resources for health, and key health indicators. Further, it presents the situation of maternal healthcare and its quality. Finally, it describes the pay for performance intervention including the incentives offered as part of this intervention.

3.2 Geography, climate and administrative units

Zimbabwe is a sub-Saharan African country situated between the Limpopo and Zambezi rivers.[121] Zimbabwe is a land-locked country, bordering to South Africa on the South, Mozambique on the East, Zambia on the North and North-West and Botswana on the West (Figure 3.1). The country possesses a land area of 390,757 square kilometers,[121] including 8.6 million hectares of potentially arable land and more than 5 million hectares of forests. Zimbabwe has plenty of natural resources, especially minerals and wild life. It has a mixed climate with dryness, cool winter, and warm and rainy summer.[121] The three distinct seasons are the cool dry winter from May to August, a hot dry season during September and October, and a warm wet season from November to April.[122]

Administratively, Zimbabwe has a decentralized and deconcentrated system with eight provinces at the top, followed by several districts, wards and villages.[122] A district is the main body of direct service delivery to populations at the local level. Wards are the planning and implementation units of the district. Villages are the smallest administrative units with more direct representation to peoples' voice.[122]

Figure 3.1: Map of Zimbabwe

Source: National Health Profile, 2013[123]

3.3 Demographic Characteristics

Table 3.1 gives an account of Zimbabwe's key demographic characteristics. As per the Zimbabwe Population Census 2012,[121] Zimbabwe is inhabited by 13.06 million people with females representing a slightly higher proportion at 52%, while the sex ratio is 93 Males/100 Females. About 65% of the population resides in rural areas and the rest lives in urban settings. The population density is 33 persons per square kilometer.[121] More than half of the population (55%) is 15 to 64 years of age, 41% is under 15 years (41%), while only 4% are in the 65+ age group.[121]

The average household size is 4.2 with the majority households being headed by men (65%).[121] Among the economically active population, a majority come from the "other employed" category (52%), followed by communal farmers and workers 37%, while only 11% remaining unemployed.[121] Less than a half of the households have electricity (44%), while two-thirds of the households have access to safe water (75%) and toilet facilities (76%).[121]

Zimbabwe's crude birth rate as estimated by the direct method is 32 per 1000 population while crude death rate is 10.2.[121] Total fertility rate is 3.8 and average life expectancy at birth is 38 years.[121] The country's annual average intercensal population growth rate is 1.1%.[121]

Table 3.1 Zimbabwe demographic characteristics

Population Size	
Total	13,061,239
Males	6,280,539 (48%)
Females	6,780,700 (52%)
Sex Ratio (Males/ 100 Females)	93
Urban/ Rural Population	
Population in Urban Areas	4,284,145 (33%)
Population in Rural Areas	8,777,094 (67%)
Area (Sq. km)	390,757
Density (Persons/ Sq.Km)	33
Age Composition/ Percent	
Under 15 years	41
15 –64	55
65+ years	4
Households	
Number of Private Households	3,059,016
Average Household Size	4.2
Percent Male Headed Households	65
Activity and Labor Force (Economically Active)	
Communal Farmers/ Workers (%)	37
Other Employed (%)	52
Unemployed (%)	11
Housing Conditions	
Households with electricity (%)	44
Households with Safe water (%)	75
Households with Toilet facilities (%)	76
Crude Birth Rate (Direct Method) (Births/ 1000 Population)	32
Total Fertility Rate (Direct Method)	3.8
Crude Death Rate (Deaths/1000 Population)	10.2
Average Life Expectancy at Birth	38
Average Annual Inter-Censal Population Growth Rate	1.1

Source: Zimbabwe Population Census 2012[121]

3.4 Economic Context

Zimbabwe was a better performing economy before the start of the decade long economic recession during the 2000s.[124] This economic depression had a severe negative effect on the country's economy, especially, fiscal conditions, macro-economic stability and balance of payments.[124] The annual economic growth reflected a negative trend at -5.4% between 2000 and 2008. The year 2008 had a low GDP per capita at US$392.[124] Despite the commencement of the Zimbabwe Program for Economic and Social Transformation (ZIMPREST) to seek international help for economic growth, the direct development assistance has declined from US$71 million in 1997 to US$7 million in 2002.[124] Currently, agriculture is the primary source of government's revenue, while manufacturing and tourism sectors also contribute significantly to national budget.[124] During the 2000s, population growth rate was constant at 1%, while economic growth slowed down drastically and even reached -10% in 2008.[124] According to UNDP, a majority of population (73%) was living below the total consumption poverty line in 2003.[125]

However, adoption of a multicurrency regime has instilled in macroeconomic stability and positive economic growth.[125] As shown in table 3.2, Zimbabwe's GDP was 14.2 billion USD in 2014 with per capita GDP at $1773 (PPP).[126] The country's human development index ranking has also improved from 173 in 2011 to 155 in 2014.[125]

Table 3.2: Zimbabwe – Socio-economic indicators

Indicators	**2014**
GDP (Billion USD)	14.2
GDP per capita (in PPP)	$1773
Unemployment rate	5%
Human development index rank	155
Poverty headcount ratio at national poverty lines	72.3%

Source: Human Development Report 2015[125] and World Development Indicators 2016[126]

3.5 Zimbabwe Health System

Ministry of Health and Child Care (MoHCC) anchors the activities in the Zimbabwe health sector with the support of Finance Ministry, other allied ministries and development partners.[122] Zimbabwe's health system is decentralized at four levels namely central, provincial, district and community levels.[122] The healthcare provision is done by the public sector facilities and privately registered physicians or group of providers. The public healthcare sector consists of the Ministry of Health and Child Welfare (MoHCC), Local Authorities (municipalities), and other allied Ministries.[122] More than a half of the healthcare services are provided by this public health sector. Private for-profit hospitals, nursing homes, maternity homes, industrial clinics and general practitioners, private laboratories and imaging facilities constitute the private for-profit sector.[127] The non-profit sector includes faith-based organizations and other non-governmental organizations (NGOs).[127]

As reported by the 'Access to Health Care Services Study (2008)', majority of the communities reside within 5 kilometer radius from their nearest health facilities.[128] However, around 20% of the communities live 10 kilometers far from a health facility.[128] As shown in table 3.3, health facilities have a four tier referral system.[123] There are 1,231 primary healthcare (PHC) facilities as first point of care units. These facilities are public, faith-based and rural council health centers.[123] At the secondary referral, there are 179 referral facilities.[123] There are seven provincial hospitals at the tertiary level and 15 quaternary facilities at the quaternary level. Both secondary and tertiary level facilities provide curative and rehabilitative care including long term care services.

Table 3.3: Health Facilities by levels of care and province

Province	Primary	Secondary (1st Referral) Level	Tertiary (2nd Referral) Level	Quaternary (3rd Referral) Level	Total
Harare	45	0	0	8	53
Manicaland	253	36	1	0	290
Mashonaland Central	130	13	1	0	144
Mashonaland East	168	22	1	0	191
Mashonaland West	128	22	1	0	151
Matabeleland North	92	17	0	0	109
Matabeleland	105	18	1	0	124

South					
Midlands	106	28	1	0	135
Masvingo	170	23	1	0	194
Bulawayo	34	0	0	7	41
Total	1231	179	7	15	1432

Source: National Health Profile 2013[123]

The existing 1,920 private facilities, mostly based in urban Harare, Bulawayo and provincial headquarters also provide curative, long term and rehabilitative services (table 3.4).[129] There are 126 hospitals and 582 rural health centers run by NGOs, mostly faith-based missions.

Table 3.4: Registered Private Health Facilities by Province and Service Type

Category	HR	BW	ME	MW	MC	MN	MS	MV	ML	MC	Total
Dental	89	18	2	7	3	2	-	2	8	10	**141**
Medical laboratories	52	14	2	8	3	-	-	4	7	7	**97**
Speech and Occup.	11	-	-	-	-	-	-	-	1	-	**12**
Physiotherapy	40	14	4	3	2	2	-	1	4	7	**77**
Nursing homes	12	9	-	5	-	-	-	4	3	1	**34**
Consulting	347	147	27	55	15	8	3	17	49	48	**716**
Nurses' consulting	29	6	14	16	1	-	1	12	7	24	**110**
Maternity homes	12	3	2	1	-	-	-	1	1	-	**20**
Special clinics	15	8	1	5	2	1	1	6	6	6	**51**
Pharmacies	132	36	4	16	4	1	1	4	16	15	**229**
Private	13		1	1	4	1		4	5	4	**33**
Industrial clinics	91	34	-	13	5	16	5	9	23	12	**208**
Estate clinics	-		3	-	-	-	-	3	-	4	**10**
Psychological services	51	9	-	-	1	-	-	1	1	1	**64**
Operating theatres	4	1	-	-	-	-	-	-	-	-	**5**
Dietetics	4	1	-	-	-	-	-	-	-	1	**6**
Natural therapy	8	2	-	-	-	-	-	-	-	-	**10**
Emergency services	12	6	1	1	1	2		1	3	1	**28**
Radiology services	25	9	2	1	-	-	2	-	2	2	**43**
Optical	15	8	-	-	-	-	-	-	2	1	**26**
Total	**962**	**325**	**63**	**132**	**41**	**33**	**13**	**69**	**138**	**144**	**1920**

Source: Health Professions Authority Register 2009;[129]
Note: HR – Harare, BW – Bulawayo, ME – Mashonaland East, MW – Mashonaland West, MC – Mashonaland Central, MN – Matabeleland North, MS – Matabeleland South, MV – Masvingo, ML – Midlands, MC – Manicaland

Public health units within the national, district health offices, rural councils and urban councils provide preventive health services.[122] The major preventive services in the country include family health services, HIV/AIDS preventive services, epidemiological surveillance services and environmental health services.[122]

While a number of interventions have been rolled out to strengthen the health system since 2009, they: (i) are more input-focused than results-oriented; and (ii) lack focused, measurable and well-designed clinical quality improvement interventions.[130] As a result, Zimbabwe's public health system has been heavily focused on basic quantity coverage of health interventions with isolated quality improvement and measurement interventions across various programs—mainly HIV/AIDS, TB and malaria through PEPFAR and Global Fund support.[130]

The prolonged economic depression has adversely affected Zimbabwe's fiscal capacity to finance the envisaged activities under the National Health Strategy.[130] Although Government is the largest source of financing through the tax-based system, currently, the major health sector programs are largely funded by international development partners.[130] Other key sources of financing are out-of-pocket payments, private voluntary organizations and insurance schemes.[130]

It is estimated that Zimbabwe needs to spend at least US$34 per capita per annum on health, mainly to achieve MDGs 4 and 5.[124] However, in 2009 the Government allocation on health was US$27 per capita per annum. Between 2001 and 2010, public health spending declined from 39% to 18% of the total health expenditure. This shift resulted in households making the largest contribution (39%) to total health expenditures through out-of-pocket payments (OOPs) — which are regressive and disproportionately affect poor households.[124] The historical focus on curative care has shifted the budget away from the primary health care approach and has resulted in disproportionately higher shares of expenditure for central and tertiary hospitals at the expense of the community and primary levels.[130] Allocation for curative care remained above 80% in 2013.[130] This leaves 7% of health budget to be spent on preventive services. On account of the economic difficulties the external funders have largely borne the financing of drugs and other preventive services.[130] In 2010 the Government of Zimbabwe (GoZ) had allocated 12.7% of the total budget to health.[124] This was a decline from previous years, with a budget allocation for health 13% in 2006 and 14% in 2008.[124]

3.6 Human Resource Scenario

The Health human resource scenario has been in crisis in Zimbabwe ever since the Economic crisis of 2000s.[131] Sup-optimal production of technical staff, shortage of skilled workers due to migration to other better remunerating peer countries, poor retention capacity with the Government and low productivity of workers are the critical issues.[131] Economic crisis has left the Government with limited financial capacity to train and retain staff.[132] Currently, the government depends largely on international development partners to finance its staff retention strategies.[131] In addition, health workers face several challenges in service provision. The most discussed issues among them are limited infrastructure and equipment demotivating health workers to perform; low salaries, limited supervision and Human Resource Management capacity.[131] The National Integrated Health Facility Assessment (2012) reported that health workers are dissatisfied with salary, employment benefits, opportunities for promotion and the general state of health facilities.[133]

Table 3.5 illustrates the current status of health workforce numbers by staff category as reported by the National Health Profile of 2013.[123] As a whole, total vacancy rate is 15%. However, for some positions, closer to a half are vacant. Most positions with higher vacancy rates pertain to technician categories – hospital equipment (55%), radiography (49%), orthopedic (47%), laboratory (47%), research officer (44%), and top management (40%).[123] Among the primary service providers, 37% of doctor positions are vacant, whereas 10% nurses' positions are not filled in.

Table 3.5: Zimbabwe health system – Summary of staff numbers

Staff category	Establishment	In position as of Dec 2013	Vacant
Top Management	83	50	40%
Doctors	1767	1114	37%
Nurses	20735	18722	10%
Environmental Health	2495	1885	24%
Pharmacy	589	394	33%
Radiography	471	239	49%
Physiotherapy	472	419	11%
Nutrition	980	858	12%
Orthopedic	49	26	47%
Oral Health	327	236	28%
Laboratory	644	343	47%
Research Officers	25	14	44%
Health Information	227	187	18%
Health Promotion	73	55	25%
Hospital Equipment	197	88	55%
Admin. General	6049	5334	12%
Program Managers	3	3	0%
Total	35186	29954	15%

Source: Zimbabwe National Health Profile, 2013[123]

3.7 Health Status

As reported by the National Health Strategy (NHS) 2009-2013, there is considerable mortality from preventable and treatable conditions due to the weak state of the public health system.[127] As it can be seen from table 3.6, Zimbabwe's key health indicators remain low. Although births delivered by a skilled health care provider is relatively high at 80% compared to the sub-Saharan African (SSA) levels, the maternal mortality ratio is higher (Zimbabwe 614; SSA 547).[134]

Table 3.6: Key health indicators in Zimbabwe

Indicator	Zimbabwe	Sub-Saharan Africa
Maternal mortality ratio (per 100,000 live births)	614 (506 - 722)	547
Births delivered by a skilled provider (%)	80	47.9
HIV prevalence in 15 – 49 age group (%)	16.7 (15.9 - 17.5)	4.5

Tuberculosis incidence (per 100,000 population)	278 (193 - 379)	281 (250 - 313)
Infant Mortality Rate (per 1000 live births)	55 (50 - 60)	56.4
Under five Mortality Rate (per 1000 live births)	75 (68 - 81)	83.2
Children (12-23 months) receiving third dose of DPT vaccine by their first birthday (%)	85.4	77.2

Source: Multiple Indicator Cluster Survey 2014[134]; Global TB Report 2015[135];
Note: figures in brackets are 95% confidence intervals

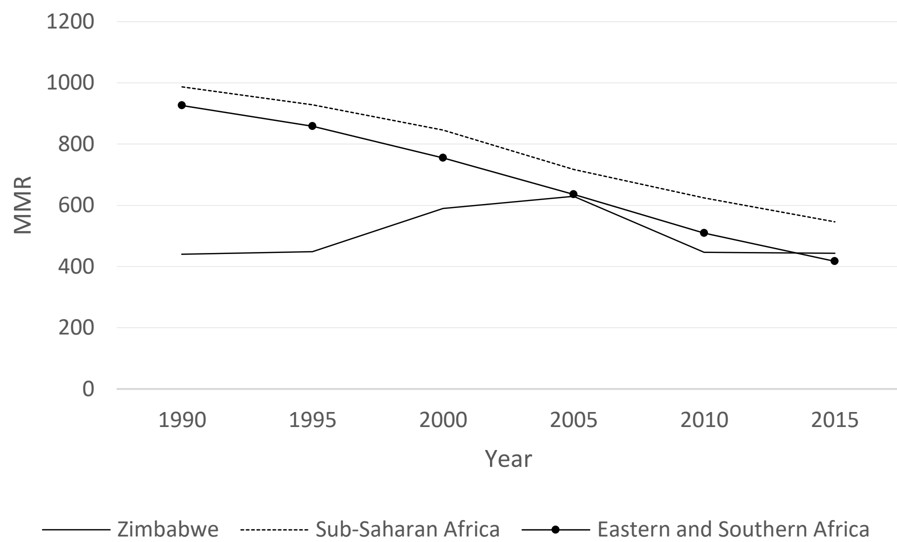
The prevalence of HIV is also higher than the SSA levels (Zimbabwe 16.7%; SSA 4.5%). HIV prevalence among 15 to 49 years age group remains high at 16.7%. TB is still among the major causes of morbidity with an incidence of 278 per 100,000 population.[135] Infant and under five mortality rates are at 55 and 75 per 1000 live births respectively. About 85% of children in their 12 – 23 months age received third dose of DPT vaccine by their first birthday.[134] Life expectancy in Zimbabwe remains very low at 38 years.[123]

A 2013 Urban Demand Side Survey by the World Bank highlights that regardless of gender, most participants had knowledge of the health risks associated with pregnancy and childbirth.[136] However, there is still limited knowledge of the signs, symptoms and management of non-communicable diseases (NCDs).

3.8 Maternal health in Zimbabwe

Zimbabwe has failed to achieve Millennium Development Goals 4 and 5 by 2015. According to the Maternal Mortality Estimation Inter-Agency Group, maternal mortality ratio (MMR) declined in sub-Saharan Africa by 45% and in Eastern and Southern Africa by 55% between 2000 and 2015, whereas it increased by 1% in Zimbabwe during the same period.[137,138] After 2005, MMR has shown a decline in Zimbabwe.[138] But, it still remains at a higher level than that of the Eastern and Southern Africa region (figure 3.2) even though access to antenatal care (90% of women in their reproductive age received ANC from a skilled provider) and skilled delivery are higher (80%) than the regional averages.[137]

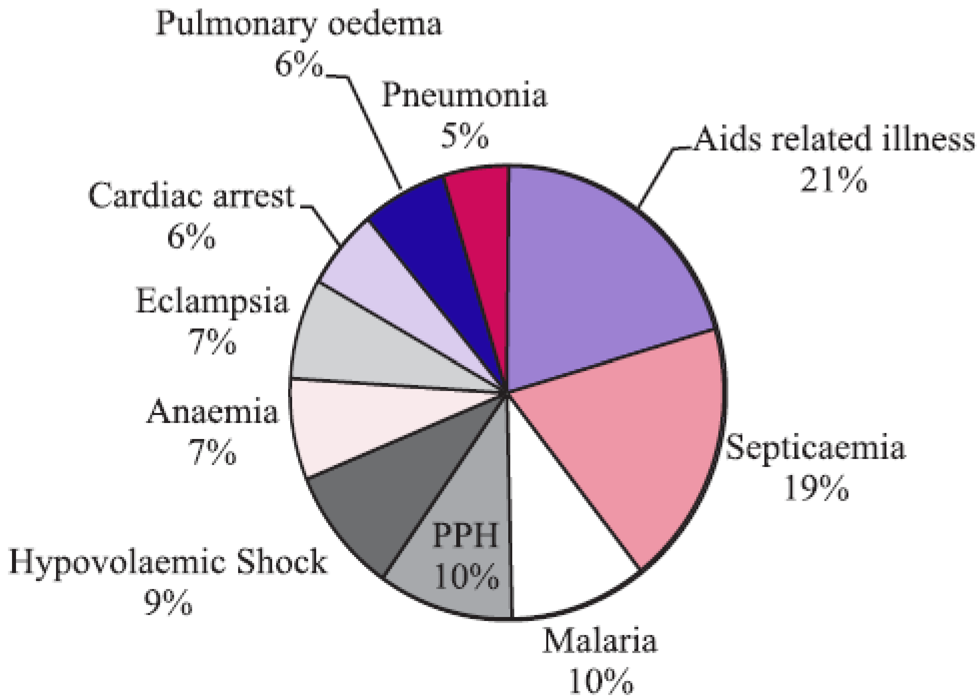
Figure 3.2: Trends in maternal mortality ratio in Zimbabwe



Source: WHO, UNICEF, UNFPA and The World Bank estimates. Trends in maternal mortality: 1990 to 2015[138]

Over 60% of the maternal mortality cases occur in the post-partum period and almost a half outside institutions.[139] As shown in figure 3.3, the primary clinical causes of maternal mortality in Zimbabwe are AIDS related illness (21%), septicemia (19%), post-partum hemorrhage (10%) and malaria (10%).[123]

Figure 3.3: Causes of maternal death in Zimbabwe



Source: National Health Profile, 2013[123]

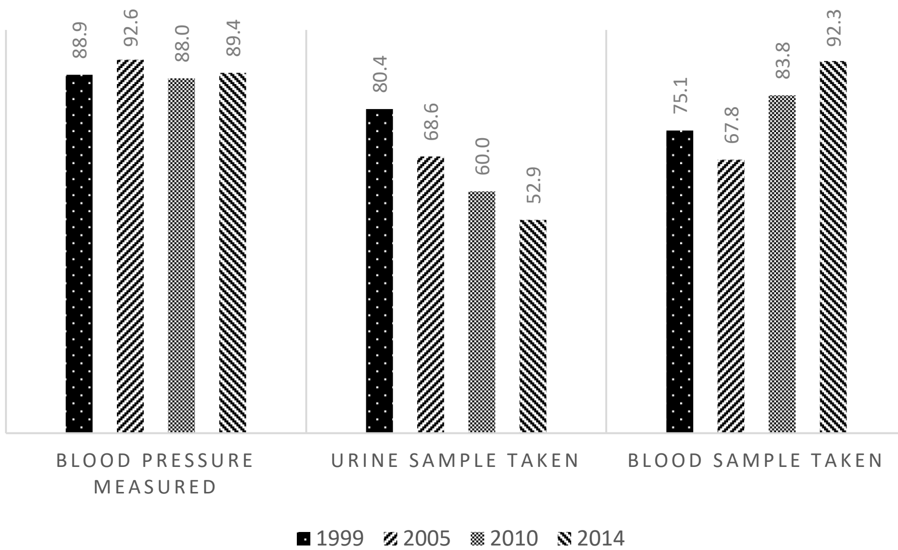
Key challenges to maternal health are lack of access to and use of midwives and higher user charges.[128] The shortage of midwives was 30% at the national level in 2012, whereas for some rural provinces it was as high as 60%.[140] The largest demand-side barrier to care is the client's inability to pay for care – a result of poverty and user fees at the point of care in both rural and urban areas.[128] A World Bank study indicates that the minimum OOPs by a household in urban areas (Bulawayo and Harare) for maternal and newborn care was around US$200 per pregnancy.[136] Zimbabwe's inadequate and expensive transportation system is another barrier, even in urban areas.[128] Ambulance fees average $20 per trip irrespective of the distance to the health facility. For these and other reasons, including poor quality of care, mothers in rural settings generally deliver at home unless there is a health center within 10 KMs.[128] In addition, long waiting times, shortages of staff, drugs and supplies, and improper provider attitudes towards clients were also reported to be affecting the utilization of care negatively.[133] There is marked disparity in access to maternal care between rural and urban areas. Women in rural areas deliver less with skilled birth assistance (51.7%) compared to those in urban areas (94.2%).[137] The former also has lower uptake of modern family planning methods (60.7%) compared to the latter (67.3%).[137]

3.9 Quality of maternal care in Zimbabwe

Quality of maternal care services specifically antenatal care quality is sub-optimal. As per the household surveys such as the Demographic and Household Survey (DHS) and Multiple Indicator Cluster Survey (MICS), quality of ANC remains low (figure 3.4).[134,137] For instance, collection of urine sample (at least once during the pregnancy) was reported only by a half of the respondents (52.9%), whereas measurement of blood pressure and collection of blood sample were closer to 90%, even though the national and international guidelines recommend them to be universal. These household surveys collected information from women in their reproductive age group who reported having a birth outcome in the two years preceding the survey.

The National Integrated Health Facility Assessment was undertaken in 2012 that visited the health facilities and collected information through exit interviews and direct clinical observations during the provision of antenatal care.[133] The assessment found that during the last ANC visit to the health centers, only half of the pregnant women had their blood sample taken, and less than 10% had their urine sample taken.[133] During the observation of service delivery, only 2% were screened for pre-eclampsia signs during ANC, less than half (46%) health workers provided all routine preventive medicines; whereas a little more than a third (36%) provided counselling on birth preparation and only 12% provided adequate counselling on danger signs in pregnancy.[133]

Figure 3.4: Receipt of antenatal services components in Zimbabwe



Note: Values are in percentages.

Source: Demographic and Health Surveys 1999, 2005, 2010[137]; Multiple Indicator Cluster Survey 2014[134]

3.10 Pay for performance in the context of Zimbabwe's health system

In order to reduce the prevailing high level of adverse maternal and child health outcomes, the Government of Zimbabwe introduced the pay for performance project in 2012 with the support of the World Bank. The project locally known as Results Based Financing (RBF) Project was meant to support the Ministry of Health and Child Care (MOHCC) in its effort to increase the availability, accessibility and utilization of quality health care to improve maternal and child health.[120] The project was in line with the Investment Case for Health 2010-2012 that recommended for high impact interventions to improve maternal and child health based on selected indicators.[130] The RBF project directly contributed to the implementation of the Government of Zimbabwe's Results Based Management approach.[120] In addition, the RBF project provided support for implementation of MOHCC's National Health Strategy 2009 - 2013.[127] The RBF project was overseen by Steering Committees consisting of central government, local government, community health council, non-government and community based organizations at the National, Provincial and District levels.[120] The expected benefits of the RBF project are shown in Table 3.7.

Table 3.7: Potential Advantages of RBF Project

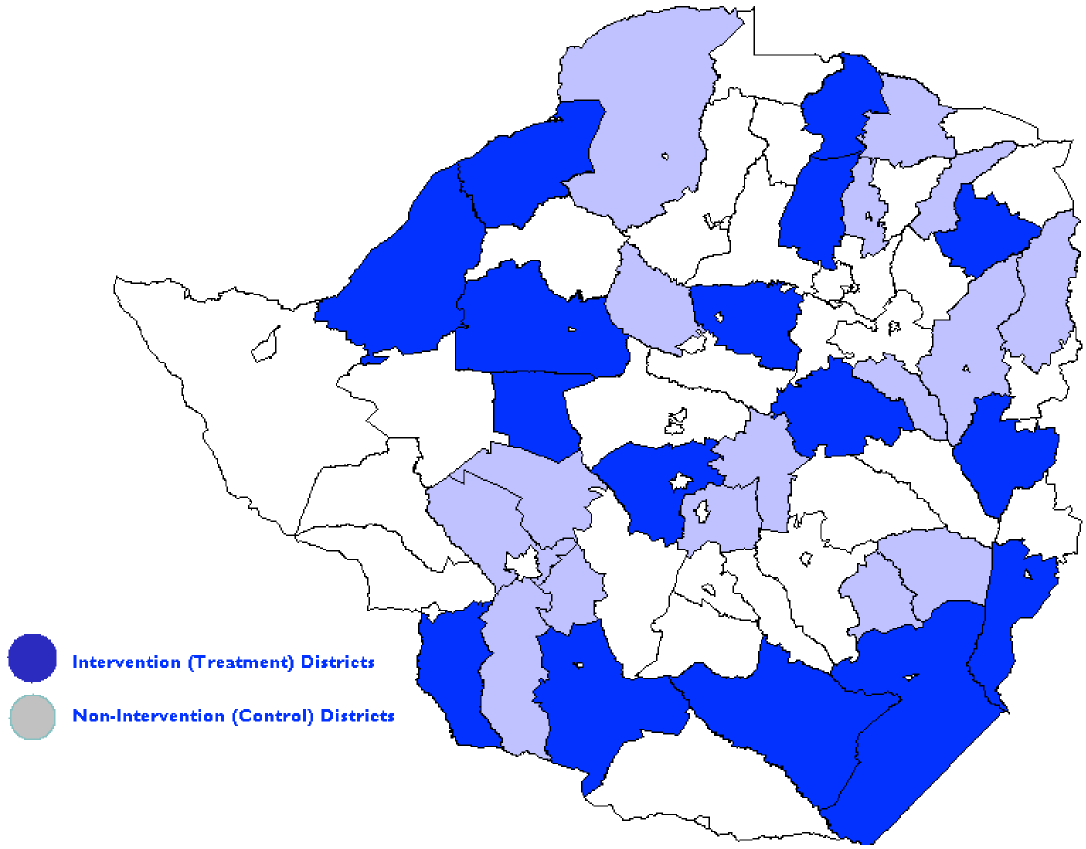
1.	**For the population and local communities**
▪	Higher Quality of Care because health care providers are motivated by RBF to improve the quality of services
▪	Better access to health care because RBF payments to facilities will lower the service fees
▪	Involvement in quality and quantity verification and able to report to independent body (purchaser)
2.	**For the Ministry of Health and Child Welfare, Ministry of Finance and Economic Development, other policy makers and Governmental bodies**
▪	Increased control (power) and better outcomes of the health system
▪	Increased legitimacy and acceptance as a result of better quality and accessibility of health care
▪	More transparency (through checks and balances) and efficiency and thus better opportunities to attract donor funding
3.	**For health facilities (hospitals, health centers and their staff)**
▪	Better working conditions (more feedback, professional supervision)
▪	Increased acceptance by the population / communities
▪	More flexibility and space for "social entrepreneurship" within certain boundaries, objectives and conditions
▪	Initiatives and creative solutions are rewarded
4.	**For aid agencies and donors**
▪	Better health system outcomes
▪	Efficient spending of funds
▪	More transparencies through checks and balances in the system

Source: RBF Project Implementation Manual, Zimbabwe[120]

3.11 Description of the intervention

The RBF project incentivized health facilities in 16 rural districts for selected maternal and child care services (figure 3.5).[120] For impact evaluation purposes, 16 matched control districts were also selected. The project was implemented from April, 2012 to September, 2014. A few key incentivized services were ante natal care, post-natal care, and institutionalized skilled birth attendance. These indicators were selected based on the country's dismal performance during the previous years and to achieve MDGs 4 and 5.[128]

Figure 3.5: Districts implementing RBF Project in Zimbabwe



Source: RBF Project Implementation Manual, Zimbabwe[120]

Performance incentives were provided to facilities every quarter based on verification of performance. RBF introduced a strict separation of functions of provider – purchaser – regulator.[120] The Ministry of Health was the purchaser of services from health facilities, which were the providers. Provincial government, which was the local health authority was the regulator of the purchasing and paying activities.[120] An international NGO internally verified the performance of facilities based on management information system and random spot checks. University of Zimbabwe was the external verifier of performance through random spot checks and client tracer surveys.[120]

Apart from the incentives, the RBF project also provided autonomy to health facilities on planning and utilizing the performance incentives; supervision of quantity performance through monthly visits by the NGO; and supervision of quality performance through quarterly visits by the District Health Management Team.[120] As the Zimbabwe RBF project introduced elements of supportive supervision, reforms in the payment, autonomy to health facilities, and continuous quality improvement through supervision of quality, it can be considered a broader health systems improvement intervention rather than just providing performance-based incentives. As noted earlier, health worker performance is one of the leading causes of poor health care system performance and quality of care, leading to underutilization of services and poor health outcomes. This low health worker performance on the other hand is also driven by certain health system challenges such as lack of supportive supervision and issues with infrastructure and supplies in health centers. RBF project was intended to improve health worker performance and bring in multi-faceted changes in healthcare system (e.g. improved infrastructure and supplies).

3.12 Incentive Scheme

The health facilities were incentivized on their performance towards maternal and child health services.[120] A quarter (25%) of the total income from P4P at the facility level had to be reinvested at the facility level to improve and maintain the infrastructure, equipment, and supplies. The rest 75% had to be shared among the staff according to a guideline designed considering their qualifications and experience (Annex-A Table A1).[120]

Incentives were disbursed every quarter under three dimensions of service delivery, i.e. 1) Quantity of services (quantity bonus); 2) Quality of services (quality bonus); and 3) Client satisfaction (satisfaction bonus).

3.12.1 Quantity Bonus

The amount of quantity bonus was based on a pre-fixed fee schedule for each selected indicator and was calculated by multiplying the utilization of each service with its unit price as shown in the equation below.[120]

Quantity bonus = $\sum_{i=1}^{16} a_i b_i$

where a_i = Unit Price for indicator i;

b_i = Quantity achieved for indicator i

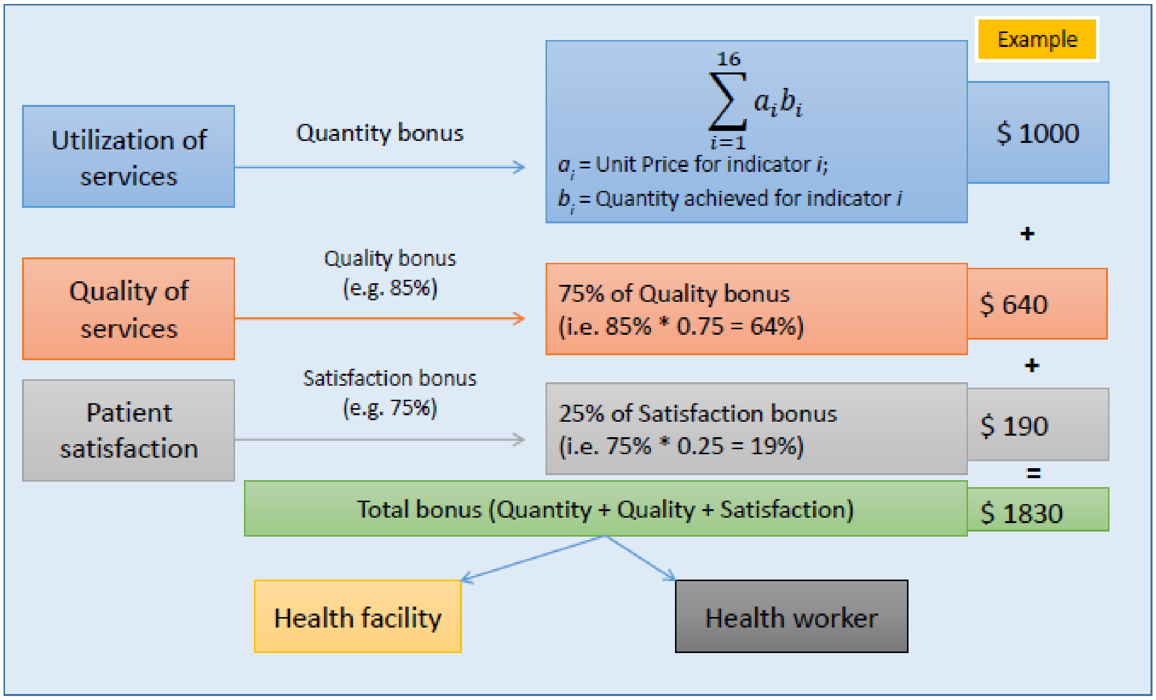
For instance, the unit price for institutional delivery was US$ 12.50. If in a quarter, there were 5 deliveries in the facility, then the income from this particular indicator would be $62.50 (illustration in figure 3.6 and table 3.8). Finally, the income from all indicators was added to create the final quantity bonus.

3.12.2 Quality Bonus

Quality bonus was a composite of quality of services (75%) and client satisfaction (25%).[120] Quality of services was verified by the District Health Management Team through a balanced score card (quality checklist – shown in table 3.9) consisting of structural, administrative, financing, and clinical elements. For instance, availability of blood pressure equipment to conduct ANC check ups constituted a quality parameter for incentives. Balanced score cards have been applied to measure the performance and progress of health systems in several LMIC settings successfully.[141–143]

Client satisfaction was assessed by community based organizations in the health facility catchment areas through household visits. Only one community based organization was selected for each health facility. These community based organizations were chosen based on their long term presence in the facility catchment areas and experience of undertaking community surveys. Community based organizations visited a random sample of 25 clients from the health facility records every month.[120] The clients were sampled from the facility records following a systematic random sampling method. The sampling unit was a client. They validated the authenticity of the clients accessing care from the particular health facilities as well as their satisfaction. The health facilities were paid a start-up amount for the first quarter of implementation.[120] Afterwards, based on the achievements in each quarter, the facilities were been paid as per the following table (table 3.8). There were no capping of the incentives, i.e. facilities could potentially earn as much they provided services for.

Figure 3.6: Incentive Calculation Mechanism in RBF Project, Zimbabwe



Source: RBF Project Implementation Manual, Zimbabwe[120]

Table 3.8: Quarterly price for each incentivized indicator and calculation of final bonus (an illustration)

	Indicator	Price in US$ (A)	Verified data (B)	Subsidy in US$ (A X B)
1	OPD new consultations	0.15	670	100.50
2	1st ANC Visit during first 16 weeks	3.00	13	39.00
3	ANC 4+ visits completed	3.00	5	15.00
4	HIV VCT in ANC	2.00	8	16.00
5	ARVs to HIV+ pregn. Women (PMTCT)	2.00	3	6.00
6	Tetanus TT2+	0.45	11	4.95
7	Syphilis RPR test	0.45	14	6.30
8	IPT (x2 doses)	0.45	8	3.60
9	Normal deliveries	12.50	5	62.50
10	High risk perinatal referrals.	3.00	2	6.00
11	PN visits 2 or more	3.00	4	12.00
12.a	Family planning, short term methods	2.50	34	85.00
12.b	Family planning, long term methods	50.00	8	400.00
13	Pri. course completed, immunization	3.50	3	10.50

14	Vit. A supplementation	0.18	6	1.08
15	Growth monitoring	0.18	34	6.12
16	Malnutrition correctly managed: cured cases discharged	3.00	0	0
17. Quantity bonus				774.55
18. DHE supervision score			70%	
19. Client satisfaction score			60%	
20. Overall quality score (75% of DHE supervision score + 25% of Client satisfaction score)			68%	
21. Quality bonus (Overall quality score X Quantity bonus)				526.69
22. Total bonus to health facility (Quantity bonus + Quality bonus)				1301.24

Source: RBF Project Implementation Manual, Zimbabwe[120]

Table 3.9 and table 3.10 respectively show the summary quality checklist and ANC checklist that were being used in the Zimbabwe P4P program.

Table 3.9: Summary of the quality components

HEALTH SERVICE COMPONENTS	**Available Points**	**Number of indicators**
General Appearance	5	5
Administration and planning	30	8
Out Patient Department/consultation area	35	23
Emergency services	10	6
Family and Child Health	65	28
Maternity Service	30	21
Observation/inpatient services	5	5
Medicines and sundries stock management	20	7
Referral services	10	5
Community services	20	6
Health information systems management	10	6
Infection control and waste management	20	9
Environmental health services	10	5
TOTAL	**270**	**134**

Source: RBF Project Implementation Manual, Zimbabwe[120]

Table 3.10: Summary of quality scores for antenatal care component in Zimbabwe P4P

FAMILY AND CHILD HEALTH (FCH)	**YES (available & guidelines followed)**	**NO (Not available & guidelines not followed)**
Necessary functional equipment (fetoscope, tape measure, scale, stethoscope, sphygmomanometer, HB meter) *equipment should be readily accessible for use by relevant staff.*	1	0
Availability of diagnostic test kits: *Urine test kit, RPR kit, HIV rapid test kits, RDT for malaria.*	2	0
ANC register available and well filled in *Complete identity, date visit, Supervisor verifies the 5 last entries:* *Examinations: Weight, BP, Parity, last menstrual period (LMP)* *Laboratory: Urine tests, HIV tests, RPR test, Hb, Obstetrical examination done: Foetal Heart (FH), Presentation, foetal movement, HOF* *High Risk cases well documented in red and actions taken*	3	0
ANC register shows the administration of Ferrous Sulphate and folic acid, TT and routine IPT (where applicable)	2	0
ANC Cards available – Minimum stock according to expected no of pregnancies per month.	1	0
PMTCT columns properly filled. *(Latest guidelines being followed)*	2	0
Focused ANC protocol (availability of guidelines and displayed)	2	0
Infant feeding policy, knowledge among staff. *Ask what they know.*	3	0

Source: RBF Project Implementation Manual, Zimbabwe[120]

Chapter 4: Methods

4.1 Overview

This chapter presents the methods of the study that forms the basis of the thesis. It describes the conceptual framework, study design, sampling and sample size, data collection, data entry and quality control of the research. Further, it describes the key outcomes and data analysis. The role of the PhD candidate in the design, data collection, analysis and dissemination of the study is also described in this chapter.

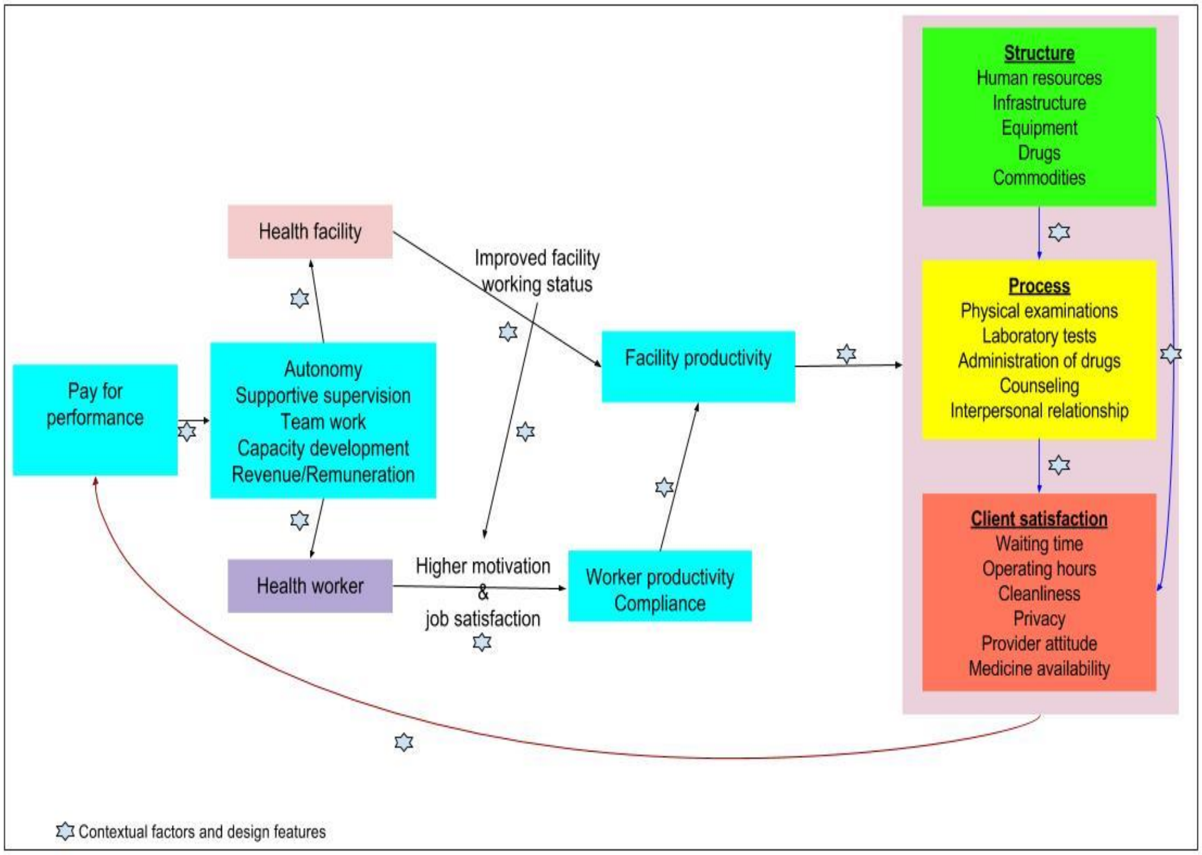
4.2 Conceptual framework

Pathways of the effects of P4P on quality of antenatal care

Pay for performance is expected to affect quality of antenatal care through incentivizing rural health centers and providers in Zimbabwe. As explained earlier in Chapter 3, incentives were split between health facility development and individual staff bonuses.[120] There are several pathways through which P4P would improve quality of ANC services. As shown in figure 4.1, P4P is expected to bring in changes mainly at two levels – (1) health facility and (2) health worker – to improve quality of ANC.

At the health center level, the main pathways to improve ANC quality are enhancements in – financial and managerial autonomy, revenues, supervision and support from higher authorities, team work, technical and managerial capacity development, and efficiency in planning, management and monitoring.[120] In other words, the trajectory of P4P is expected to augment the above to enhance facility's working status (e.g. physical infrastructure, staff remuneration, skill development and overall management and functioning). This improved 'working status' would ultimately lead to better 'facility productivity' (i.e. higher utilization and quality of services). For instance, health centers get autonomy to function and spend their additional revenue coming out of P4P. With the additional autonomy and revenue, health centers get better opportunities to improve their working status. This improvement in working status would naturally lead to an increment in utilization and quality of services.

Figure 4.1: Conceptual framework on the pathways of effect of P4P on quality of antenatal care



Note: Contextual factors work at four levels – health systems, health facility, health worker and client (detailed description is given in table 4.1)

At the health worker or provider level, the main pathways to augment health worker motivation are betterment in – remuneration through incentives, working status of facilities, team work, technical and managerial capacity of staff and supportive supervision.[120,144] These improvements are likely to enhance worker motivation (intrinsic and extrinsic) and job satisfaction towards better productivity. Increased productivity can be reflected through increased staff availability, attendance to optimum number of patients and compliance to clinical protocols (i.e. process quality).[144] In addition, certain incentives to health centers are also conditional on providers achieving quality of ANC indicators.[120] This would further motivate the facility staff to achieve pre-defined targets on quality of care. Motivated health workers would enhance the teamwork in an attempt to increase their incentives by being more innovative and collaborative. They are more likely to follow the guidelines on provision of services as the quality of service delivery is incentivized along with utilization of services.

The postulated effect of P4P on health facility status and health worker performance is expected to influence the pathways of quality of ANC care through the following three quality dimensions.

1) ***Structural quality:*** Under the structural elements, P4P directly incentivizes availability of relevant equipment, drugs and diagnostic kits, protocols and registers.[120] In addition, the health centers can reinvest their incomes from P4P to improve their working conditions.[120] In the context of ANC, for instance, the revenue generated through incentives can be utilized to purchase and maintain relevant medical equipment such as weighing scales, tape measures, stethoscope, fetoscope, hemoglobinometer and sphygmomanometer. Incentives can also be utilized to ensure the stock of diagnostic kits (urine test kits for protein and sugar, rapid diagnostic kits for malaria and HIV), surgical gloves, and disinfectants. Availability of these structural quality elements in good working condition will reward further the health centers under P4P. Incentives related to structural quality are measured through direct observation.
2) ***Process quality:*** P4P incentivizes compliance to the standard guidelines on ANC such as physical examinations (weight, blood pressure, abdominal examination) and laboratory diagnosis (urine test for protein and sugar; blood tests for anemia, syphilis and HIV) performed, drugs (iron-folic acid, antimalarials) and vaccines (tetanus toxoid) administered.[120] Incentives related to process quality are measured through the review of records. Enhanced supervision by peers and autonomy are components of P4P. A motivated health worker along with the availability of

required resources (achieved through the structural element) and technical feedback from peers would comply with the guidelines while providing ANC services as well as maintaining an acceptable level of inter-personal relationship with the client.

3) ***Client satisfaction:*** Client satisfaction (an element of health outcomes as explained in section 1.3.1) is one of the key factors to decide the amount of the incentive in this project. Along with the volume and quality of services, the incentives take in to account the satisfaction among recipients elicited through a household based satisfaction survey conducted during every payment cycle.[120] It is expected that the health workers at the health centers through provision of basic amenities (seating place, cleanliness, and privacy), equipment, drugs (structural quality), and appropriate behavior would try to minimize the discomfort and waiting time to the clients and hence, increase their satisfaction. Compliance of the health workers (process quality) to performing recommended procedures relevant for ANC such as physical examinations, screening for pre-eclampsia and sexually transmitted diseases including HIV, and counselling on diet and birth preparedness would also enhance the client satisfaction. Further, as the motivation of providers increases, their inter-personal relations with the clients would also improve. Client satisfaction is likely to be affected under the following dimensions – waiting time, operating hours, availability of medicines and cleanliness of the facility, privacy during examination, provider attitude and cost of care.

In summary, since P4P is aiming to reward every element of quality of ANC (structure, process and client satisfaction), there is an incentive for the health centers to improve on these elements to enhance their incomes. Apart from P4P influencing each of the quality elements separately through health center and staff incentives, these elements also affect each other as shown in figure 4.1.

There could be a possibility of P4P influencing health outcomes. As this research focuses on P4P's effect on ANC, health outcomes are not within the purview of this study. Health outcome such as maternal mortality would need a massive sample size to measure an effect of any intervention.[44] Similarly, measuring the effect of improved quality of ANC on maternal and neonatal health outcomes is also complex in a multi-faceted intervention such as P4P.[44] Thus, this research focuses on client satisfaction as an element of outcome and does not attempt to measure P4P's impact on health outcomes.

In the above mentioned causal pathway of P4P affecting the ANC quality, there are certain contextual factors which determine the direction and magnitude of effectiveness (Table 4.1). These contextual factors are at four levels, i.e. health system, health facility, providers and clients. Certain health system factors such as timeliness of disbursement of incentives to facilities, regularity of supervision and monitoring, and presence of other MCH programs can also have an impact on performance of facilities towards ANC quality.

At the facility level, the contextual factors are ownership type, levels of care and catchment population. For example, facilities owned by public sector may have a different approach towards earning incentives due to the facility management structure in comparison with a private mission health facility. Similarly, facilities with a secondary level of care would have a different case-mix (patient profile) than a primary level facility. Consequently, the focus may be more on curative care than preventive. A larger catchment population size can give a higher work load and performance bonus, which may trigger improved structural quality. However, with the higher patient load, there will be possibilities for reduced process quality in those facilities with limited staff size.

At the provider level, mainly their quantity and qualification (including level of cadre) have an impact on ANC quality. For instance, if the provider-population ratio is high, there is a higher chance of giving improved quality of services and vice versa. The higher the qualification and cadre of providers, the better skills they may possess in order to provide optimum quality of services.
Certain client level characteristics such as socio-economic, residential, demographic and health profile can have an impact on ANC quality. For example, some providers can

be discriminatory, and thus they may provide sub-optimal quality services to clients from socially disadvantaged groups. Receiving sub-optimal services would lead to dissatisfaction among clients.

Unintended consequences such as cherry picking, cream skimming or a decline in intrinsic motivation (driven by provider characteristics) may affect the quality outcomes under P4P (shown in table 4.1).[12,24–26] For instance, there could be selective efforts to improve the services only on a limited set of indicators (e.g. more emphasis on institutional delivery than antenatal care) due to their perceived importance or a higher bonus. Similarly, within a service, there could be differential preference to an element (e.g. structure vs. process). As a result, the study outcomes could show improvements only related to those limited set of services. These unintended consequences mainly affect at the provider level to drive quality of ANC.

In addition to contextual factors, program design features are potential to impact ANC quality.[101,145] Program design features pertain to the way the P4P program has been designed including implementation arrangements, stakeholders involved, funds disbursement mechanism, selection and pricing of indicators. For example, if incentives are intended for ANC quality in the program design, then naturally there will be a higher chance of improved ANC quality. Similarly, relative weight (or price) of incentives for a particular quality area would also impact provider performance on such service.

Table 4.1 Contextual factors and anticipated pathways of their effects on study outcomes

Factor	**Level**	**Anticipated Pathway**	**Study Outcomes**
		Contextual	
1. Timeliness of disbursement	Health systems characteristics	Delays in funds disbursement may reduce-ability to enhance structure quality, motivation of the health workers and hence	Structure, process, client satisfaction

		the facility level performance.	
2. Catchment population	Health facility	A facility with a larger catchment population would be able to raise better quantitative performance bonuses compared to a facility with a smaller population- this will lead to better quality of services; a higher patient load may lead to poor quality of services, if staff availability is limited in a particular facility	Structure, process, client satisfaction
3. Ownership	Health facility	Facilities with different ownership, i.e. public vs. private may perform differently.	Structure, process, client satisfaction
4. Level of care	Health facility	Facilities with different levels of care, i.e. primary vs. secondary may perform differently.	Structure, process, client satisfaction
5. Other MCH programs	Health facility	Facilities where other health specifically MCH programs are being implemented may show better outcomes due to aggregated effects of multiple programs.	Structure, process, client satisfaction
6. Socio-economic, residential, demographic and health profile of clients	Client	Providers can be inequitable and thus provide sub-optimal quality services to poor and backward population; well-off population may demand superior quality services	Process, client satisfaction
7. Quantity and qualification (or cadre) of health workers	Health worker	Facilities with inadequate number of skilled staff may achieve low performance bonus	Structure, process, client satisfaction
		Unintended consequences	
8. Cherry picking	Health worker	Selecting patients with conditions that are incentivized may lead to better outcomes for those at the expense of	Process, client satisfaction

		other services.	
9. Cream skimming	Health worker	Predetermined selection of patients with less critical condition may end up showing better outcomes for the facility.	Process, client satisfaction
10. Reduced intrinsic motivation	Health worker	Incentives may reduce intrinsic motivation of the health worker.	Process, client satisfaction

This research had attempted to validate the study findings on causal pathway mechanisms (shown in figure 4.1) from relevant studies on P4P program in Zimbabwe and similar settings. However, as the scope of this doctoral research was primarily quantitative in nature by using secondary data, there were limitations in exploring the role of all of the contextual determinants (as shown in table 4.1) and design features in driving the effect of P4P on quality of ANC in Zimbabwe.

4.3 Study design

Data for this PhD research comes from the impact evaluation of the Zimbabwe RBF project. The impact evaluation was a comprehensive health systems evaluation that assessed the effects of the RBF project at the health facility and household levels. This evaluation consisted of health facility and household surveys. Households were selected from the catchment area of the health facilities that had a pregnancy related outcome in the previous two years of the survey. Health facility survey consisted of five modules, i.e. (1) health facility checklist, (2) health worker interviews, (3) exit interviews of antenatal clients, (4) exit interview of child care clients, and (5) review of clinical records. In addition, a cost effectiveness evaluation, analysis of the health management information systems (HMIS) data and a process monitoring and evaluation were undertaken. This PhD research utilizes data from two health facility survey modules – health facility checklist and exit interviews of antenatal clients.

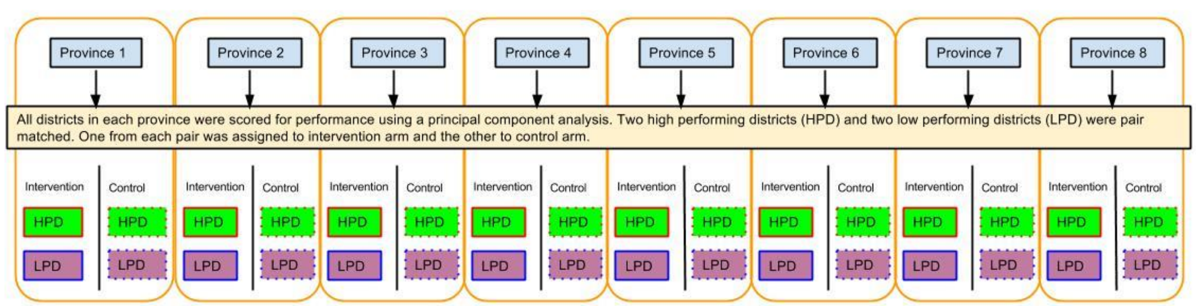
The study is a controlled before-after design consisting of eight provinces. The provinces were purposively sampled with rural as the selection criterion. As Zimbabwe has a total of eight rural provinces, all were included in the sample. In each province (figure 4.2), two pairs of districts were selected – one pair of matched high capacity and another pair of matched low capacity districts. Classification of high or low capacity was based on the pair matching score that was obtained by matching of districts through a principal component analysis considering the following key characteristics.

a. average catchment size (per facility)
b. proportion of staff posts filled
c. whether a district medical officer is present
d. utilization rates of ANC coverage for 2008, 2009, and 2010
e. utilization rates of in-facility delivery rates for 2008, 2009, and 2010
f. utilization rates of postnatal coverage for 2008, 2009, and 2010
g. utilization rates of vaccinations (BCG and penta3) for 2008, 2009, and 2010

Thus, the pair of districts that topped the list in the province after ranking by principal component analysis scores were selected as high capacity district pairs and the bottom two as low capacity district pairs.

One district in each matched pair was assigned by MoHCC to the intervention arm, i.e. P4P and the other was then assigned to the control arm i.e. business-as-usual, resulting in a total of 16 intervention and 16 control districts for the whole study. Intervention facilities received P4P, while control facilities did not receive any additional incentives or other intervention.

Figure 4.2: Selection of study districts



4.4 Sampling and sample size

A study with 32 districts (16 matched pairs), 64 health facilities (32 in each arm) and 3 clients per health facility should be able to detect a difference of 0.53, 0.39 and 0.37 standard deviations respectively in standardized structural quality, process quality, and client satisfaction indices. These power calculations shown in table 4.2 were performed using Optimal Design software for a three-level evaluation design with P4P variation at the third (district) level, and with 5% significance, 80% power and explained variance through the baseline covariate at 5%.[146] Based on a similar study conducted in Zimbabwe, the intra-cluster correlation coefficient (ICC) was estimated to be 0.16, 0.2 and 0.12 for structural quality, process quality and client satisfaction respectively.[133] While estimating the ICCs, health facilities were considered as clusters. This is also true for this study where the districts are the units of intervention, facilities are clusters within intervention units and clients are the observations within clusters. Details about the quality measures are presented in section 4.8 and in results chapters 5, 6 and 7.

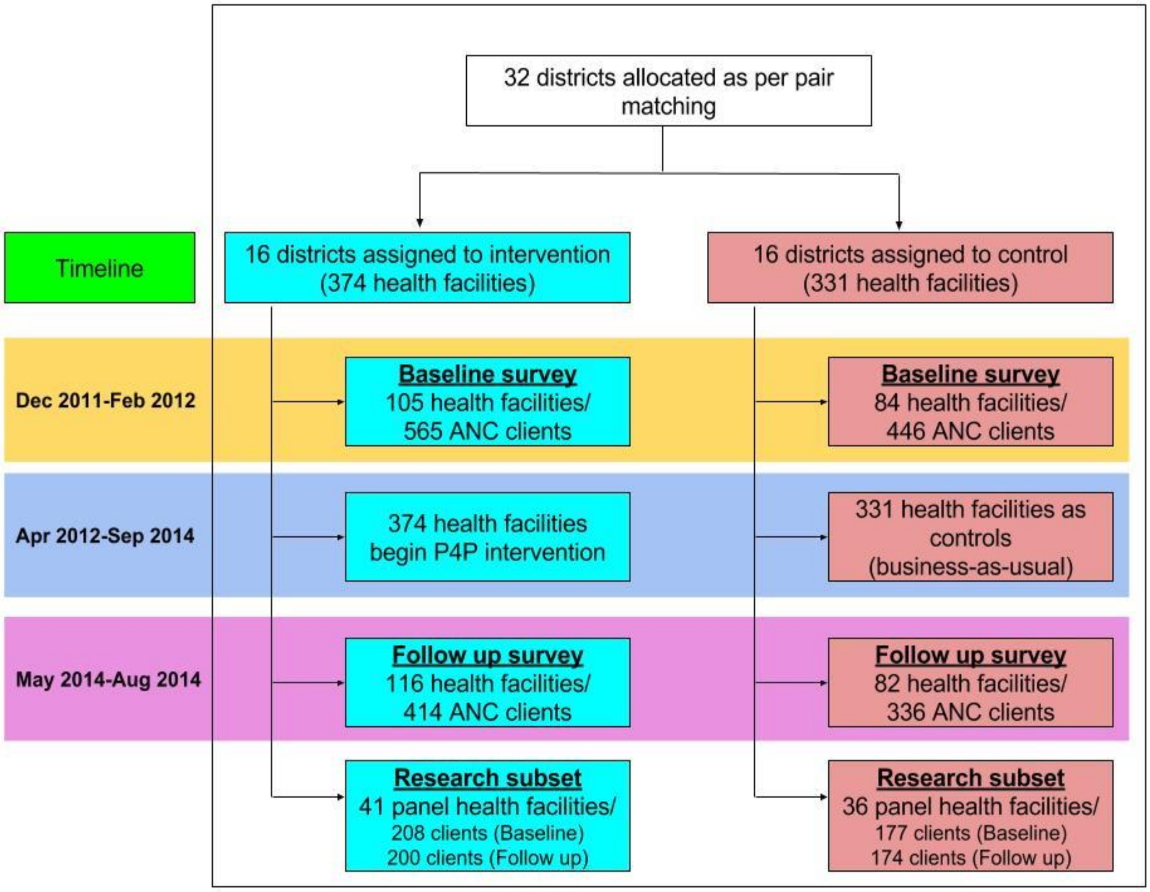
Table 4.2 Study power and sample size

Outcome	D	N	n	Power	Significance	ICC	Baseline covariate variance	Difference detectable (SD)
Structural quality	32	66	3	0.80	0.05	0.16	0.05	0.53
Process quality	32	66	3	0.80	0.05	0.20	0.05	0.39
Client satisfaction	32	66	3	0.80	0.05	0.12	0.05	0.37

Notes: D – Number of districts; N – Number of health facilities; n – Number of clients per health facility; ICC – Intra-cluster correlation coefficient; SD – Standard deviation

Health facilities were randomly selected based on a simple random sampling method. The sampling frame was all rural health facilities from 32 study districts. Up to five ANC clients were sampled in each health facility for exit interviews through systematic random sampling. Systematic random sampling was based on ANC case load for the same day (as that of the day of survey) from the previous week. Thus, every 'n'th woman was selected. Figure 4.3 shows the timeline of the survey and distribution of sample across P4P arms. As part of the broader evaluation, a survey was conducted before the intervention of P4P (baseline survey) to capture the pre-intervention status of the facilities between December 2011 and February 2012. In this baseline survey, there were a total of 189 facilities (105 P4P and 84 control) and 1011 antenatal clients (565 P4P and 446 control). P4P intervention was implemented in 374 health facilities in the P4P arm for about two and half years (April 2012 through September 2014), whereas 331 health facilities in the control arm continued business-as-usual, i.e. without any additional incentives or supervision mechanism. Another survey was conducted towards the end of the intervention (follow up survey) to ascertain the progress and changes as a result of the intervention. This follow up survey utilizing the same instruments as in the baseline survey included 198 health facilities (116 P4P and 82 control) and 750 antenatal clients (414 P4P and 336 control). The follow up survey targeting the wider study retained few of the baseline survey facilities, but added other facilities as the interest of the next phase of the RBF project was towards implementing continuous quality improvement within P4P. This follow up survey served as the baseline for the next phase of P4P project.That is how there were only 77 health facilities that were common among both survey rounds (i.e. visited twice) and they had both survey instruments completely administered. Thus, due to completeness of information, this subset of 77 health facilities was chosen to answer the research question addressed by this thesis. The panel (subset) health facilities yielded 385 clients (208 P4P and 177 control) in the baseline survey and 374 (200 P4P and 174 control) in the follow up.

Figure 4.3 Study design and timelines



4.5 Data collection

Data were collected in two phases, i.e. baseline and follow up by a local survey firm. The baseline study was conducted during December 2011 to February 2012. This involved health facility assessment (health facility instrument) and exit interviews for ANC (exit interview instrument). In the follow up survey, the health facility assessment and interviews of clients were conducted using the same instruments during May to August 2014. The health facility instrument collected information about: assessment of human resources (quantity and qualifications), infrastructure, availability of drugs, commodities and equipment. Health facility records were verified to ascertain the number of health workers that were designated to provide ANC services. A section of the health facility instrument validated the number of health workers present on the day of the survey against their number of sanctioned positions in the facility. The health facility in-charge was the primary respondent for most sections; whereas other staff responded to specific sections (e.g. pharmacist on drugs). Some details such as on equipment needed direct observations by the enumerator. The health facility in-charge was informed at least a week prior about the purpose and expected date of visit. The health facility interviews were conducted during a time which would not interfere with the routine activities of the health facility staff. In exit interviews, background socio-economic information about the client (e.g. age, marital status, education, household structure and assets, distance of residence from the health center); experiences with the provider (e.g. questions asked about medical history, diagnostic and physical examinations performed, medications and counseling provided during the consultation); and satisfaction with the provider and services received, were collected. The client interviews were conducted in the vicinity of the health facility, but away from the providers or general public to maintain privacy of the respondent and confidentiality of the information. The data collection instruments for each objective of the study are summarized in table 4.3 and presented in Annex C.

Table 4.3 Data collection methods

Objective	**Data collection instrument**	**Respondent**
To understand the effect of pay for performance on *structural quality* of antenatal care	Health facility instrument	Health facility in-charge or most informed staff for specific sections
To examine the effect of pay for performance on *process quality* of antenatal care	ANC exit interview instrument	ANC client
To assess the effect of pay for performance on *client satisfaction* of antenatal care	ANC exit interview instrument	ANC client

4.6 Data entry

The survey team was provided with hand held devices containing the data entry program in CS Pro. The candidate programmed the data entry program with inbuilt consistency and validity checks to reduce potential data entry errors. The data entry was verified by the PhD candidate (AD) for consistency and data entry ranges.

4.7 Quality assurance

A local research firm was selected for fieldwork based on extensive experience of conducting health surveys in Zimbabwe and the presence of qualified survey professionals on the team. A one week class-room based training was provided by the candidate (AD) for all enumerators followed by pre-testing of the instruments in the field. All survey instruments were translated into local languages (Shona and Ndebele). The translated instruments were back-translated to verify the accuracy of translations. The candidate (AD) provided a sampling strategy with the list of health facilities to enable it to plan for the selection of clients. The health facilities were oversampled to account for any unforeseen events, such as inclement weather, poor road connectivity, or refusals. Replacement of facilities was to be done only if there were strong reasons and it would need approval from the field supervisors. Coding lists with unique identifiers for each facility were generated by the candidate to allow for efficient data entry and merging of datasets. Announced and unannounced supervisions were undertaken by the candidate (AD) to ensure compliance to data collection guidelines and quality of data.

4.8 Measurement of key outcomes – quality measures

The key study outcome is the quality of ANC which was categorized across three dimensions, i.e. structure, process and client satisfaction following the conceptual framework shown in Fig 4.1. These three dimensions were converted to quantitative measures known as indices. The primary motivation of converting a dimension of quality to a quantitative measure was to reduce various components (items) of care to one single measure. A single measure (index) better enables comparative assessment between intervention units. The impact on individual items are also presented along with the composite measure (index).

Indices were calculated for each of the elements separately and compared between P4P and control arms. Equal weighting was applied to compute the indices as the initial method. Other alternative ways of creating indices such as principal component analysis (PCA) was also explored for robustness. As individual indices had variations in the number of sub-indices, after deriving the indices out of the data through the equal weighting method, the indices were further standardized on a '0 to 1' scale to enable comparison between them. On the other hand, as PCA index is dependent on the sample distribution, separate indices were created for baseline and follow up data. However, the method of estimating PCA index was uniform across both rounds. The indices were continuous variables.

Comparisons between both techniques of creating indices were tested with kernel density and Bland-Altman plots. Bland-Altman plot is a graphical way of comparing two quantitative measurements techniques.[147] In this method, the differences between the two techniques are plotted against the averages of the two techniques.[148] Horizontal lines are drawn at the mean difference, and at the limits of agreement. The limits of agreement are defined as the mean difference and 1.96 times the standard deviation of the differences in both directions, i.e. plus and minus. It is recommended that 95% of the data points should lie within the limits of agreement (± 1.96 SD of the mean difference).

Kernel density estimation is a non-parametric technique for estimating the probability density (alternatively a kernel) function of a random variable.[149] Essentially, it helps to visualize the underlying distribution of a continuous variable by placing a kernel (or probability density) over each observation point in the sample.[150] Observations closer to a point of estimate tend to contribute more to the estimate than the farther ones. Due to variations in the number of observations, the density estimate will be high in certain areas (with many observations), and low in others (with fewer observations).[150]

Structural quality index was derived out of the health facility data, whereas process quality index and client satisfaction index came out of the client exit interview data. Details about construction of the indices have been presented in the chapters 5, 6 and 7 for structural quality, process quality and client satisfaction respectively.

4.9 Data analysis

Data analysis was undertaken in the following sequence – (a) descriptive analysis, (b) baseline balance, (c) correlation among items (d) impact estimate through multilevel modeling, (e) subgroup analysis, and (f) robustness and sensitivity checks. Details about all analyses are presented in the following section. Data were transferred from CSPro to Stata. All data analyses including cleaning were performed in Stata software – version 13.[151]

4.9.1 Descriptive analysis

Descriptive analysis was performed for the study sample with key considerations for socio-demographic variables. For health facilities, this entailed facility type and ownership, distances to the nearest higher level facilities, catchment population, physical infrastructure, availability of drugs, vaccines, diagnostics and equipment. For exit clients, variables included age, education, socio-economic status, duration and order of pregnancy, distance and travel time from home and waiting time, and key activities during the antenatal visit (physical examinations, laboratory tests, counseling and prescription). Socio-economic background of the clients was estimated as wealth quintiles derived from the housing quality and household asset data. Household quality and asset variables in the survey questionnaire were aligned with the most recent Zimbabwe Demographic and Household Survey questionnaire so that they reflect the local context. Using the method proposed by Filmer and Pritchett, the housing quality and assets data were converted to a wealth index through a principal component analysis. [152] The entire sample based on their household wealth index was then grouped under five equally-sized groups to create the wealth quintiles – first (most poor), second (poorer), third (middle), fourth (less poor), and fifth (least poor).

Scores were developed for each element of quality through appropriate weighting of the underlying items and sub-indices. Description of the construction of indices is mentioned under the results chapters as follows – structural quality (Chapter 5), process quality (Chapter 6) and client satisfaction (Chapter 7). Continuous variables were summarized with means.

4.9.2 Baseline balance

Balance of key socio-demographic characteristics between the P4P and control arms at baseline was tested with normalized mean tests (Wilcoxon Rank Sum test for satisfaction scores).

4.9.3 Correlation analysis

Since the indices and sub-indices may be interdependent (correlated), the degree of correlation was tested using correlation coefficients (Pearson's for continuous data, tetrachoric for binary data and polychoric for ordinal data). The analysis planned to drop highly correlated items defined by a correlation coefficient of more than 0.8[153] unless there was a strong scientific evidence from the literature to retain the items for construction of indices.

4.9.4 Impact estimate analysis

The impact estimate analysis was carried out as intention-to-treat with difference-in-difference estimates (through multilevel linear regression analyses as explained below) for key outcome variables between the P4P and control arms for two rounds of data adjusting for covariates.

Multilevel model: This analysis was done where the units of analysis were hierarchical. For instance, clients are nested within health facilities, health facilities are nested within districts and districts are nested within provinces. Due to this hierarchical nature of data, conventional linear regression models that do not account for these multiple levels would underestimate the standard errors of the effect sizes. Underestimation of standard errors increases Type I error where obtained results are considered significant when they may not actually be significant.[154]

Also, in hierarchical data, observation units tend to be clustered under the same higher level unit, i.e. showing similar characteristics.[155] For example, clients visiting the same health facility may be more similar to each other than clients elsewhere. However, conventional linear regression models operate under the assumptions that observations are independent and variances are equal across the clusters.[155] Due to clustering of observations, these assumptions are violated in hierarchical data. As public health research specifically health systems research delves more in to investigating the impact of contextual factors on key health outcomes (e.g. state or district influences), there is a need to explore analytic methods that allow explorations of variance both within and between clusters.[156–159] Thus, multilevel regression models (also known as mixed effects models, hierarchical models or nested models) were developed to account for the clustered data and correct the dependency of observations in a cluster.[160,161] By acknowledging the hierarchical nature of data, multilevel models provide more appropriate estimates of observation and higher-level effect sizes and their variances.[162,163] Multilevel models can separately estimate the effect sizes of an individual independent variable (direct effect) and its group-level mean (contextual effect).[164] These models split the analysis in to two parts – fixed part and random part. The fixed part is a linear function of individual- and contextual-level factors, whereas the random part presents variance components between its several multiple levels. Thus, due to hierarchical nature of the data and obvious advantages of multilevel models, multilevel modeling was used in the analysis of the effect of P4P on key outcomes. The levels of analysis depends on the outcome variable. For instance, structural quality is an outcome at the health facility level. Therefore, the effects sizes on structural quality are observed on a three level model, i.e. health facility (level 1), district (level 2) and province (level 3). While, process quality and client satisfaction are outcomes at the client level. So, the impact is estimated on a four level model, i.e. client (level 1), health facility (level 2), district (level 3) and province (level 4).

The difference-in-difference equation for the three level model can be explained as follows

$$Y_{ijktd} = \propto + \beta P_{ijkd} + \gamma T_{ijkt} + \delta\,(P.T)_{ijkdt} + \theta DP_d + \beta_1 X_{1ijktd} + \cdots + \beta_n X_{nijktd} + \sigma_{ktd} + \mu_{jktd} + \varepsilon_{ijktd} \quad \ldots\ldots (1)$$

where

- Y is the outcome for health facility i (level 1) under district j (level 2) and province k (level 3) at time t for district pair d. The outcome is the standardized structural quality score;
- α is a constant;

- P is a binary variable for the intervention where it is 1 for P4P sample and 0 otherwise;
- T is a binary variable for the time period where it is 1 for post-intervention sample and 0 otherwise;
- β and γ are the coefficients for intervention (P4P) and period respectively;
- the interaction term is P.T and δ is the intervention (P4P) effect;
- DP represents district pair stratification dummy with its coefficient θ – these stratification variables are included to improve precision;
- X1ijk ……. Xnijk are the covariates with β1 …… βn as their coefficients;
- σ, μ and ε are the error terms at province, district and facility levels respectively

While, the four-level model can be described as follows.

$$Y_{ijkltd} = \propto + \beta P_{ijkld} + \gamma T_{ijklt} + \delta\,(P.T)_{ijkltd} + \theta DP_d + \beta_1 X_{1ijkltd} + \cdots + \beta_n X_{nijkltd} + \pi_{ltd} + \sigma_{kltd} + \mu_{jkltd} + \varepsilon_{ijkltd} \quad \ldots\ldots (2)$$

where

- Y is the outcome for client i (level 1) under health facility j (level 2) in district k (level 3) and province l (level 4) at time t for district pair d. The outcomes are the standardized quality scores for process quality and client satisfaction;
- α is a constant;
- P is a binary variable for the intervention where it is 1 for P4P sample and 0 otherwise;
- T is a binary variable for the time period where it is 1 for post-intervention sample and 0 otherwise;
- β and γ are the coefficients for intervention and period respectively;
- the interaction term is P.T and δ is the intervention effect;
- DP represents district pair stratification dummy with its coefficient θ – these stratification variables are included to improve precision;
- X1ijkltd ……. Xnijkltd are the covariates with β1 …… βn as their coefficients;
- π, σ, μ and ε are the error terms at province, district, facility and client levels respectively

Additionally, sensitivity results to individual covariates at the facility and client level were tested with a fully interacted model as follows for the three level model.[165]

$$Y_{ijktd} = \propto + \beta P_{ijkd} + \gamma T_{ijkt} + \delta\,(P.T)_{ijktd} + \theta DP_d + \varphi X_{ijktd} + \pi(T_t.\,X_{ijktd}) + \rho(P_d.\,X_{ijktd}) + \tau\{(P.T)_{dt}.\,X_{ijktd}\} + \sigma_{ktd} + \mu_{jktd} + \varepsilon_{ijktd} \quad \ldots\ldots\ldots\ldots \quad (3)$$

where

- Y is the outcome for sample unit i at time t for district pair d;
- α is a constant;
- P is a binary variable for the intervention where it is 1 for P4P sample and 0 otherwise;
- T is a binary variable for the time period where it is 1 for post-intervention sample and 0 otherwise;
- β and γ are the coefficients for intervention and period respectively;
- the interaction term is P.T and δ is the intervention effect;
- DP represents district pair stratification dummy with its coefficient θ;
- X is the covariate at facility and client levels (table 4.4) with coefficient φ;
- Here the covariate X was interacted with the period, intervention and interaction variable with their respective coefficients π, ρ, and τ.
- σ, μ and ε are the error terms at province, district and facility levels respectively

The fully interacted notation for the four level model is as follows.[165]

$$Y_{ijkltd} = \propto + \beta P_{ijkld} + \gamma T_{ijklt} + \delta\,(P.T)_{ijkltd} + \theta DP_d + \varphi X_{ijkltd} + \pi(T_t.\,X_{ijkltd}) + \rho(P_d.\,X_{ijkltd}) + \tau\{(P.T)_{dt}.\,X_{ijkltd}\} + \tau_{ltd} + \sigma_{kltd} + \mu_{jkltd} + \varepsilon_{ijkltd} \quad \ldots\ldots\ldots\ldots \quad (4)$$

where

- Y is the outcome for sample unit i at time t for district pair d;
- α is a constant;
- P is a binary variable for the intervention where it is 1 for P4P sample and 0 otherwise;

- T is a binary variable for the time period where it is 1 for post-intervention sample and 0 otherwise;
- β and γ are the coefficients for intervention and period respectively;
- the interaction term is P.T and δ is the intervention effect;
- DP represents district pair stratification dummy with its coefficient θ;
- X is the covariate at facility and client levels (table 4.4) with coefficient φ;
- Here the covariate X was interacted with the period, intervention and interaction variable with their respective coefficients π, ρ, and τ.
- τ, σ, μ and ε are the error terms at province, district, facility and client levels respectively

Table 4.4 Study covariates

Level	Covariates	Study outcomes (Quality domain)
Health facility	level, ownership, catchment population, distance from the nearest higher level health facility	Structure, process, satisfaction
Health worker	sex, and cadre	Process, satisfaction
ANC clients	age, education, wealth quintile, distance from home to health facility, parity, number of visit, gestational age	Process, satisfaction

4.9.5 Subgroup analysis

Analyses were performed among various subgroups to observe effect sizes within each and ascertain if any particular subgroup had different estimates compared to that of the full sample. The following subgroup analyses were conducted by level.

1. Facility level – ownership (public and private) and type (rural hospital and rural health center)
2. Provider level - provider gender, provider cadre (nurse and nurse midwife)
3. Client level – age group (<20 and 20-34 years), education (primary and secondary), wealth quintile, gravidity (primigravida and multigravida), trimester (second and third)

4.9.6 Sensitivity and robustness checks

Sensitivity to alterations of model parameters was checked. These model parameters were – alternate ways of constructing indices (equal weighting vs. principal component analysis), varying levels of analysis i.e., replacing the highest level province with district (three-level vs. two-level), empty model (without any covariate vs. full model, i.e. with covariates), without district pair matching dummy, and fully interacted model. Robust standard errors were also calculated at the province level to account for clustering. Goodness of fit tests for the regression models were used to see how close the predicted values are to the observed values. Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were estimated to select the best fitting model with the least information loss, i.e. lowest values of AIC and BIC.[166] Finally, regression diagnostics were conducted for the outcomes of interest to check for normality and homoscedasticity of residuals.

4.10 Ethical considerations

The survey was approved by the Medical Research Council of Zimbabwe. The study obtained written informed consent from all the respondents, after receiving explanations about the objectives and intended purpose of the surveys. Individual responses were coded before entry for anonymity and sufficient efforts were taken to safeguard confidentiality. Additional ethical approval for analysis of secondary data was obtained from the London School of Hygiene and Tropical Medicine (LSHTM Ethics Ref # 11201).

4.11 Role of the candidate

This thesis utilizes data from impact evaluation of pay for performance (locally known as Results Based Financing) project for maternal and child health in Zimbabwe. The impact evaluation was undertaken by the World Bank in collaboration with the Ministry of Health and Child Care in Zimbabwe. While working at the World Bank, the candidate served as the Co-Principal Investigator. The candidate's role in the project as well as in the PhD specific work at various stages are described below.

Conception and Design: The candidate was part of conceptualization and design of this impact evaluation. Along with other team members of the evaluation, he initiated dialogue with relevant stakeholders such as the Ministry of Health and Child Care (MoHCC) including various departments, local and international survey firms and experts, local ethics approval entity, development partners working on health (Unicef, WHO, DFID, USAID, EU), and academic and research organizations. He drafted the concept note, protocol, survey instruments, and submitted the application for ethical approval from the local ethics committee in Zimbabwe. The candidate obtained approvals from the government and Medical Research Council of Zimbabwe (ethical approval). After obtaining the approvals, he worked with senior officials from the MoHCC to develop an evaluation design consisting of type of design, intervention package, selection of provinces and districts, thematic areas, sampling, sample selection, timelines for data collection, analysis and dissemination. He also registered this evaluation in the International Standard Randomized Controlled Trial Number (ISCTRN) registry (reg# ISRCTN16392613).

The candidate was the team leader for the selection of the survey firm, which followed an international competitive selection process. This selection process entailed drafting of terms of references, inviting request for proposals, reviewing technical and financial proposals of the firms, and interacting with the team leaders of the short-listed firms.

Date collection: After selection of the firm, the candidate provided training to the data collection team through a combination of workshops and field practices. He took the supervisors (n=10) and enumerators (n=30) through a series of sessions on effective data collection methods, understanding the concepts of health facility survey, and its various components. He led the team on pretesting of the instruments and subsequent adaptations. The candidate sampled the health facilities for both rounds of surveys (baseline and follow up). Along with the survey firm and MoHCC, he developed a plan for data collection with detailed timelines and contingency plan. He accompanied the data collection team for the first two weeks of data collection in each round.

Quality control: During the data collection process, the candidate made random supervision visits to the sites to ensure necessary protocols were being adhered to. He developed the data entry template in CS Pro software considering data logic based on the skip patterns in the instruments, out of range and missing values. He trained the data entry personnel from the survey firm and further performed data cleaning to verify the inconsistencies in the data. The candidate ensured the data collection and entry follow the agreed timelines through regular supervision and feedback.

Data analysis: The candidate drafted the analysis plan and undertook extracting data from the impact evaluation datasets, identified coherent sampling units, split, and merged extracted datasets by survey and rounds. In terms of manipulating the variables, he undertook the following steps – labeling, relabeling, naming, renaming, reformatting, generating, and transformation (e.g. continuous to categorical, string to numerical). The candidate generated outcome indices through various means of weighting. He performed descriptive analysis, balance of sample at baseline, inferential analysis through multi-level modeling, subgroup analysis, sensitivity and robustness checks.

Dissemination: The candidate presented the systematic review out of this doctoral research as an oral presentation in a session titled "Performance based Incentives to improve quality of health care: experimental evidence from low- and middle-income countries" at the conference of International Health Economics Association in Milan, Italy (July 2015). The same systematic review has been published in the BMC Public Health Journal (full paper is provided in Annex B). The candidate has drafted another manuscript detailing the main results of this research. In all these dissemination materials (powerpoint presentation and journal articles/manuscripts), he wrote the first version and incorporated feedback from the coauthors and peer reviewers.

Chapter 5: Impact of P4P on Structural Quality – Findings from the health facility survey

5.1 Overview

Building on to the conceptual framework presented in Chapter 3 and using data from the Zimbabwe P4P impact evaluation, this chapter presents the effects of P4P on the first of the three quality components under antenatal care, i.e. structural quality. Structural quality pertains to availability of elements that are necessary to carry out essential antenatal care functions. These elements are physical infrastructure, skilled human resources, equipment, drugs, and diagnostics. The chapter begins with a methods section specific to structural quality. It explains the construction of structural quality index. Overall, the findings are divided in to two parts based on the way the indices were constructed. The first part (section 5.4) presents findings from the health facility survey using equal weighting of structural components. The second part (section 5.5) however utilizes weights from the quality checklist (a balanced score card) that was administered during the Zimbabwe P4P program to calculate quality bonuses. As all structural components described in the quality checklist could not be extracted from the facility survey data, the weights were only applied on a few structural components. The results are presented in the following sequence – descriptive statistics, sample balance at baseline, correlation among sub-indices, impact estimates, subgroup analysis, sensitivity and robustness verifications and regression diagnostics. Finally, impact estimates are mapped against their incentive prices to observe if components with higher prices show higher gains.

5.2 Methods

A detailed description of the methods used for this evaluation is given in Chapter 4. A summary of the methods is thus given in this section along with some specific information on the objective that pertains to the effects of P4P on structural quality. This study had a controlled before-after design consisting of eight provinces with four districts in each province. Out of the 32 districts, half implemented the pay for performance program (16 P4P districts with 374 health facilities) and the other half continued without any P4P program, i.e. business-as-usual (16 control districts with 331 health facilities). To assess the impact of P4P program, two rounds of surveys were conducted – one each before (baseline) and after (follow up) the program's implementation.

5.2.1 Data collection

The baseline survey was conducted during Dec, 2011 to Feb, 2012 and the follow up survey during May-August of 2014. Two survey instruments were administered during these surveys – health facility and client exit interviews. Both rounds of survey utilized the same instruments and the same set of health facilities, thus, creating a panel of health facilities for this research.

During the health facility interviews, information was collected on – (a) facility infrastructure; (b) human resources; (c) facility's available and functional equipment; (d) laboratory services available at the facility; (e) stock of key drugs, diagnostics and vaccines in the last 30 days for general health conditions, malaria, family planning, tuberculosis, obstetric, and vaccination services; and (f) catchment area population characteristics. The respondent for this interview was the facility in-charge. In some health facilities, the pharmacists were interviewed for the medicines section. The data collection instruments are presented in Annex C.

5.2.2 Sampling

During the baseline survey, health facilities were randomly selected based on a simple random sampling method. The sampling frame was all rural health facilities from 32 study districts. The same baseline survey facilities were revisited during the follow up survey two years after the implementation of the P4P intervention. Thus, a panel of same health facilities was created with data for two survey rounds. The panel yielded 77 health facilities with 41 from P4P and 36 from control districts.

5.2.3 Data analysis

Data analysis was undertaken in the following sequence – (a) descriptive analysis, (b) baseline balance, (c) correlation among items (d) impact estimate through multilevel modeling, (e) subgroup analysis, and (f) robustness and sensitivity checks. In the impact estimate analysis, the effect sizes were adjusted for health facility, provider and client determinants. Details about all analyses are presented in the methods chapter (Chapter 4).

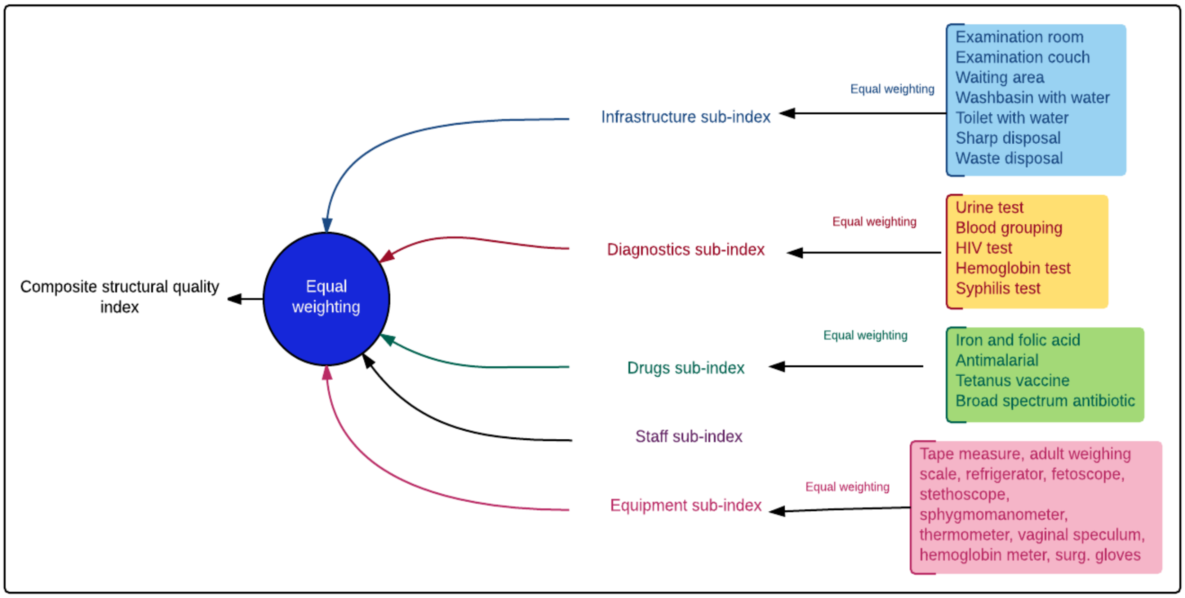
5.2.4 Outcome measures

The primary outcome measure – structural quality index – is explained in the methods chapter (Chapter 4). Structural quality index was created broadly in two ways – (a) applying equal weighting of sub-indices, (b) applying differential weighting of sub-indices, where the weights of items were derived from the quality checklist.

5.2.4.1 Constructing sub-indices Part 1 (Equal weighting)

Structural quality index was generated from five quality sub-indices and each sub-index in turn utilized a set of items for construction (shown in Figure 5.1). Equal weighting of components was applied while constructing sub-indices from the items, and the composite structural index from the sub-indices. Since the sub-indices had variations in the number of their items, all sub-indices were converted to a 'zero to one' scale by arithmetic means of the underlying items. All item variables were binary. For example, if a facility reported to have a functional equipment, this variable would score '1' for that particular facility and '0' otherwise. Selection of items on structural quality is based on the existing literature and the P4P program's adherence to the country's clinical protocols on ANC.[51–54,56–59] This has been explained in detail in the review of literature (Chapter 2).

Figure 5.1: Constructing structural quality index and sub-indices



There were five sub-indices – (a) physical infrastructure, (b) staff, (c) diagnostic test, (d) drugs and vaccines, and (e) equipment. Scores were computed for this element by considering the following items as per their sub-indices on structural quality of antenatal care.

A. <u>Infrastructure sub-index</u> consisted of seven items – waiting area, examination room with couch, toilet with provision of water, wash basin with soap and water, sharp and biomedical waste disposal. Due to equal weighting of one point per item, the maximum possible score for this sub-index was "7".
B. <u>Staff sub-index</u> had only one item – at least one staff trained to undertake ANC, i.e. primary care nurse and higher qualifications.
C. <u>Diagnostics sub-index</u> comprised of five items – urine dipsticks for protein and glucose, syphilis (RPR) test, blood grouping, HIV test kits, and hemoglobin test. With equal weighting of one point per item, the maximum possible score for this sub-index was "5".
D. <u>Drugs sub-index</u> was constructed from four items and with due consideration of the fact that the drugs were available during the day of survey with no stock outs within previous three weeks. The items were iron and folic acid, antimalarials,

tetanus toxoid, one broad spectrum antibiotic. Equal weighting of one point per item led to a maximum possible score of "4" for this sub-index.

E. Equipment sub-index took in to account availability of at least one functional equipment/supplies each needed for ANC with 10 items. The items were tape measure, adult weighing scale, fetoscope, stethoscope, sphygmomanometer, vaginal speculum, surgical gloves, thermometer, refrigerator, hemoglobinometer. Equal weighting thus gave a maximum possible score of "10" for this sub-index.

5.2.4.2 Constructing sub-indices Part 2 (Differential weighting)

RBF facilities were supervised every quarter by the district health executive (DHE), which monitored quality of services using a quality checklist. This checklist had 13 dimensions, each consisting of several items, weighted differently depending on their perceived importance to service delivery. This quality checklist with differential weighting was designed by experts through a Delphi method. The quality checklist used by the district health executive and the facility survey instrument used during data collection for this impact evaluation contained a few common items with respect to antenatal care. These common items were extracted from the facility survey and the weights from the quality checklist applied, to construct a quality index similar to that used by the DHEs. Table 5.1 shows the summary components of the quality checklist with its thirteen quality dimensions.

Table 5.1: Summary Components of Quality checklist

HEALTH SERVICE COMPONENTS	Available Points	Number of composite indicators
1. General Appearance	5	5
2. Administration and planning	30	8
3. Out Patient Department/consultation area	35	23
4. Emergency services	10	6
5. Family and Child Health	65	28
6. Maternity Service	30	21
7. Observation/inpatient services	5	5
8. Medicines and sundries stock management	20	7
9. Referral services	10	5

10. Community services	20	6
11. Health information systems management	10	6
12. Infection control and waste management	20	9
13. Environmental health services	10	5
TOTAL	**270**	**134**

Source: RBF Project Implementation Manual, Zimbabwe[120]

However, only four out of these thirteen health service components could be extracted from the health facility survey data (table 5.2). These four health service components (sub-indices) were (1) medicines and sundries stock management, (2) outpatient department/consultation area, (3) family and child health, and (4) infection control and waste management. Maximum possible points from these four health service components were 67 in the checklist. However, only 33 points could be available based on the health service items that were present in the survey data. The scores by components (sub-indices) are given below.

A. <u>Medicines and sundries stock management sub-index:</u> This component had two items – Staff maintains stock cards and correct storage of drugs, each with two points if the facilities met the criteria. Thus, the maximum possible score was four points.

B. <u>Outpatient department/consultation area sub-index:</u> Four items with equal weighting of one point made up this sub-index with a maximum possible score of four. The items were availability of functional stethoscope and sphygmomanometer, thermometer, otoscope, adult weighing scale.

C. <u>Family and child health sub-index:</u> This sub-index utilized seven items of differential weighting. The items were assured cold chain and availability of key vaccines (5 points each); and availability of diagnostic test kits, focused ANC protocol, and sharp boxes (2 points each). Availability of functional equipment (fetoscope, tape measure, scale, stethoscope, sphygmomanometer, HB meter) and baby scale – one point each. Thus, the maximum possible score for this sub-index was 18 points.

D. <u>Infection control and waste management sub-index:</u> Three items were combined to create this sub-index. They were availability and use of infection control policy (3 points), sterilization of instruments as per standards (2 points) and availability and appropriate use of disinfectants (2 points). Maximum possible score for this sub-index was seven.

Table 5.2: Common structural quality items between health facility survey instrument and P4P quality checklist

Health service components	Health service items	Score
Medicines and sundries stock management	Staff maintains stock cards	2
	Drugs are stored correctly	2
Out Patient Department/consultation area	Stethoscope & Sphygmomanometer available and functional	1
	Thermometer available and functional	1
	Otoscope available and functional	1
	Adult Weighing Scale available and functional	1
Family and child health	Necessary functional equipment (fetoscope, tape measure, scale, stethoscope, sphygmomanometer, HB meter)	1
	Availability of diagnostic test kits (Urine, RPR, malaria, HIV)	2
	Focused ANC protocol	2
	Cold Chain Assured	5
	Availability of vaccines (BCG, measles, polio, DPT, Hep B, HiB, tetanus, vitamin A, pneumococcal and rotavirus vaccines)	5
	Availability of sharps boxes	2
	Salter scale (baby scale) available and in good state	1
Infection control and waste management	Infection control policy, available and being used	3
	Staff sterilizes instruments according to standards	2
	Disinfectants available and being used according to guidelines	2
Total		33

5.2.4.3 Constructing structural quality index

The sub-indices explained in the previous section were first standardized on a scale of 0 to 1 so that all sub-indices could be equally weighted. This standardization of the sub-indices was performed by applying the “rowmean” command of Stata. The standardized sub-indices were combined with equal weighting to generate the composite process quality index (continuous variable) separately for parts 1 and 2. This composite index was further standardized to enable comparison between other quality outcomes (i.e. objectives 2 and 3). Standardized structural quality index (z-score) was constructed based on the following equation.

$$Z = \frac{X - \mu}{\sigma}$$

Where Z – standard score, X – each value in the data, μ – sample mean, and σ – standard deviation

5.3 Results – Part 1 (Indices by Equal Weighting)

This section describes the findings from the health facility survey with indices construction by equal weighting.

5.3.1 Descriptive statistics

5.3.1.1 General health facility characteristics

As shown in table 5.3, there were two types of health facilities in the sample, i.e. rural health center and rural hospital. Rural health centers were the predominant facility type with 81% representation in the full baseline sample (P4P = 83% and control = 78%), whereas rural hospitals constituted only 19% (P4P = 17% and control = 22%). Majority of the facilities were government owned (P4P = 56% and control = 58%) followed by local government (P4P = 34% and control = 33%) and faith based organization (P4P = 10% and control = 8%). The predominant source of electricity was the main grid (P4P = 61% and control = 58%), whereas 26% of the facilities (P4P = 20% and control = 33%) did not have any source of electricity. A third of facilities reported electricity outages within the week preceding the survey (P4P = 32% and control = 36%).

More than half of the facilities had a piped water supply (P4P = 63% and control = 44%) followed by water from boreholes (P4P = 29% and control = 44%). A large proportion of the facilities experienced water outage during a week preceding the survey (P4P = 80% and control = 92%). Around 90% of the facilities reported some kind of functional telephone services (P4P = 85% and control = 94%). On an average the nearest higher level health facility was around 40 kilometers away (P4P = 39.39 and control = 39.53).

Table 5.3: General Health Facility Characteristics

Variable	Control N = 36		P4P N = 41		Total N = 77	
	N	%	N	%	N	%
Facility type						
Rural health centers	28	78	34	83	62	81
Rural hospital	8	22	7	17	15	19
Facility ownership						
Government	21	58	23	56	44	57
Mission	3	8	4	10	7	9
Local government	12	33	14	34	26	34
Primary source of electricity						
Main	21	58	25	61	46	60
Generator	0	0	1	2	1	1
Solar	3	8	7	17	10	13
No electricity	12	33	8	20	20	26
Electricity outage during previous 7 days	9	36	12	32	21	33
Primary source of water						
Piped to health facility	16	44	26	63	42	55
Piped to facility yard	4	11	0	0	4	5
Well	0	0	1	2	1	1
Surface	0	0	1	2	1	1
Borehole	16	44	12	29	28	36
Water outage during previous 7 days	33	92	32	80	65	85
Mean distance to the nearest higher level facility (KMs)	36	39.53	41	39.39	77	39.45
Availability of phone	34	94	35	85	69	89
Mean catchment population (number)	36	7271	41	6351	77	6781

5.3.1.2 Physical infrastructure and staff

Almost all facilities reported of having an outpatient examination room (P4P = 98% and control = 100%) (Table 5.4). Similarly, provision of sharp disposal (P4P = 88% and control = 92%), biomedical waste disposal (P4P = 93% and control = 97%) and toilet with running water (P4P = 98% and control = 97%) were also high. A third of the facilities had a wash basin with water (P4P = 71% and control = 81%) and examination couch (P4P = 85% and control = 64%) in the outpatient room. Only half of the facilities reported of having a waiting area for the patients (P4P = 54% and control = 50%).

A high proportion of facilities had at least one skilled staff, defined as a health worker who has been trained to conduct antenatal checkups (P4P = 95% and control = 100%).

Table 5.4: Physical infrastructure of the health facilities

Variable	Control N = 36		P4P N = 41		Total N = 77	
	N	**%**	**N**	**%**	**N**	**%**
Availability of examination room	36	100	40	98	76	98
Provision of sharp disposal	33	92	36	88	69	89
Availability of wash basin with water	29	81	29	71	58	75
Provision of biomedical waste disposal	35	97	38	93	73	95
Availability of waiting area	18	50	22	54	40	52
Availability of examination couch	23	64	35	85	58	75
Provision of toilet with running water	35	97	40	98	75	97
Availability of skilled staff	36	100	39	95	75	97

5.3.1.3 Availability of drugs, vaccines and diagnostic tests

Almost all facilities reported availability of iron and folic acid (P4P = 93% and control = 97%), antimalarial (P4P = 90% and control = 97%), at least one broad spectrum antibiotic (P4P = 93% and control = 97%) and tetanus toxoid (P4P = 98% and control = 89%) (Table 5.5).

Relatively lower proportion of facilities reported provision of diagnostic tests at baseline. Among these, testing for HIV (P4P = 71% and control = 67%) and syphilis (P4P = 68% and control = 72%) were higher, while only a few provided hemoglobin tests (P4P = 10% and control = 14%) and urine dipstick tests (P4P = 2% and control = 3%). None had the provision of blood grouping and cross matching tests.

Table 5.5: Availability of drugs, vaccine and diagnostics at the health facilities

Variable	Control N = 36		P4P N = 41		Total N = 77	
	N	**%**	**N**	**%**	**N**	**%**
Iron and folic acid	35	97	38	93	73	95

Antimalarial	35	97	37	90	72	94
Broad spectrum antibiotic	35	97	38	93	73	95
Tetanus toxoid	32	89	40	98	72	94
Hemoglobin testing	5	14	4	10	9	12
Blood grouping and cross matching	0	0	0	0	0	0
HIV testing	24	67	29	71	53	69
Syphilis testing	26	72	28	68	54	70
Urine testing	1	3	1	2	2	3

5.3.1.4 Availability of equipment

Availability of equipment is shown in table 5.6. A vast majority of health facilities (> 90%) reported having functional medical equipment – tape measure (P4P = 95% and control = 100%), adult weighing scale (P4P = 88% and control = 92%), sphygmomanometer (P4P = 85% and control = 94%), thermometer (P4P = 98% and control = 100%), stethoscope (P4P = 98% and control = 100%), fetoscope (P4P = 93% and control = 94%), refrigerator (P4P = 85% and control = 100%), surgical gloves (P4P = 90% and control = 92%).

However, only about two-thirds of the facilities had a functional vaginal speculum (P4P = 68% and control = 61%), whereas none of the facilities reported having a hemoglobinometer.

Table 5.6: Equipment at the health facilities

Variable	**Control N = 36**		**P4P N = 41**		**Total N = 77**	
	N	**%**	**N**	**%**	**N**	**%**
Tape measure	36	100	39	95	75	97
Adult weighing scale	33	92	36	88	69	90
Sphygmomanometer	34	94	35	85	69	90
Thermometer	36	100	40	98	76	99
Stethoscope	36	100	40	98	76	99
Fetoscope	34	94	38	93	72	94
Refrigerator	36	100	35	85	71	92
Vaginal speculum	22	61	28	68	50	65
Surgical gloves	33	92	37	90	70	91
Hemoglobinometer	36	0	41	0	77	0

5.3.2 Baseline sample balance

5.3.2.1 General health facility characteristics

Table 5.7 shows the P4P arm had a slightly higher proportion of rural health centers (83% in P4P vs. 78% in control), whereas the control arm had a larger proportion of rural hospitals (22% control vs. 17% P4P). In terms of facility ownership, both arms had fairly similar representation (government – 56% P4P vs. control 58%; local government - P4P 34% vs. control 33%; mission – P4P 10% vs. control 8%).

The sources of electricity and outages were similar in both arms (main grid – P4P 61% vs. control 58%; outage – P4P 32% vs. control 36%). Almost two-thirds of P4P facilities (63%) reported piped water to facility, compared to 44% for control facilities. None of the P4P facilities had piped water to the facility yard, but 11% of the control facilities did so (p value = 0.028).

There were no significant differences in the distance to the nearest higher level facility, having a phone in the facility and catchment population between the two arms.

Table 5.7: Sample balance – General Health Facility Characteristics

Variable	Control %	P4P %	Normalized difference	p value
Facility type				
Rural health centers	78	83	9	0.575
Rural hospital	22	17	-9	0.575
Facility ownership				
Government	58	56	-3	0.846
Mission	8	10	3	0.831
Local government	33	34	1	0.941
Primary source of electricity				
Main	58	61	4	0.816
Generator	0	2	15	0.352
Solar	8	17	18	0.261
No electricity	33	20	-22	0.172
Electricity outage during previous 7 days	36	32	-5	0.775
Primary source of water				
Piped to health facility	44	63	26	0.098*
Piped to facility yard	11	0	-33	0.028**

Well	0	2	15	0.352
Surface	0	2	15	0.352
Borehole	44	29	-22	0.172
Water outage during previous 7 days	92	80	-23	0.153
Distance to the nearest higher level facility (KMs)	39.53	39.39	0.00	0.981
Availability of phone	94	85	-21	0.198
Catchment population (number)	7271	6351	-0.11	0.468

*** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

5.3.2.2 Physical infrastructure

In terms of physical infrastructure (table 5.8), both arms were similar except for having an examination couch (P4P 85% vs. control 64%; p value = 0.029).

Table 5.8: Sample balance – Physical infrastructure of the health facilities

Variable	**Control %**	**P4P %**	**Normalized difference**	**p value**
Availability of examination room	100	98	-15	0.352
Provision of sharp disposal	92	88	-9	0.585
Availability of wash basin with water	81	71	-16	0.325
Provision of biomedical waste disposal	97	93	-14	0.377
Availability of waiting area	50	54	5	0.752
Availability of examination couch	64	85	33	0.029**
Provision of toilet with running water	97	98	1	0.927
Availability of skilled staff	100	95	-22	0.184

*** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

5.3.2.3 Availability of drugs, vaccines and diagnostic tests

A large proportion of facilities in both arms reported to have similar levels of stocks on drugs, and vaccines (Table 5.9). Even though relatively lower proportion of facilities had the provision of diagnostic tests, the situation was similar across both arms.

Table 5.9: Sample balance – Availability of drugs, vaccine and diagnostics at the health facilities

Variable	**Control %**	**P4P %**	**Normalized difference**	**p value**
Iron	97	93	-14	0.377
Tetanus toxoid	97	90	-20	0.220
Antimalarial	89	98	24	0.127
Broad spectrum antibiotic	97	93	-14	0.377

Hemoglobin testing	14	10	-9	0.579
Blood grouping and cross matching	0	0	-	-
HIV test kit	67	71	6	0.705
Syphilis test kit	72	68	-6	0.711
Urine test kit	3	2	-1	0.927

*** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

5.3.2.4 Availability of equipment

Table 5.10 shows except for refrigerator, reported equipment availability was similar. All control facilities had a refrigerator, whereas it was reported only among 85% of the P4P facilities (p value = 0.017).

Table 5.10: Sample balance – Equipment at the health facilities

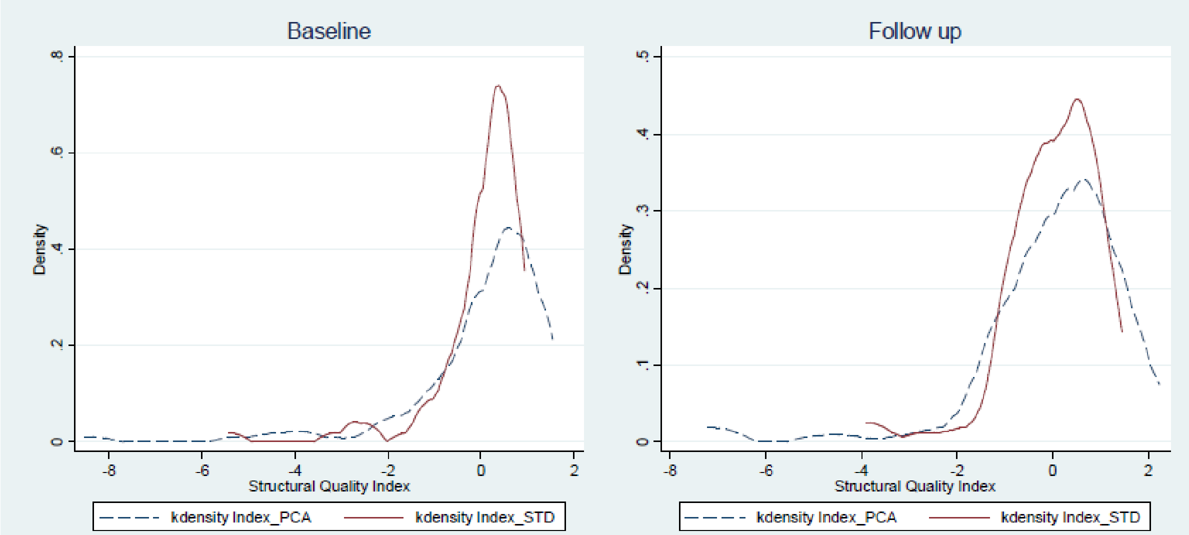
Variable	**Control %**	**P4P %**	**Normalized difference**	**p value**
Tape measure	100	95	-22	0.184
Adult weighing scale	92	88	-9	0.585
Sphygmomanometer	94	85	-21	0.198
Thermometer	100	98	-15	0.352
Stethoscope	100	98	-15	0.352
Fetoscope	94	93	-5	0.758
Refrigerator	100	85	-38	0.017**
Vaginal speculum	61	68	10	0.516
Surgical gloves	92	90	-3	0.831

*** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

5.3.2.5 Comparison of quality indices by index construction

Apart from applying equal weighting, the composite structural quality index was also created using principal component analysis. As explained in the methods chapter (Chapter 4), comparisons between both techniques of creating indices were tested with kernel density and Bland-Altman plots. The kernel density distribution of both indices can be seen from figure 5.2. Indices constructed by PCA and equal weighting show similar distribution within each survey round, i.e. baseline and follow up.

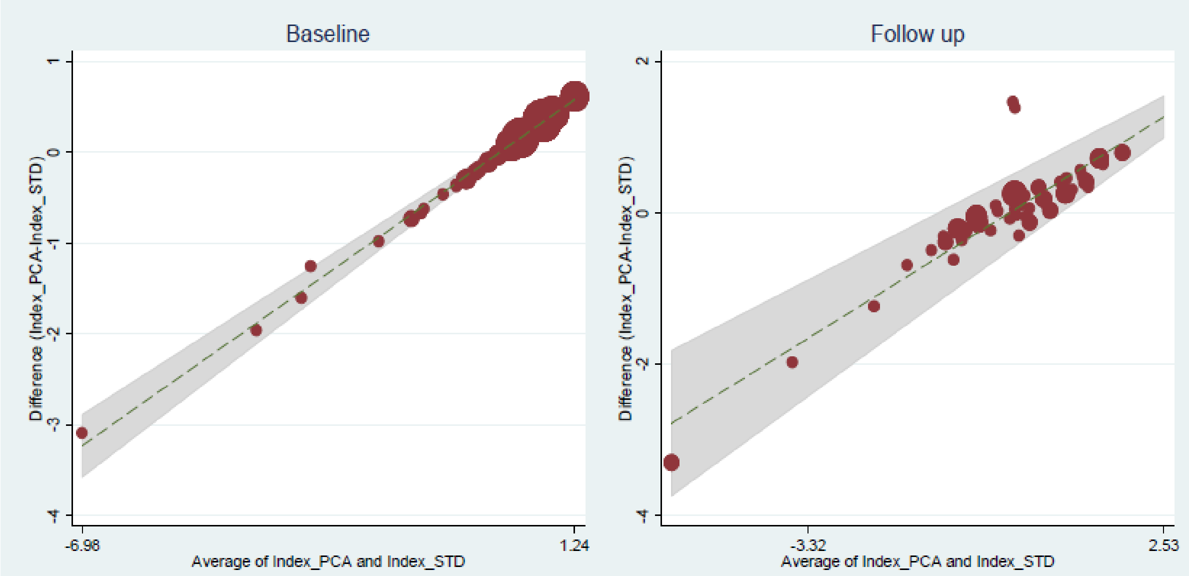
Figure 5.2: Distribution of structural quality estimates by index construction



Note: Index_PCA - Index using principal component analysis; Index_STD - Index using standardized equal weighting

The Bland-Altman plots comparing the differences in both ways of index construction by survey rounds (figure 5.3), show that majority of the data points fall within the recommended limits of agreement (within ± 1.96 SD of the mean difference). This means the indices are in high agreement and they can be used interchangeably.

Figure 5.3: Agreement of structural quality indices by index construction



Note: Index_PCA - Index using principal component analysis; Index_STD - Index using standardized equal weighting

5.3.3 Correlation analysis

Correlation analyses were performed for each process quality sub-index as well as the composite index. As it can be seen from table 5.11, none of the correlation coefficients was above the threshold of 0.8 except for the correlation between syphilis and HIV tests. As explained earlier in Chapter 2, literature shows both syphilis and HIV tests are useful for identifying key risk factors during pregnancy. Thus, all sub-index items as well as the sub-indices themselves were retained for the index construction.

Table 5.11: Correlation matrix – Structural quality index and sub-indices

Physical infrastructure sub-index items

	exam. room	sharp disposal	washbasin with water	waste disposal	waiting area	exam. couch	toilet with water
examination room	1.00						
sharp disposal	-0.02	1.00					
washbasin with water	-0.05	-0.12	1.00				
waste disposal	-0.02	0.07	-0.05	1.00			
waiting area	0.10	-0.15	0.02	-0.04	1.00		
Examination couch	-0.05	0.11	0.06	0.04	0.12	1.00	
toilet with water	-0.02	0.04	-0.14	-0.05	0.10	0.20	1.00

Diagnostic test sub-index items

	Hb	Blood grouping and cross matching	HIV test	Syphilis	Urine
Hemoglobin (Hb)	1.00				
Blood grouping and cross matching	0.24	1.00			
HIV test	0.53	0.30	1.00		
Syphilis	0.51	0.31	**0.96**	1.00	
Urine	0.46	0.23	0.75	0.75	1.00

Drugs and vaccines sub-index items

	Iron	Tetanus toxoid	Antimalarial	BSA
Iron	1.00			
Tetanus toxoid	0.35	1.00		
Antimalarial	0.12	0.06	1.00	
Broad spectrum antibiotic (BSA)	0.54	0.51	0.13	1.00

Equipment sub-index items

	Tape measure	Adult weighing scale	SPH	TM	STH	FET	REF	Vaginal speculum	Gloves	HBM
Tape measure	1.00									
Adult weighing scale	0.16	1.00								
Sphygmomanometer (SPH)	0.32	0.33	1.00							
Thermometer (TM)	0.41	0.21	0.39	1.00						
Stethoscope (STH)	0.26	0.21	0.16	0.31	1.00					
Fetoscope (FET)	0.26	0.11	0.07	0.19	0.57	1.00				
Refrigerator (REF)	0.13	0.26	0.20	0.17	0.17	0.16	1.00			
Vaginal speculum (SPEC)	0.03	0.08	0.01	0.22	0.01	0.01	0.03	1.00		
Surgical gloves	0.20	0.14	0.09	0.47	0.25	0.05	0.11	0.20	1.00	
Hemoglobinometer (HBM)	-0.04	0.07	0.10	0.01	0.01	-0.05	-0.02	0.12	-0.04	1.00

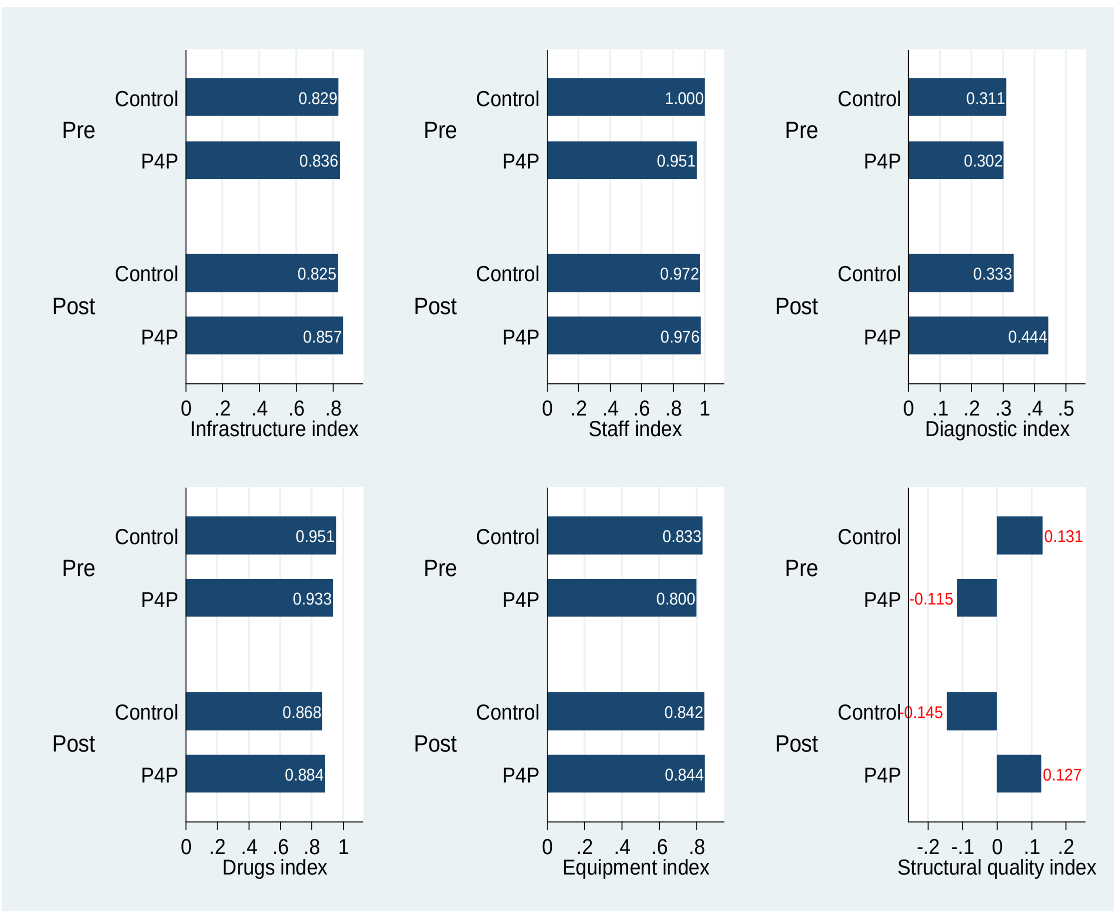
Structural Quality index items

	Physical infrastructure index	Staff index	Diagnostic test index	Drugs and vaccines index	Equipment index
Physical infrastructure index	1.00				
Staff index	0.11	1.00			
Diagnostic test index	0.06	-0.11	1.00		
Drugs and vaccines index	0.18	0.07	-0.01	1.00	
Equipment index	0.16	-0.06	0.26	0.49	1.00

5.3.4 Structural Quality

A comparison of unadjusted standardized structural quality indices pre- and post-intervention between the control arm and P4P arm is shown in figure 5.4. The infrastructure index rose from 0.836 to 0.857 points in the P4P arm, while it went down from 0.829 to 0.825 points in the control arm with a difference-in-difference of 0.024 points. The relative differences (difference-in-difference) for other indices were also better in the P4P arm as follows – staff index 0.052 points, diagnostic test index 0.12 points, drugs index 0.035 points, equipment index 0.036 points and finally the composite structural quality index was 0.535 standard deviation points.

Figure 5.4: Unadjusted changes in structural quality indices



5.3.5 Impact estimates

Impact of the P4P program on structural quality was estimated as intention-to-treat with difference-in-difference estimates (using multilevel modelling regression) adjusting for facility characteristics. Here the multilevel model considered three levels of analysis, i.e. health facility, district and province. The individual quality items were binary, thus multilevel mixed-effects logistic regression was carried out. Whereas, multilevel mixed-effects linear regression was undertaken for quality indices as they were continuous variables. The models ran the regressions while adjusting for contextual factors at the facility level, such as ownership, type of facility, catchment population and distance to the nearest higher level facility.

The impact estimates are difference-in-difference values, i.e. the relative difference between changes in P4P arm and control arm across two rounds of survey. For instance, an impact estimate of 0.231 for an index means the relative gain in the P4P arm was 0.231 units higher than that of the control arm between the baseline and follow up time periods. The impact of P4P was estimated using three different units of measurement. For the individual items, the unit of measurement was percentage points; while it was points for sub-indices; and it was standard deviations for the composite index as it was standardized.

5.3.5.1 Estimates for individual quality items

5.3.5.1.1 Physical infrastructure

Most of the quality items related to infrastructure showed a positive relative increment in the P4P facilities (table 5.12). Having a wash basin with running water posted the maximum relative gain (22.4% points; SE 0.13; p value = 0.086), followed by provision of waste disposal (10% points; SE 0.059; p value = 0.092), waiting area (3% points; SE 0.143; p value = 0.834), toilet with water (2% points; SE 0.069; p value = 0.816), and examination room by (0.4% points; SE 0.035; p value = 0.911). On the contrary, there were higher gains for control facilities on provision of sharp disposal (1% point; SE 0.079; p value = 0.89) and examination couch (1.4% point; SE 0.12; p value = 0.909). None of these indicators was statistically significant.

Table 5.12: Impact estimates – availability of physical infrastructure

		examination room	sharp disposal	washbasin with water	waste disposal	waiting area	examination couch	toilet with water
impact estimate*	**est**	0.004	-0.011	0.224*	0.099*	0.030	-0.014	0.016
	se	(0.035)	(0.079)	(0.130)	(0.059)	(0.143)	(0.120)	(0.069)
	p	0.911	0.890	0.086	0.092	0.834	0.909	0.816
P4P	**est**	-0.025	-0.067	-0.093	-0.062	0.077	0.057	-0.012
	se	(0.027)	(0.061)	(0.100)	(0.046)	(0.110)	(0.093)	(0.054)
	p	0.348	0.278	0.352	0.172	0.486	0.535	0.819
period	**est**	0.001	0.059	-0.170*	-0.028	0.124	0.021	-0.057
	se	(0.026)	(0.059)	(0.096)	(0.044)	(0.106)	(0.089)	(0.051)
	p	0.978	0.317	0.077	0.524	0.241	0.815	0.268
rural hospital	**est**	0.031	0.060	-0.177*	0.036	0.221**	0.032	0.017
	se	(0.025)	(0.057)	(0.093)	(0.042)	(0.102)	(0.086)	(0.050)
	p	0.220	0.286	0.056	0.387	0.030	0.708	0.735
govt. owned	**est**	-0.031	-0.047	0.201***	-0.043	0.027	-0.078	-0.021
	se	(0.020)	(0.045)	(0.074)	(0.033)	(0.081)	(0.068)	(0.039)
	p	0.116	0.302	0.006	0.198	0.741	0.250	0.590
catchment population	**est**	-0.000	-0.000	0.000	0.000	0.000	-0.000	0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.863	0.771	0.933	0.559	0.664	0.310	0.843
distance to hospital	**est**	-0.000	-0.000	0.001	-0.000	-0.001	-0.001	-0.001
	se	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
	p	0.534	0.862	0.364	0.804	0.533	0.664	0.267
Constant	**est**	1.025***	0.922***	0.783***	1.017***	0.253	0.737***	0.988***
	se	(0.041)	(0.093)	(0.152)	(0.069)	(0.167)	(0.140)	(0.081)
	p	0.000	0.000	0.000	0.000	0.131	0.000	0.000

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.3.5.1.2 Availability of skilled staff

The P4P facilities had a relative increase of skilled staff by 5.4% points (SE 0.048) (Table 5.13). However, there was no statistically significant effect (p value = 0.262).

Table 5.13: Impact estimates – availability of skilled staff

		Staff
impact estimate*	**est**	0.054
	se	(0.048)
	p	0.262
P4P	**est**	-0.039
	se	(0.037)
	p	0.297
period	**est**	-0.029
	se	(0.036)
	p	0.422
rural hospital	**est**	0.055
	se	(0.035)
	p	0.111
govt. owned	**est**	-0.017
	se	(0.027)
	p	0.526
catchment population	**est**	0.000*
	se	(0.000)
	p	0.050
distance to hospital	**est**	-0.000
	se	(0.001)
	p	0.836
Constant	**est**	0.899***
	se	(0.056)
	p	0.000

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.3.5.1.3 Availability of drugs and vaccine

The availability of select drugs improved in the P4P arm (Table 5.14). Among those however, only availability of iron was significant (21% points; SE 0.076; p value = 0.006). There was a 9% point relative increase in antimalarials (SE 0.069; p value = 0.193) and a 3% point relative increase in having at least one broad spectrum antibiotic

(SE 0.068; p value = 0.621). But, there was also a 13% points relative reduction among P4P facilities for tetanus toxoid (SE 0.072; p value = 0.066).

Table 5.14: Impact estimates – availability of drugs and vaccine

		Iron	Antimalarial	Tetanus toxoid	Broad spectrum antibiotic
impact estimate*	**est**	0.208***	0.089	-0.132*	0.033
	se	(0.076)	(0.069)	(0.072)	(0.068)
	p	0.006	0.193	0.066	0.621
P4P	**est**	-0.032	-0.044	0.049	-0.078
	se	(0.058)	(0.052)	(0.054)	(0.052)
	p	0.579	0.401	0.371	0.133
period	**est**	-0.183***	-0.039	0.073	-0.021
	se	(0.056)	(0.051)	(0.053)	(0.050)
	p	0.001	0.438	0.163	0.669
rural hospital	**est**	-0.162***	-0.035	0.029	0.050
	se	(0.055)	(0.049)	(0.052)	(0.048)
	p	0.003	0.473	0.574	0.301
govt. owned	**est**	0.045	0.007	-0.034	-0.022
	se	(0.043)	(0.038)	(0.041)	(0.038)
	p	0.293	0.851	0.410	0.560
catchment population	**est**	-0.000	0.000	0.000	-0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.418	0.507	0.591	0.193
distance to hospital	**est**	-0.001*	0.002**	-0.000	-0.001*
	se	(0.001)	(0.001)	(0.001)	(0.001)
	p	0.088	0.030	0.741	0.051
Constant	**est**	1.171***	0.934***	0.989***	1.107***
	se	(0.088)	(0.079)	(0.083)	(0.079)
	p	0.000	0.000	0.000	0.000

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.3.5.1.4 Availability of diagnostic tests

All diagnostic tests except blood grouping (7% points; SE 0.051; p value = 0.171) showed relative gains in the P4P arm (table 5.15). Availability of urine tests was significantly higher by 22% points (SE 0.1; p value = 0.027); while hemoglobin, HIV and syphilis tests were higher by 4.4% points (SE 0.102; p value = 0.668), 16.5% points (SE 0.123; p value = 0.179) and 19.2% points (SE 0.125; p value = 0.126) respectively.

Table 5.15: Impact estimates – availability of diagnostic tests

		hemoglobin	blood group	HIV	syphilis	urine
impact estimate*	**est**	0.044	-0.070	0.165	0.192	0.220**
	se	(0.102)	(0.051)	(0.123)	(0.125)	(0.100)
	p	0.668	0.171	0.179	0.126	0.027
P4P	**est**	-0.073	0.019	-0.049	-0.127	-0.055
	se	(0.079)	(0.039)	(0.095)	(0.097)	(0.077)
	p	0.354	0.633	0.609	0.189	0.473
period	**est**	0.057	0.112***	-0.178**	-0.235**	0.265***
	se	(0.075)	(0.038)	(0.091)	(0.093)	(0.074)
	p	0.445	0.003	0.050	0.011	0.000
rural hospital	**est**	0.099	-0.069*	0.174**	0.080	0.162**
	se	(0.073)	(0.036)	(0.088)	(0.089)	(0.071)
	p	0.171	0.056	0.047	0.370	0.023
govt. owned	**est**	0.029	0.043	0.057	0.066	0.121**
	se	(0.057)	(0.029)	(0.069)	(0.071)	(0.056)
	p	0.612	0.131	0.412	0.355	0.032
catchment population	**est**	0.000***	0.000**	0.000	0.000	-0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.005	0.044	0.504	0.624	0.478
distance to hospital	**est**	0.003***	0.001	-0.001	-0.000	-0.001
	se	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	p	0.005	0.244	0.598	0.846	0.214
Constant	**est**	0.376***	-0.112*	0.907***	0.883***	0.175
	se	(0.119)	(0.060)	(0.143)	(0.146)	(0.116)
	p	0.002	0.060	0.000	0.000	0.133

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.3.5.1.5 Availability of equipment

Among all relevant medical equipment, the availability was relatively higher in the P4P arm for most (table 5.16 A and B). Major gains was observed for refrigerator with a 22.6% point increment (SE 0.086; p value = 0.009). Statistically insignificant gains were observed for hemoglobinometer at 16.7% points (SE 0.088; p value = 0.058), sphygmomanometer at 12.9% points (SE 0.086; p value = 0.133), tape measure 8% points (SE 0.067; p value = 0.236), adult weighing scale 5.4% points (SE 0.078; p value = 0.487), thermometer 4.2% points (SE 0.053; p value = 0.423), surgical gloves 1.4% points (SE 0.088; p value = 0.869), and stethoscope 0.7% points (SE 0.059; p value = 0.905)

However, there was a statistically insignificant decline in the availability of vaginal speculum 7.2% points (SE 0.133; p value = 0.589) and fetoscope 2.3% points (SE 0.081; p value = 0.78).

Table 5.16 A: Impact estimates – availability of equipment

		Tape measure	Adult weighing scale	SPMmeter	Thermometer	Stethoscope
impact estimate*	**est**	0.080	0.054	0.129	0.042	0.007
	se	(0.067)	(0.078)	(0.086)	(0.053)	(0.059)
	p	0.236	0.487	0.133	0.423	0.905
P4P	**est**	-0.072	0.005	-0.063	-0.003	-0.021
	se	(0.052)	(0.060)	(0.066)	(0.041)	(0.046)
	p	0.167	0.934	0.342	0.936	0.652
period	**est**	-0.086*	0.054	-0.030	-0.053	-0.056
	se	(0.050)	(0.057)	(0.064)	(0.039)	(0.044)
	p	0.083	0.349	0.633	0.174	0.204
rural hospital	**est**	0.066	0.074	0.102*	0.087**	-0.066
	se	(0.048)	(0.056)	(0.061)	(0.038)	(0.042)
	p	0.170	0.184	0.097	0.020	0.120
govt. owned	**est**	-0.053	-0.023	-0.041	-0.050*	-0.021
	se	(0.038)	(0.044)	(0.049)	(0.030)	(0.034)
	p	0.161	0.595	0.403	0.091	0.533
catchment population	**est**	-0.000	0.000	-0.000	-0.000	0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.397	0.205	0.416	0.319	0.603
distance to hospital	**est**	-0.001	-0.002**	-0.002*	-0.001***	-0.001
	se	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	p	0.224	0.019	0.059	0.009	0.424
Constant	**est**	0.945***	0.917***	0.920***	1.101***	1.084***
	se	(0.079)	(0.091)	(0.100)	(0.061)	(0.069)
	p	0.000	0.000	0.000	0.000	0.000

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; SPMmeter – Sphygmomanometer; sample size 77 facilities (P4P 41 and control 36)

Table 5.16 B: Impact estimates – availability of equipment

		Fetoscope	Refrigerator	Vaginal speculum	Surgical gloves	Hb meter
impact estimate*	**est**	-0.023	0.226***	-0.072	0.014	0.167*
	se	(0.081)	(0.086)	(0.133)	(0.088)	(0.088)
	p	0.780	0.009	0.589	0.869	0.058
P4P	**est**	-0.045	-0.162**	0.186*	0.059	-0.065
	se	(0.063)	(0.067)	(0.102)	(0.068)	(0.068)
	p	0.471	0.015	0.070	0.380	0.337
period	**est**	-0.008	-0.141**	0.096	-0.029	0.260***
	se	(0.060)	(0.064)	(0.098)	(0.065)	(0.065)
	p	0.892	0.026	0.326	0.649	0.000
rural hospital	**est**	-0.033	0.070	0.106	0.079	0.031
	se	(0.058)	(0.062)	(0.095)	(0.063)	(0.063)
	p	0.569	0.256	0.263	0.209	0.626
govt. owned	**est**	0.015	0.009	0.089	-0.061	0.022
	se	(0.046)	(0.049)	(0.075)	(0.050)	(0.050)
	p	0.737	0.851	0.235	0.216	0.653
catchment population	**est**	0.000	-0.000	-0.000	0.000	0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.964	0.637	0.303	0.136	0.288
distance to hospital	**est**	0.000	-0.001	-0.001	-0.002*	0.001
	se	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	p	0.781	0.224	0.296	0.062	0.500
Constant	**est**	0.762***	1.099***	0.849***	0.965***	0.329***
	se	(0.095)	(0.101)	(0.155)	(0.102)	(0.103)
	p	0.000	0.000	0.000	0.000	0.001

* Multilevel modeling estimates adjusted for facility covariates and district pair matching;
estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;
est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.3.5.2 Estimates for quality indices

Individual quality items were combined to create quality sub-indices and these sub-indices further gave rise to the composite structural quality index (table 5.17). The changes in the sub-indices were statistically insignificant. There was a 0.048 points relative increase in the physical infrastructure index for the P4P arm (SE 0.039; p value = 0.226). The diagnostic test index demonstrated a relative increase by 0.11 points in the P4P arm (SE 0.071; p value = 0.12). Drugs and equipment indices showed 0.051

points (SE 0.062; p value = 0.405) and 0.063 points (SE 0.039; p value = 0.109) relative increments respectively.

The composite structural quality index showed a relative improvement of 0.595 standard deviations in the P4P arm (SE 0.262; p value = 0.023) above the mean of the control arm, which was statistically significant.

Table 5.17: Impact estimates – structural quality indices

		physical infra index	**diagnostic test index**	**drugs index**	**equipment index**	**composite structural quality index**
impact estimate*	**est**	0.048	0.110	0.051	0.063	0.595**
	se	(0.039)	(0.071)	(0.062)	(0.039)	(0.262)
	p	0.226	0.120	0.405	0.109	0.023
P4P	**est**	-0.017	-0.057	-0.041	-0.018	-0.374*
	se	(0.030)	(0.055)	(0.048)	(0.030)	(0.202)
	p	0.567	0.298	0.387	0.546	0.065
period	**est**	-0.007	0.004	-0.076*	0.001	-0.304
	se	(0.029)	(0.052)	(0.046)	(0.029)	(0.194)
	p	0.800	0.935	0.097	0.985	0.117
rural hospital	**est**	0.032	0.089*	-0.015	0.052*	0.428**
	se	(0.028)	(0.051)	(0.044)	(0.028)	(0.187)
	p	0.253	0.078	0.734	0.065	0.022
govt. owned	**est**	-0.001	0.063	-0.016	-0.011	0.033
	se	(0.022)	(0.040)	(0.035)	(0.022)	(0.148)
	p	0.970	0.115	0.652	0.606	0.826
catchment population	**est**	-0.000	0.000	-0.000	0.000	0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.901	0.196	0.450	0.998	0.264
distance to hospital	**est**	-0.000	0.000	-0.001	-0.001**	-0.003
	se	(0.000)	(0.001)	(0.001)	(0.000)	(0.003)
	p	0.581	0.709	0.217	0.016	0.288
Constant	**est**	0.820***	0.446***	1.105***	0.897***	0.503*
	se	(0.046)	(0.083)	(0.072)	(0.046)	(0.306)
	p	0.000	0.000	0.000	0.000	0.100

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations for the composite index and points for others; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.3.5.3 Subgroup analysis

Subgroup analyses were undertaken to ascertain the distribution of impact by various facility types and ownership.

Composite structural quality and diagnostic test indices were significant in local government facilities (table 5.18). The gains in composite structural quality index were significantly higher for government facilities (0.804 SD; SE 0.31; p value= 0.01) and in-significant for local government health facilities (1.044 SD; SE 0.551; p value= 0.058).

In local government facilities, the relative increase and level of significance for diagnostic index were higher (0.397 points; SE 0.077; p value<0.001) than the full sample (0.11 points; SE 0.071; p value = 0.12). On the other hand, government facilities reported insignificant increases in drugs (0.143 points; SE 0.08; p value = 0.077) and equipment indices (0.088 points; SE 0.049; p value = 0.073).

Non-significant indices for government facilities were – physical infrastructure (0.064 points; SE 0.05; p value = 0.2), staff (0.045 points; SE 0.071; p value = 0.528), diagnostics (0.039 points; SE 0.098; p value = 0.694); whereas physical infrastructure (0.087 points; SE 0.072; p value = 0.228), staff (0.073 points; SE 0.077; p value = 0.343), drugs (0.082 points; SE 0.096; p value = 0.392) and equipment indices (0.1 points; SE 0.07; p value = 0.153) were insignificant for local government facilities.

Table 5.18: Subgroup impact estimates – structural quality indices by facility ownership

	Government facilities (n = 44)			**Local government facilities (n = 26)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical infrastructure	0.064	(0.050)	0.200	0.087	(0.072)	0.228
Staff	0.045	(0.071)	0.528	0.073	(0.077)	0.343
Diagnostics	0.039	(0.098)	0.694	0.282***	(0.098)	0.004
Drugs	0.143*	(0.080)	0.077	0.082	(0.096)	0.392
Equipment	0.088*	(0.049)	0.073	0.100	(0.070)	0.153
Composite structural index	0.804***	(0.310)	0.010	1.044*	(0.551)	0.058

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations for the composite index and points for others;

standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Among the two types of health facilities, none echoed the findings from the full sample in terms of the quality components (composite and diagnostic test indices), their magnitude and significance (table 5.19). Composite structural quality index rose significantly by 0.589 standard deviations (SE 0.297; p value = 0.048) in the rural health centers, whereas equipment index went up insignificantly by 0.079 points (SE 0.043; p value = 0.067). Other not significant changes were physical infrastructure index rose by 0.065 points (SE 0.043; p value = 0.137), diagnostic test index 0.088 points (SE 0.078; p value = 0.255), staff index 0.067 points (SE 0.059; p value = 0.255) and drugs index 0.046 points (SE 0.066; p value = 0.483).

Rural hospitals however, reported significant increase in the composite index (0.869 points; SE 0.359; p value = 0.015). Other non-significant indices were diagnostic index (0.26 points; SE 0.135; p value = 0.053), physical infrastructure (0.034 points; SE 0.073; p value = 0.645), drugs (0.074 points; SE 0.068; p value = 0.276) and equipment indices (0.01 point; SE 0.045; p value = 0.82).

Table 5.19: Subgroup impact estimates – structural quality indices by facility type

	Rural hospitals (n = 15)			**Rural health centers (n = 62)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical infrastructure	0.034	(0.073)	0.645	0.065	(0.043)	0.137
Staff	ISS	ISS	ISS	0.067	(0.059)	0.255
Diagnostics	0.260*	(0.135)	0.053	0.088	(0.078)	0.255
Drugs	0.074	(0.068)	0.276	0.046	(0.066)	0.483
Equipment	0.010	(0.045)	0.820	0.079*	(0.043)	0.067
Composite structural index	0.869**	(0.359)	0.015	0.589**	(0.297)	0.048

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations for the composite index and points for others; standard errors in parentheses; ISS – insufficient sample size; *** p<0.01, ** p<0.05, * p<0.1

5.3.5.4 Sensitivity and robustness checks

Alternative ways of generating the composite structural quality index was explored through a principal component analysis (PCA). In this analysis, the composite index was obtained from the five sub-indices (physical infrastructure, staff, diagnostics, drugs, and equipment) and only one principal component was considered.

Based on the PCA (table 5.20), the structural quality index shows 0.955 standard deviation relative increase in the P4P arm at similar levels of significance to the equal weighted index (SE 0.43; p value = 0.026).

Table 5.20: Impact estimates – creating the quality index by principal component analysis and equal weighting

		Composite structural quality index (PCA)	**Composite structural quality index (equal weights)#**
impact estimate*	**est**	0.955**	0.595**
	se	(0.430)	(0.262)
	p	0.026	0.023
P4P	**est**	-0.547*	-0.374*
	se	(0.332)	(0.202)
	p	0.100	0.065
period	**est**	-0.466	-0.304
	se	(0.318)	(0.194)
	p	0.143	0.117
rural hospital	**est**	0.593*	0.428**
	se	(0.307)	(0.187)
	p	0.054	0.022
govt. owned	**est**	0.051	0.033
	se	(0.243)	(0.148)
	p	0.835	0.826
catchment population	**est**	0.000	0.000
	se	(0.000)	(0.000)
	p	0.511	0.264
distance to hospital	**est**	-0.006	-0.003
	se	(0.005)	(0.003)
	p	0.212	0.288
Constant	**est**	0.966*	0.503*
	se	(0.502)	(0.306)
	p	0.055	0.100

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points for the PCA index and standard deviations otherwise; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value, # - final model; sample size 77 facilities (P4P 41 and control 36)

Model specification parameters were altered to observe the changes in the impact estimates. For example, the level parameters were three levels (facility, district, and province) or two levels (facility and district). Models were also built without covariates. Table 5.21 shows impact estimates for these various models. Though the impact estimates remain similar across all models, there were no changes by altering the levels. However, models with covariates show a higher level of significance.

Table 5.21: Sensitivity of impact estimates by levels and covariates

	Physical infrastructure	Staff	Diagnostics	Drugs	Equipment	Composite structural index
Two levels without covariates						
Estimate	0.036	0.058	0.098	0.029	0.043	0.497*
SE	(0.039)	(0.049)	(0.072)	(0.066)	(0.040)	(0.271)
P value	0.354	0.234	0.172	0.656	0.281	0.067
Two levels and covariates						
Estimate	0.048	0.054	0.110	0.051	0.063	0.595**
SE	(0.039)	(0.048)	(0.071)	(0.062)	(0.039)	(0.262)
P value	0.226	0.262	0.120	0.405	0.109	0.023
Three levels without covariates						
Estimate	0.036	0.058	0.098	0.029	0.043	0.497*
SE	(0.039)	(0.049)	(0.072)	(0.066)	(0.040)	(0.271)
P value	0.354	0.234	0.172	0.656	0.281	0.067
Three levels and covariates (final model)						
Estimate	0.048	0.054	0.110	0.051	0.063	0.595**
SE	(0.039)	(0.048)	(0.071)	(0.062)	(0.039)	(0.262)
P value	0.226	0.262	0.120	0.405	0.109	0.023

* Multilevel modeling estimates adjusted for district pair matching; estimate units are standard deviations for the composite index and points for others; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

Sensitivity of the regression models were also tested for district pair matching. Table 5.22 shows that the impact estimate for the model without accounting for district pair matching was marginally higher than the final model, which considered the pair matching. For instance, composite structural index was 0.081 standard deviations higher (SE 0.273; p value = 0.013) than the final model. In addition, the diagnostic tests index was 0.051 points higher and statistically significant (SE 0.077; p value = 0.036).

Table 5.22: Sensitivity of impact estimates by district pair matching

	Without adjusting for district pair-matching			Accounting for district pair-matching (final model)		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical infrastructure	0.036	(0.042)	0.392	0.048	(0.039)	0.226
Staff	0.049	(0.050)	0.328	0.054	(0.048)	0.262
Diagnostics	0.161**	(0.077)	0.036	0.110	(0.071)	0.120
Drugs	0.059	(0.064)	0.358	0.051	(0.062)	0.405
Equipment	0.064	(0.041)	0.120	0.063	(0.039)	0.109
Composite structural index	0.676**	(0.273)	0.013	0.595**	(0.262)	0.023

* Multilevel modeling with three levels (facility, district and province) and with covariates; estimate units are standard deviations for the composite index and points for others; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

Estimating the impact along with its robust clustered standard errors generated an impact estimate for the composite structural index, which was insignificant (table 5.23).

Table 5.23: Sensitivity of impact estimates by robust SE

	With robust standard errors			Without robust standard errors (final model)		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical infrastructure	0.048	(0.064)	0.456	0.048	(0.039)	0.226
Staff	0.054	(0.051)	0.289	0.054	(0.048)	0.262
Diagnostics	0.110	(0.075)	0.143	0.110	(0.071)	0.120
Drugs	0.051	(0.054)	0.339	0.051	(0.062)	0.405
Equipment	0.063	(0.039)	0.107	0.063	(0.039)	0.109
Composite structural index	0.595	(0.373)	0.111	0.595**	(0.262)	0.023

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations for the composite index and points for others; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

Sensitivity of the model was tested with a fully interacted model. In this model, apart from the specifications mentioned in the “final model”, all covariates were interacted separately with the P4P, period and interaction of P4P and period. As shown in table 5.24, the fully interacted model returns higher impact estimates at higher levels of significance and an additional index of significance than the final model. The fully interacted estimates are as follows – diagnostic index by 0.472 points (SE 0.186; p value = 0.011) and composite structural index by 1.789 standard deviations (SE 0.72; p value = 0.013).

Table 5.24: Sensitivity of impact estimates by fully interacted model

	Fully interacted model			Partial interaction model (final model)		
	estimate*	SE	P value	estimate*	SE	P value
Physical infrastructure	0.007	(0.108)	0.946	0.048	(0.039)	0.226
Staff	0.140	(0.136)	0.304	0.054	(0.048)	0.262
Diagnostics	0.472**	(0.186)	0.011	0.110	(0.071)	0.120
Drugs	0.223	(0.171)	0.191	0.051	(0.062)	0.405
Equipment	0.124	(0.110)	0.261	0.063	(0.039)	0.109
Composite structural index	1.789**	(0.720)	0.013	0.595**	(0.262)	0.023

* Multilevel modeling with three levels (facility, district and province) and with covariates; estimate units are standard deviations for the composite index and points for others; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

While testing the goodness-of-fit (table 5.25), models with covariates were generally better fit than their without covariate counterparts. There were not much difference on the variations in the levels of analysis.

Table 5.25: Tests for model goodness-of-fit

Model fit statistics	Two levels without covariates	Two levels and covariates	Three levels without covariates	Three levels and covariates (final model)
Observations	154	152	154	152
loglikelihood	-90.9859	-81.0409	-90.9859	-81.0409
df	19	23	20	23
AIC	219.9719	208.0818	221.9719	208.0818
BIC	277.674	277.6311	282.7109	277.6311
Deviance	181.9719	162.0818	181.9719	162.0818

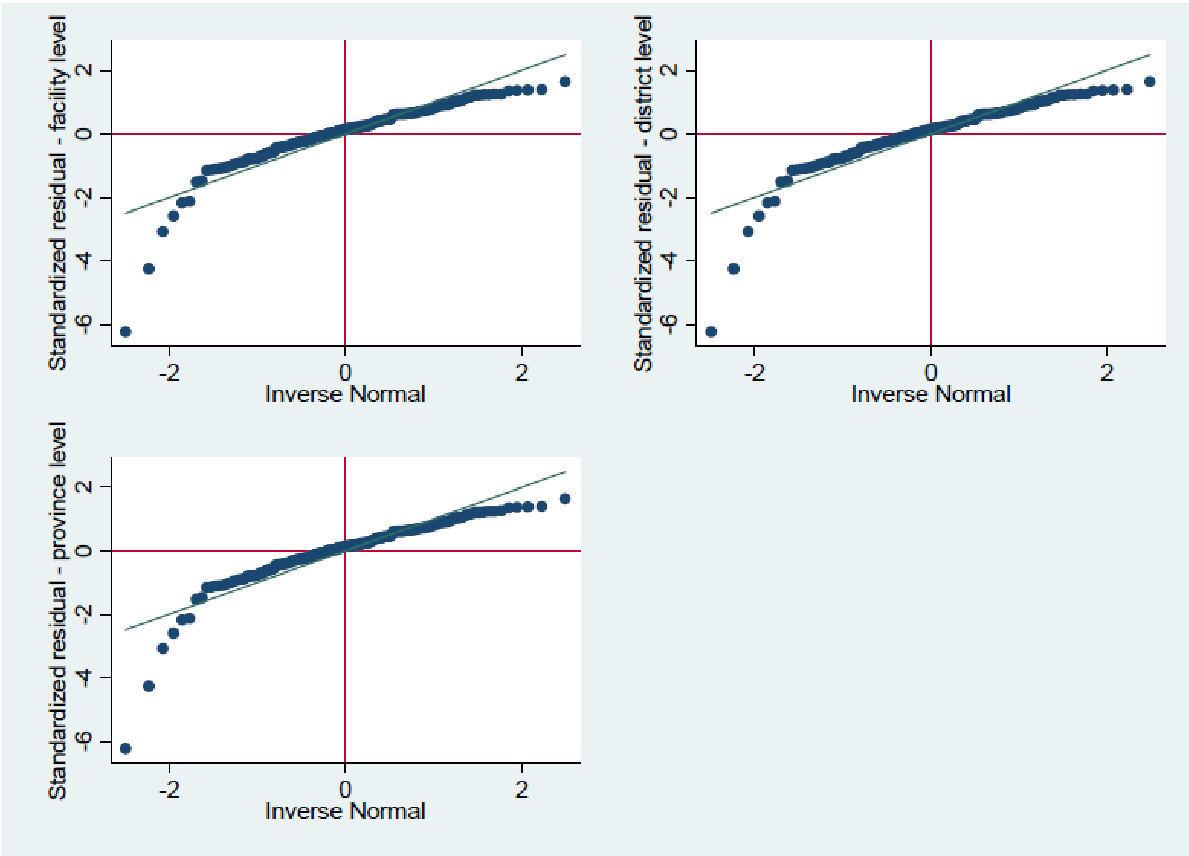
df – degrees of freedom; AIC – Akaike Information Criterion; BIC – Bayesian Information Criterion

5.3.5.5 Regression diagnostics

The normality of the regression residuals for the composite structural quality variable was verified by the standardized values of the residuals at various levels of analysis.

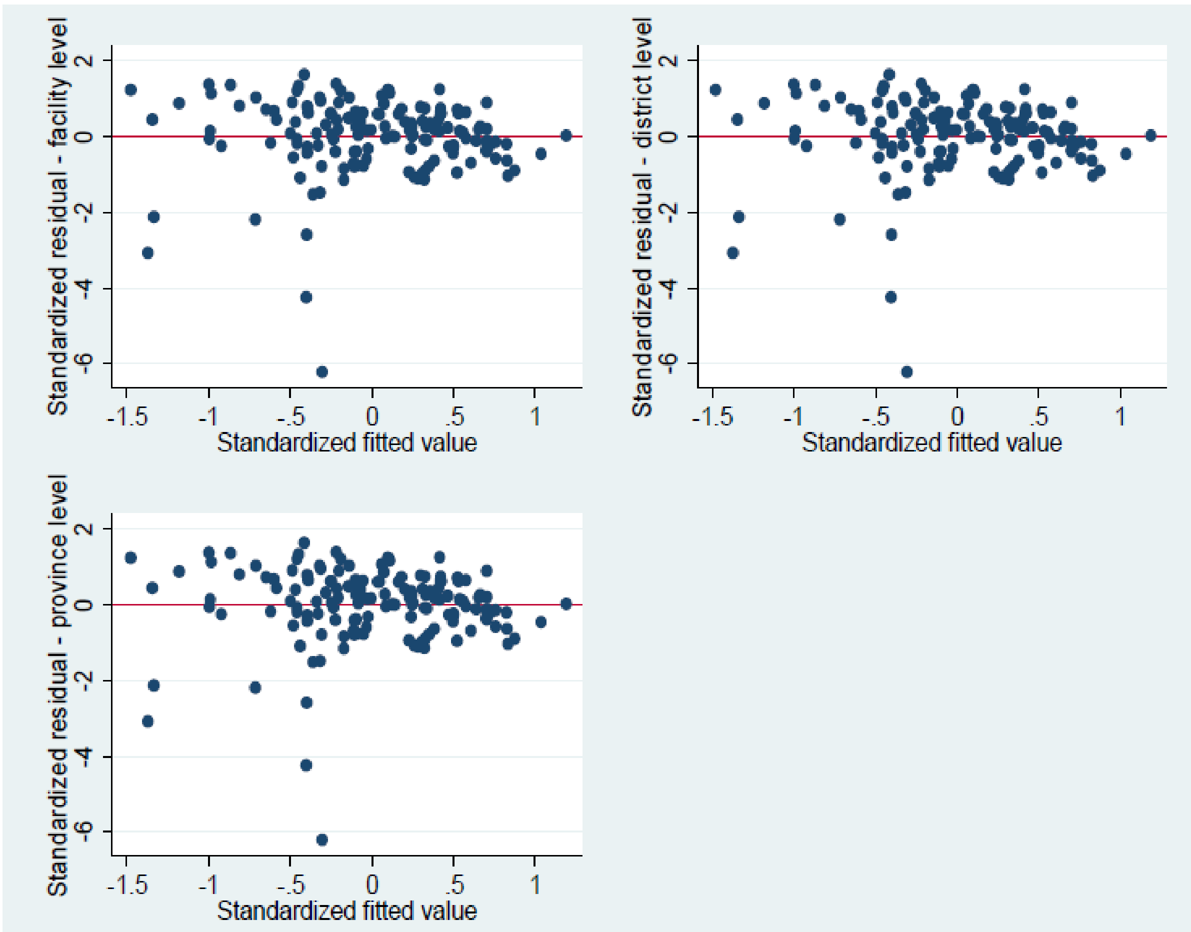
Though there is a slight deviation from normality at the tails, the residuals overall seem closer to normal distribution at all levels (Figure 5.5).

Figure 5.5: Normality of residuals



Homogeneity of variance of the residuals was checked through graphs plotting residuals against the fitted values. The residuals could be said as homoscedastic as the plot (figure 5.6) shows no particular pattern of the distribution of the residuals.

Figure 5.6: Homoscedasticity of residuals



5.4 Results – Part 2 (Indices by differential weighting)

This section describes the findings from the health facility survey with select quality components assigned variable weighting as per the quality checklist.

5.4.1 Baseline sample balance

Balance of sample characteristics was tested with normalized mean differences. Out of total 16 indicators under four health service components, control facilities scored higher in 11 compared to the P4P facilities (table 5.26).

5.4.1.1 Medicines stock management

Under medicines and sundries stock management component, control facilities reported a higher score for proper storage of drugs (1.22 P4P vs. 1.67 control; p value = 0.03). Proper storage of drugs was defined as storing in a clean place, well ventilated with cupboards, labelled shelves, and medicines stored in alphabetical order. There was no significant difference with the other indicator on maintaining drug stock cards (1.95 P4P vs. 2 control; p value = 0.352).

5.4.1.2 Outpatient department

All indicators under outpatient department component were balanced at baseline. Control facilities scored higher on all indicators except one. These indicators were – displaying National Malaria guidelines (0.88 P4P vs. 0.97 control; p value = 0.127), having functional stethoscope and sphygmomanometer (0.83 P4P vs. 0.94 control; p value = 0.12), thermometer (0.98 P4P vs. 1 control; p value = 0.352), otoscope (0.1 P4P vs. 0.08 control; p value = 0.831), and adult weighing scale (0.88 P4P vs. 0.92 control; p value = 0.585).

5.4.1.3 Family and Child Health

Control facilities scored significantly higher in two out of seven indicators. These unbalanced indicators were necessary functional equipment, i.e. fetoscope, tape measure, scale, stethoscope, sphygmomanometer, HB meter (0.44 P4P vs. 0.67 control; p value = 0.046), and display of focused ANC protocol (1.46 P4P vs. 1.83 control; p value = 0.036).

Balanced variables were availability of diagnostic test kits (0.1 P4P vs. 0.06 control; p value = 0.64), cold chain assured (4.76 P4P vs. 4.86 control; p value = 0.64), availability of vaccines (3.78 P4P vs. 4.31 control; p value = 0.251), availability of sharps boxes (1.76 P4P vs. 1.83 control; p value = 0.585), salter scale available and in good state (1 P4P vs. 0.97 control; p value = 0.289).

5.4.1.4 Infection control and waste management

Utilizing an available infection control policy was unbalanced in favor of the control facilities (1.32 P4P vs. 2.08 control; p value = 0.024). However, scores for sterilization of instruments (0.15 P4P vs. 0 control; p value = 0.1) and disinfectants (0.63 P4P vs. 0.56 control; p value = 0.711) were in favor of P4P facilities even though not statistically significant.

Table 5.26: Baseline sample balance

Health service component	Variable	Control Mean	P4P Mean	Normalized mean difference	p value
Medicines and sundries stock management	Staff maintains stock cards	2.00	1.95	-0.15	0.352
	Drugs are stored correctly	1.67	1.22	-0.34	0.03**
Out Patient Department/consultation area	Stethoscope & Sphygmomanometer available and functional	0.94	0.83	-0.25	0.120
	Thermometer available and functional	1.00	0.98	-0.15	0.352
	Otoscope available and functional	0.08	0.10	0.03	0.831
	Adult Weighing Scale available and functional	0.92	0.88	-0.09	0.585
Family and Child Health	Necessary functional equipment	0.67	0.44	-0.31	0.046**
	Availability of diagnostic test kits	0.06	0.10	0.08	0.640
	Focused ANC protocol	1.83	1.46	-0.33	0.036**
	Cold Chain Assured	4.86	4.76	-0.08	0.640
	Availability of vaccines	4.31	3.78	-0.18	0.251
	Availability of sharps boxes	1.83	1.76	-0.09	0.585
	Salter scale available and in good state	0.97	1.00	0.16	0.289
	Infection control policy, available and	2.08	1.32	-0.35	0.024**

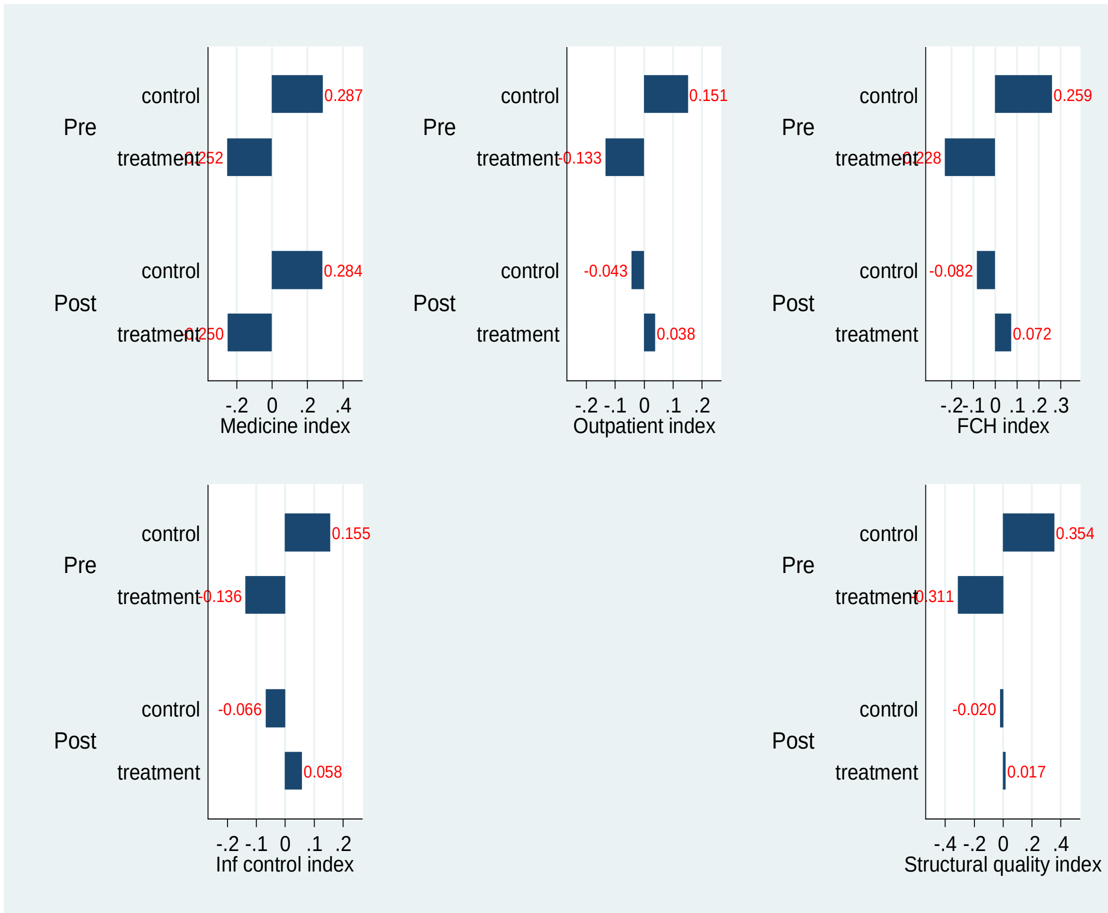
	being used				
Infection control and waste management	Staff sterilizes instruments according to standards	0.00	0.15	0.27	0.100
	Disinfectants available and being used according to guidelines	0.56	0.63	0.06	0.711

*** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

5.4.2 Impact estimates

Absolute unadjusted values of the standardized structural quality indices by P4P arm and control arm are shown in figure 5.7 for both pre- and post-intervention. Though all indices showed relative gains for the P4P arm, the highest gain was observed for the composite structural quality index. The P4P arm registered an increase from -0.311 to 0.017 points whereas it declined in the control arm from 0.354 to -0.02 points – a difference-in-difference of 0.702 points. Similarly, family and child health index went up by 0.641 points, infection control index by 0.415 points, outpatient index by 0.279 points, and medicines index by 0.005 points.

Figure 5.7: Unadjusted changes in structural quality indices



5.4.2.1 Estimates for individual quality items

5.4.2.1.1 **Medicines stock management**

There was no significant impact on the variables for medicines stocks management (table 5.27). In fact, the P4P facilities reported a relative decline (statistically insignificant) in the scores – stock cards updated by 0.01 points (SE 0.133; p value = 0.942) and drugs stored correctly by 0.118 points (SE 0.28; p value = 0.673).

Table 5.27: Impact estimates – Medicines stock management

		Stock cards updated	Drugs stored correctly
impact estimate*	**est**	-0.010	-0.118
	se	(0.133)	(0.280)
	p	0.942	0.673
P4P	**est**	-0.128	-0.628***
	se	(0.104)	(0.219)
	p	0.221	0.004
period	**est**	-0.169*	-0.405**
	se	(0.096)	(0.202)
	p	0.079	0.045
rural hospital	**est**	0.072	0.203
	se	(0.093)	(0.196)
	p	0.438	0.300
govt. owned	**est**	0.034	0.070
	se	(0.074)	(0.155)
	p	0.646	0.649
catchment population	**est**	-0.000	0.000
	se	(0.000)	(0.000)
	p	0.579	0.971
distance to hospital	**est**	-0.002*	-0.004
	se	(0.001)	(0.003)
	p	0.085	0.134
Constant	**est**	2.215***	1.838***
	se	(0.153)	(0.321)
	p	0.000	0.000

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.4.2.1.2 **Outpatient department**

Scores for the P4P facilities showed a relative enhancement though not statistically significant (table 5.28). Having a functional stethoscope and sphygmomanometer (blood pressure instrument) was up by 0.12 points (SE 0.1; p value = 0.228), thermometer by 0.048 points (SE 0.054; p value = 0.375), otoscope by 0.104 points (SE 0.101; p value = 0.302), and adult weighing scale by 0.042 points (SE 0.08; p value = 0.601).

Table 5.28: Impact estimates – Outpatient department

		Stethoscope & BP instrument	Thermometer	Otoscope	Adult weighing scale
impact estimate*	**est**	0.120	0.048	0.104	0.042
	se	(0.100)	(0.054)	(0.101)	(0.080)
	p	0.228	0.375	0.302	0.601
P4P	**est**	-0.093	-0.007	0.054	0.009
	se	(0.078)	(0.042)	(0.079)	(0.062)
	p	0.236	0.859	0.495	0.882
period	**est**	-0.057	-0.055	0.009	0.061
	se	(0.072)	(0.039)	(0.073)	(0.057)
	p	0.428	0.155	0.899	0.288
rural hospital	**est**	0.009	0.088**	0.120*	0.074
	se	(0.070)	(0.038)	(0.070)	(0.056)
	p	0.902	0.020	0.087	0.183
govt. owned	**est**	-0.070	-0.051*	-0.071	-0.024
	se	(0.055)	(0.030)	(0.056)	(0.044)
	p	0.205	0.087	0.204	0.579
catchment population	**est**	-0.000	-0.000	-0.000	0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.676	0.318	0.795	0.204
distance to hospital	**est**	-0.001	-0.001***	0.001	-0.002**
	se	(0.001)	(0.001)	(0.001)	(0.001)
	p	0.337	0.008	0.313	0.020
Constant	**est**	0.953***	1.103***	-0.000	0.916***
	se	(0.114)	(0.062)	(0.116)	(0.091)
	p	0.000	0.000	1.000	0.000

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.4.2.1.3 **Family and Child Health**

Five out of seven family and child health variables reported higher gains in P4P facilities (table 5.29). P4P facilities showed significant improvements in scores for diagnostic kits by 0.413 points (SE 0.198; p value = 0.037). Similarly, display of focused antenatal care protocol was 0.874 points higher (SE 0.214; p value<0.001). Though not statistically significant, there was relative increase for functional equipment by 0.152 points (SE 0.15; p value = 0.309), assurance of cold chain by 0.618 points (SE 0.528; p value = 0.241) and availability of vaccines by 0.26 points (SE 0.611; p value = 0.671).

However, scores on availability of sharp boxes went down by 0.054 points (SE 0.17; p value = 0.751) and by 0.014 points for functional baby scale SE 0.054; p value = 0.792).

Table 5.29: Impact estimates – Family and Child Health

		Equipment functional	Diagnostic kits	FANC protocol	Cold chain assured	Vaccines available	Sharp boxes available	Baby scale functional
impact estimate*	**est**	0.152	0.413**	0.874***	0.618	0.260	-0.054	-0.014
	se	(0.150)	(0.198)	(0.214)	(0.528)	(0.611)	(0.170)	(0.054)
	p	0.309	0.037	<0.001	0.241	0.671	0.751	0.792
P4P	**est**	-0.256**	-0.047	-0.346**	-0.144	-0.550	-0.125	0.012
	se	(0.117)	(0.155)	(0.167)	(0.413)	(0.478)	(0.133)	(0.042)
	p	0.029	0.761	0.038	0.727	0.250	0.345	0.776
period	**est**	-0.131	0.169	-0.527***	-1.441***	-0.722	0.110	-0.027
	se	(0.108)	(0.142)	(0.154)	(0.380)	(0.440)	(0.122)	(0.039)
	p	0.224	0.236	0.001	0.000	0.101	0.369	0.493
rural hospital	**est**	0.085	0.150	0.354**	-0.025	0.080	0.132	-0.016
	se	(0.104)	(0.138)	(0.149)	(0.368)	(0.427)	(0.118)	(0.038)
	p	0.417	0.276	0.018	0.945	0.851	0.265	0.680
govt. owned	**est**	-0.008	0.007	0.121	-0.034	0.026	-0.129	-0.022
	se	(0.083)	(0.109)	(0.118)	(0.291)	(0.337)	(0.094)	(0.030)
	p	0.921	0.952	0.303	0.907	0.938	0.169	0.461
catchment population	**est**	-0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.377	0.935	0.347	0.507	0.231	0.722	0.274
distance to hospital	**est**	-0.002	0.001	-0.003	-0.003	-0.002	-0.000	-0.001
	se	(0.002)	(0.002)	(0.002)	(0.005)	(0.006)	(0.002)	(0.001)
	p	0.129	0.478	0.219	0.627	0.723	0.855	0.107
Constant	**est**	0.553***	-0.146	1.719***	4.522***	5.753***	1.876***	1.090***
	se	(0.171)	(0.226)	(0.245)	(0.604)	(0.700)	(0.194)	(0.062)
	p	0.001	0.519	0.000	0.000	0.000	0.000	0.000

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.4.2.1.4 **Infection control and waste management**

Use of infection control policy score went up significantly by 1.118 points in P4P facilities (SE 0.425; p value = 0.009) (Table 5.30). Statistically insignificant changes were observed in sterilization as per standards score - down by 0.213 points (SE 0.122; p value = 0.08) and availability of disinfectants - down by 0.105 points (SE 0.247; p value = 0.672).

Table 5.30: Impact estimates – Infection control and waste management

		Infection control policy used	Sterilization according to standards	Disinfectants available
impact estimate*	**est**	1.118***	-0.213*	-0.105
	se	(0.425)	(0.122)	(0.247)
	p	0.009	0.080	0.672
P4P	**est**	-0.991***	0.161*	0.243
	se	(0.333)	(0.095)	(0.193)
	p	0.003	0.090	0.209
period	**est**	-0.186	0.120	-0.220
	se	(0.306)	(0.088)	(0.178)
	p	0.544	0.170	0.216
rural hospital	**est**	0.481	0.036	0.054
	se	(0.297)	(0.085)	(0.172)
	p	0.105	0.676	0.754
govt. owned	**est**	0.081	0.131*	0.411***
	se	(0.235)	(0.067)	(0.136)
	p	0.730	0.052	0.003
catchment population	**est**	0.000**	-0.000	-0.000
	se	(0.000)	(0.000)	(0.000)
	p	0.033	0.931	0.671
distance to hospital	**est**	-0.001	-0.001	0.001
	se	(0.004)	(0.001)	(0.003)
	p	0.907	0.399	0.644
Constant	**est**	1.142**	0.072	0.312
	se	(0.487)	(0.139)	(0.283)
	p	0.019	0.607	0.270

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.4.2.2 Estimates for quality indices

Scores of individual health service item indicators were combined to create health service component indices (table 5.31). Family and child health index was higher in the P4P facilities by 0.754 standard deviations (SE 0.264; p value = 0.004) than the mean of the control arm. Though not statistically significant, medicines score increased by 0.039

standard deviations (SE 0.281; p value = 0.89), outpatient department index by 0.479 (SE 0.291; p value = 0.1), and infection control score by 0.462 standard deviations (SE 0.299; p value = 0.122). Finally, the overall structural quality index showed a significant relative increase in P4P facilities by 0.83 standard deviations (SE 0.266; p value = 0.002).

Table 5.31: Impact estimates – structural quality indices

		Medicines	Outpatient	Family and Child Health	Infection Control	Composite index
impact estimate*	est	0.039	0.479	0.754***	0.462	0.830***
	se	(0.281)	(0.291)	(0.264)	(0.299)	(0.266)
	p	0.890	0.100	0.004	0.122	0.002
P4P	est	-0.787***	-0.091	-0.584***	-0.325	-0.770***
	se	(0.220)	(0.228)	(0.206)	(0.234)	(0.208)
	p	0.000	0.691	0.005	0.164	0.000
period	est	-0.016	-0.171	-0.339*	-0.173	-0.357*
	se	(0.202)	(0.210)	(0.190)	(0.215)	(0.192)
	p	0.935	0.415	0.074	0.421	0.063
rural hospital	est	0.285	0.435**	0.244	0.345*	0.450**
	se	(0.196)	(0.204)	(0.184)	(0.208)	(0.186)
	p	0.146	0.032	0.186	0.098	0.015
govt. owned	est	0.067	-0.323**	0.004	0.354**	0.125
	se	(0.155)	(0.161)	(0.146)	(0.165)	(0.147)
	p	0.666	0.044	0.978	0.032	0.394
catchment population	est	-0.000	-0.000	-0.000	0.000	0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.909	0.987	0.948	0.159	0.501
distance to hospital	est	-0.005*	-0.005	-0.002	0.000	-0.004
	se	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
	p	0.081	0.118	0.433	0.974	0.149
Constant	est	0.615*	0.167	0.419	-0.545	0.328
	se	(0.322)	(0.334)	(0.302)	(0.342)	(0.305)
	p	0.056	0.616	0.166	0.111	0.282

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 77 facilities (P4P 41 and control 36)

5.4.2.3 Subgroup analysis

Subgroup analyses were undertaken to ascertain the distribution of impact by various facility types and ownership.

When disaggregated by facility ownership, the composite quality index and family and child health index were similar to the full sample (table 5.32). The relative increases in the P4P facilities were higher in the sub-samples even though the levels of significance were lower than the full sample. In the government P4P facilities, composite index went up by 0.854 standard deviations (SE 0.379; p value = 0.024), family and child health index by 0.881 SD (SE 0.35; p value = 0.012), outpatient index by 0.48 SD (SE 0.382; p value = 0.209), infection control index by 0.307 SD (SE 0.404; p value = 0.447), and medicines index by 0.156 standard deviations (SE 0.356; p value = 0.661).

In local government P4P facilities, composite index was higher by 1.083 standard deviations (SE 0.405; p value = 0.007), family and child health index by 0.807 SD (SE 0.405; p value = 0.046), outpatient index by 0.49 SD (SE 0.532; p value = 0.357), infection control index by 0.536 SD (SE 0.403; p value = 0.183), and medicines index by 0.202 standard deviations (SE 0.472; p value = 0.668).

Table 5.32: Subgroup impact estimates – structural quality indices by facility ownership

	Government facilities (n = 44)			**Local government facilities (n = 26)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Medicines	0.156	(0.356)	0.661	0.202	(0.472)	0.668
Outpatient	0.48	(0.382)	0.209	0.49	(0.532)	0.357
Family and Child Health	0.881**	(0.35)	0.012	0.807**	(0.405)	0.046
Infection Control	0.307	(0.404)	0.447	0.536	(0.403)	0.183
Composite index	0.854**	(0.379)	0.024	1.083***	(0.405)	0.007

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

In addition to the two indices in the full sample, the rural health center sub-sample showed insignificantly higher outpatient index (0.558 SD; SE 0.331; p value = 0.092) (table 5.33). On the family and child health index (0.986 SD; SE 0.286; p value = 0.001) and composite index (0.989 SD; SE 0.298; p value = 0.001), the magnitude and levels of significance were better than the full sample. Other indices showed gains as well –

medicines by 0.035 SD (SE 0.319; p value = 0.912), outpatient by 0.558 SD (SE 0.331; p value = 0.092), and infection control by 0.386 SD (SE 0.33; p value = 0.243).

Rural hospitals however, reported the increase only in the infection control index (0.838 SD; SE 0.487; p value = 0.085) and that too at an insignificant level than the full sample. Similarly, though not significant, the composite index (0.274 SD; SE 0.476; p value = 0.565) and outpatient index (0.26 SD; SE 0.379; p value = 0.493) showed gains, whereas medicines (0.043 SD; SE 0.311; p value = 0.889) and family and child health indices (0.056 SD; SE 0.469; p value = 0.905) declined.

Table 5.33: Subgroup impact estimates – structural quality indices by facility type

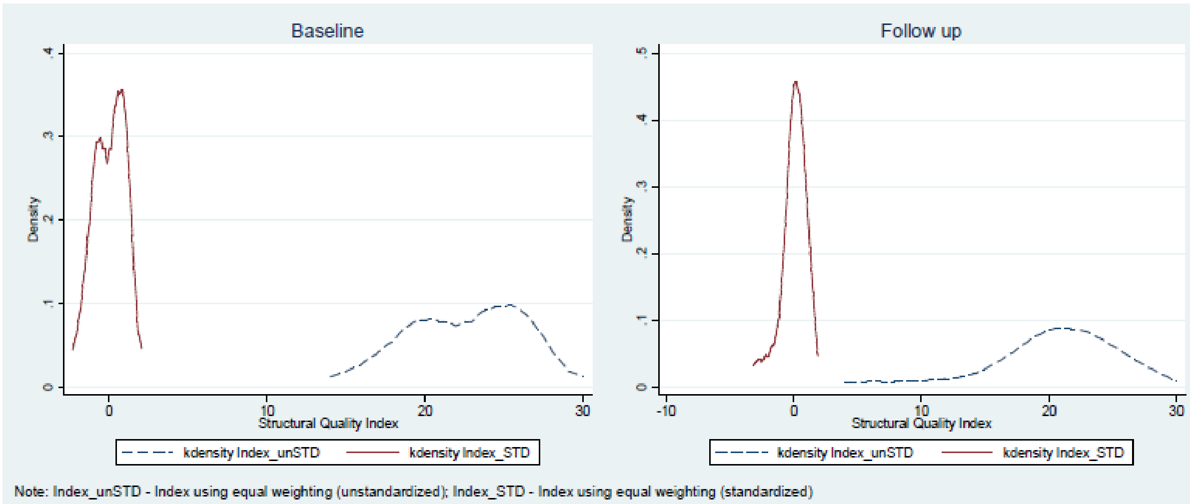
	Rural hospitals (n = 15)			**Rural health centers (n = 62)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Medicines	-0.043	(0.311)	0.889	0.035	(0.319)	0.912
Outpatient	0.26	(0.379)	0.493	0.558*	(0.331)	0.092
Family and Child Health	-0.056	(0.469)	0.905	0.986***	(0.286)	0.001
Infection Control	0.838*	(0.487)	0.085	0.386	(0.33)	0.243
Composite index	0.274	(0.476)	0.565	0.989***	(0.298)	0.001

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations; standard errors in parentheses;
*** p<0.01, ** p<0.05, * p<0.1

5.4.2.4 Sensitivity and robustness checks

Alternative ways of generating the composite structural quality index was explored through an index that was not standardized. The distribution of indices with and without standardization can be seen from figure 5.8. Indices constructed by both methods show similar sample distribution within each survey round, i.e. baseline and follow up.

Figure 5.8: Distribution of structural quality estimates by index construction



Without standardization, the structural quality index also shows 3.235 point relative increase in the P4P arm at similar levels of significance to the standardized index (SE 1.177; p value = 0.006) as shown in table 5.34.

Table 5.34: Impact estimates – creating the quality index by standardization

		Composite index unstandardized	Composite index standardized#
impact estimate*	est	3.235***	0.830***
	se	(1.177)	(0.266)
	p	0.006	0.002
P4P	est	-2.835***	-0.770***
	se	(0.920)	(0.208)
	p	0.002	0.000
period	est	-3.471***	-0.357*
	se	(0.848)	(0.192)
	p	0.000	0.063
rural hospital	est	1.897**	0.450**
	se	(0.821)	(0.186)
	p	0.021	0.015
govt. owned	est	0.472	0.125
	se	(0.649)	(0.147)
	p	0.467	0.394
catchment population	est	0.000	0.000
	se	(0.000)	(0.000)
	p	0.804	0.501
distance to hospital	est	-0.020*	-0.004
	se	(0.012)	(0.003)

	p	0.097	0.149
Constant	**est**	23.918***	0.328
	se	(1.348)	(0.305)
	p	0.000	0.282

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations for the standardized index and points otherwise; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value, # - final model; sample size 77 facilities (P4P 41 and control 36)

Model specification parameters were altered to observe the changes in the impact estimates. Models were fitted with three levels (facility, district, and province) or two levels (facility and district); and with or without covariates. Table 5.35 shows impact estimates for these various models. Though the impact estimates remain similar across all models, there were no changes by altering the levels. However, models with covariates show higher impact estimates with higher levels of significance.

Table 5.35: Sensitivity of impact estimates by levels and covariates

	Medicines	**Outpatient**	**Family and Child Health**	**Infection Control**	**Composite index**
			Two levels without covariates		
impact estimate*	0.004	0.364	0.641**	0.417	0.703**
SE	(0.295)	(0.317)	(0.281)	(0.318)	(0.295)
P value	0.989	0.251	0.023	0.190	0.017
			Two levels and covariates		
impact estimate*	0.039	0.479	0.754***	0.462	0.830***
SE	(0.281)	(0.291)	(0.264)	(0.299)	(0.266)
P value	0.890	0.100	0.004	0.122	0.002
			Three levels without covariates		
impact estimate*	0.004	0.364	0.641**	0.417	0.703**
SE	(0.295)	(0.317)	(0.280)	(0.318)	(0.289)
P value	0.989	0.251	0.022	0.190	0.015
			Three levels and covariates (final model)		
impact estimate*	0.039	0.479	0.754***	0.462	0.830***
SE	(0.281)	(0.291)	(0.264)	(0.299)	(0.266)
P value	0.890	0.100	0.004	0.122	0.002

* Multilevel modeling estimates adjusted for district pair matching; estimate units are standard deviations; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

Sensitivity of the regression models were also tested for district pair matching. Table 5.36 shows the impact estimates for the model without accounting for district pair matching were marginally lower than the final model that considered the pair matching for the two significant variables. Composite structural index was 0.047 standard deviation lower (SE 0.276; p value = 0.005), and family and child health index was 0.04 standard deviations lower (SE 0.272; p value = 0.009).

Table 5.36: Sensitivity of impact estimates by district pair matching

	Without adjusting for district pair-matching			**Accounting for district pair-matching (final model)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Medicines	0.034	(0.294)	0.908	0.039	(0.281)	0.890
Outpatient	0.460	(0.304)	0.130	0.479	(0.291)	0.100
Family and Child Health	0.714***	(0.272)	0.009	0.754***	(0.264)	0.004
Infection Control	0.430	(0.308)	0.163	0.462	(0.299)	0.122
Composite index	0.783***	(0.276)	0.005	0.830***	(0.266)	0.002

* Multilevel modeling estimates with three levels (facility, district and province) and with covariates; estimate units are standard deviations; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

Estimating the impact along with its robust clustered standard errors generated similar significance for the composite structural index along with the same estimates (table 5.37). However, with robust SEs, only outpatient index (0.479 SD; SE 0.204; p value = 0.019) came out to be statistically significant.

Table 5.37: Sensitivity of impact estimates by robust SE

	With robust standard errors			**Without robust standard errors (final model)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Medicines	0.039	(0.281)	0.890	0.039	(0.281)	0.890
Outpatient	0.479**	(0.204)	0.019	0.479	(0.291)	0.100
Family and Child Health	0.754***	(0.242)	0.002	0.754***	(0.264)	0.004
Infection Control	0.462*	(0.260)	0.076	0.462	(0.299)	0.122
Composite index	0.830***	(0.252)	0.001	0.830***	(0.266)	0.002

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

Sensitivity of the model was tested with a fully interacted model. In this model, apart from the specifications mentioned in the "final model", all covariates were interacted separately with the P4P, period and interaction of P4P and period. As shown in table 5.38, the fully interacted model returns higher impact estimates with similar levels of significance for composite structural quality (1.831 SD; SE 0.74; p value = 0.013) index.

Table 5.38: Sensitivity of impact estimates by fully interacted model

	Fully interacted model			Partial interacted model (final model)		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Medicines	0.276	(0.779)	0.724	0.039	(0.281)	0.890
Outpatient	1.107	(0.825)	0.180	0.479	(0.291)	0.100
Family and Child Health	1.224*	(0.737)	0.097	0.754***	(0.264)	0.004
Infection Control	1.506*	(0.826)	0.068	0.462	(0.299)	0.122
Composite index	1.831**	(0.740)	0.013	0.830***	(0.266)	0.002

* Multilevel modeling estimates adjusted for facility covariates and district pair matching; estimate units are standard deviations; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample size 77 facilities (P4P 41 and control 36)

While testing the goodness-of-fit (table 5.39), models with covariates and additional levels were generally better fit than their without covariate or lower level counterparts. The final model chosen was in fact the best fit.

Table 5.39: Tests for model goodness-of-fit

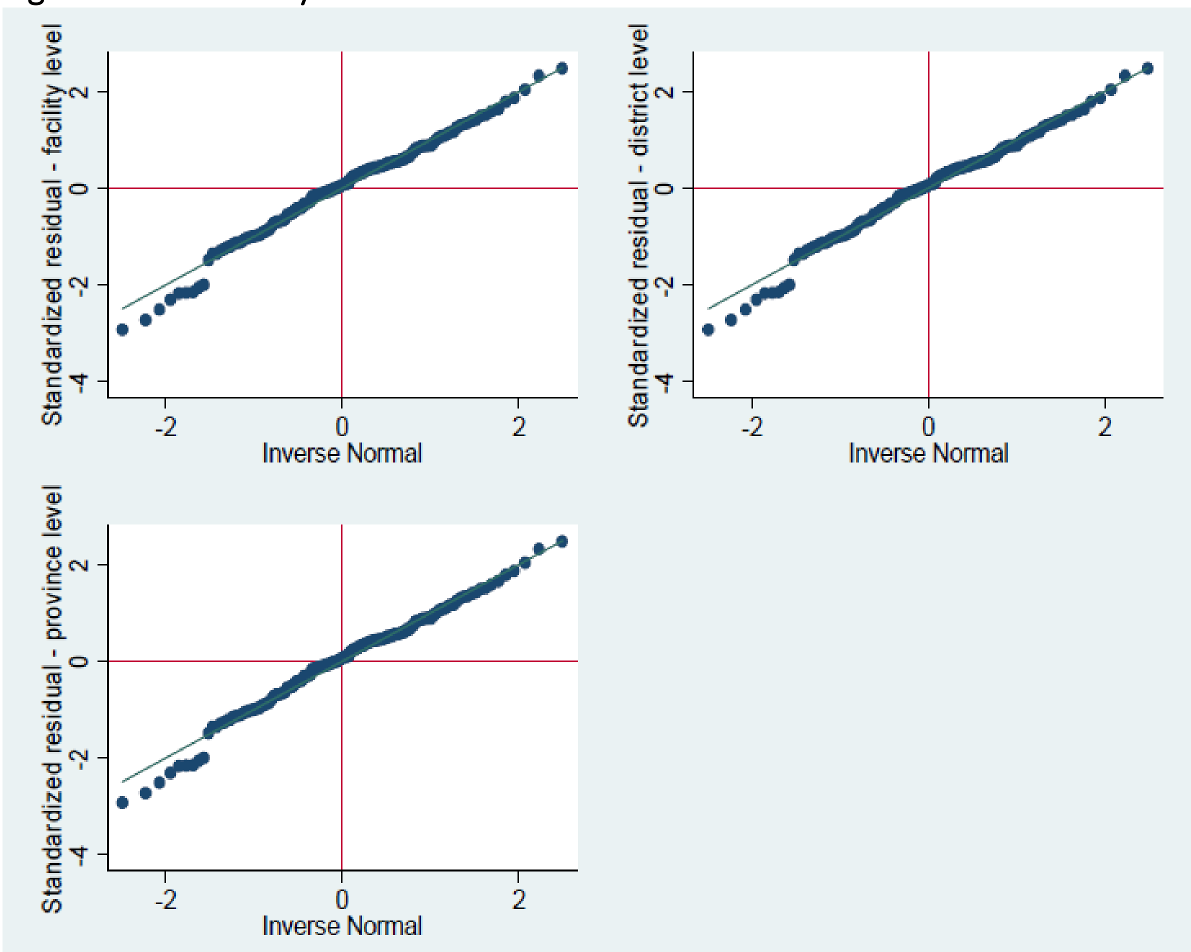
Model fit statistics	Two levels without covariates	Two levels and covariates	Three levels without covariates	Three levels and covariates (final model)
Observations	154	152	154	152
loglikelihood	-210.701	-200.082	-207.077	-196.269
df	6	10	7	11
AIC	433.4019	420.1638	428.1547	414.537
BIC	451.6237	450.4026	449.4134	447.7997
Deviance	421.402	400.1638	414.1548	392.537

df – degrees of freedom; AIC – Akaike Information Criterion; BIC – Bayesian Information Criterion

5.4.2.5 Regression diagnostics

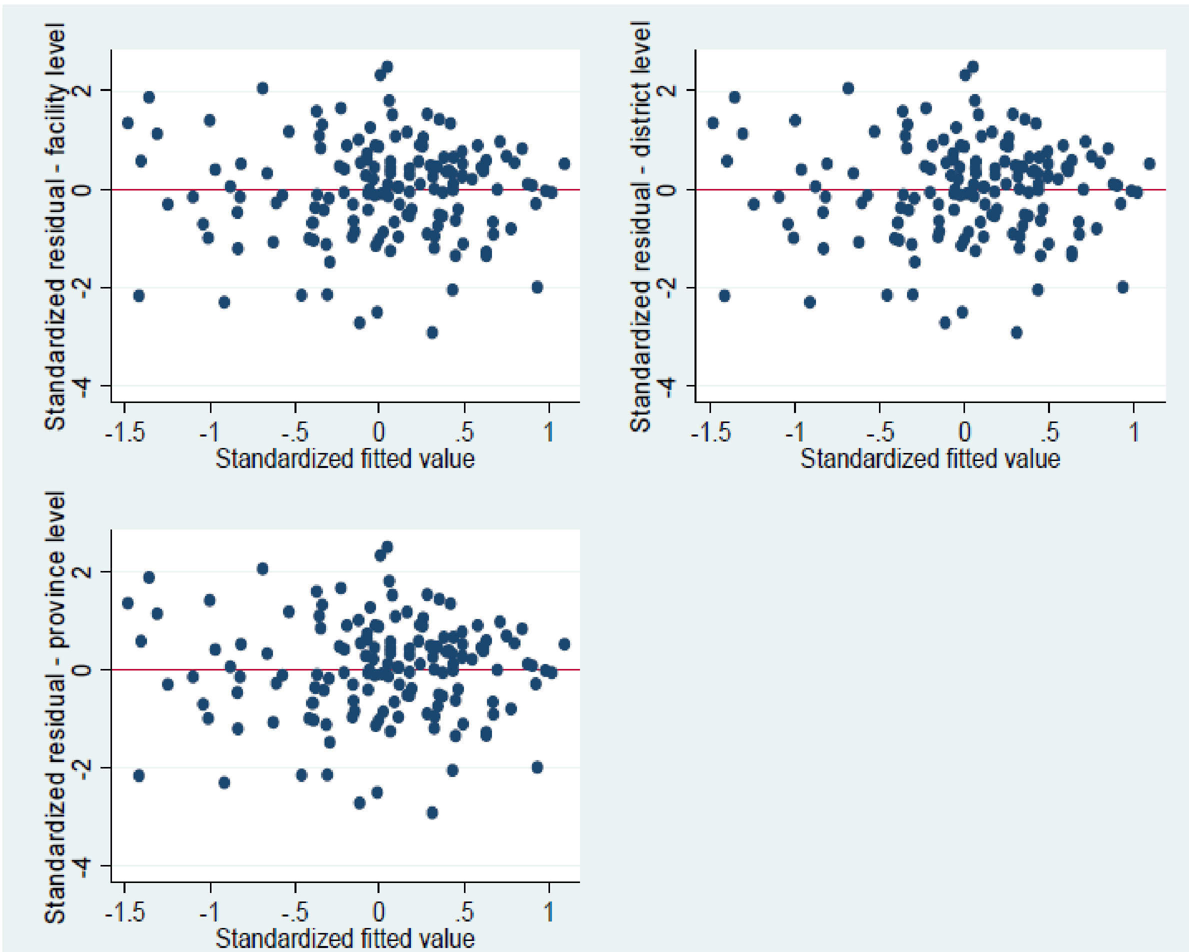
The normality of the regression residuals for the composite structural quality variable was verified by the standardized values of the residuals at various levels of analysis. Though there is a slight deviation from normality at the lower tail, the residuals overall seem closer to normal distribution at all levels (Figure 5.9).

Figure 5.9: Normality of residuals



Homogeneity of variance of the residuals was checked through graphs plotting residuals against the fitted values. The residuals could be said as homoscedastic as the plot (figure 5.10) shows no particular pattern of the distribution of the residuals.

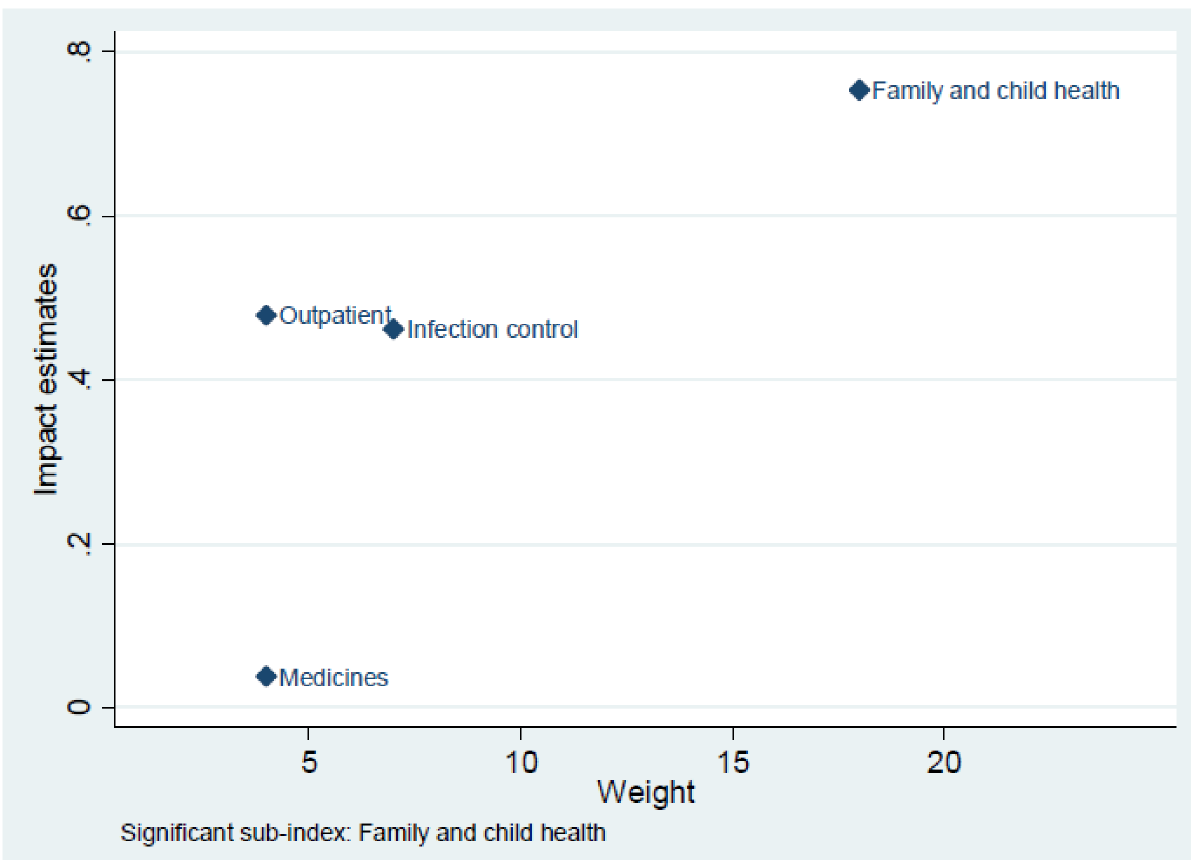
Figure 5.10: Homoscedasticity of residuals



5.4.2.6 Impact estimates vis-à-vis weights

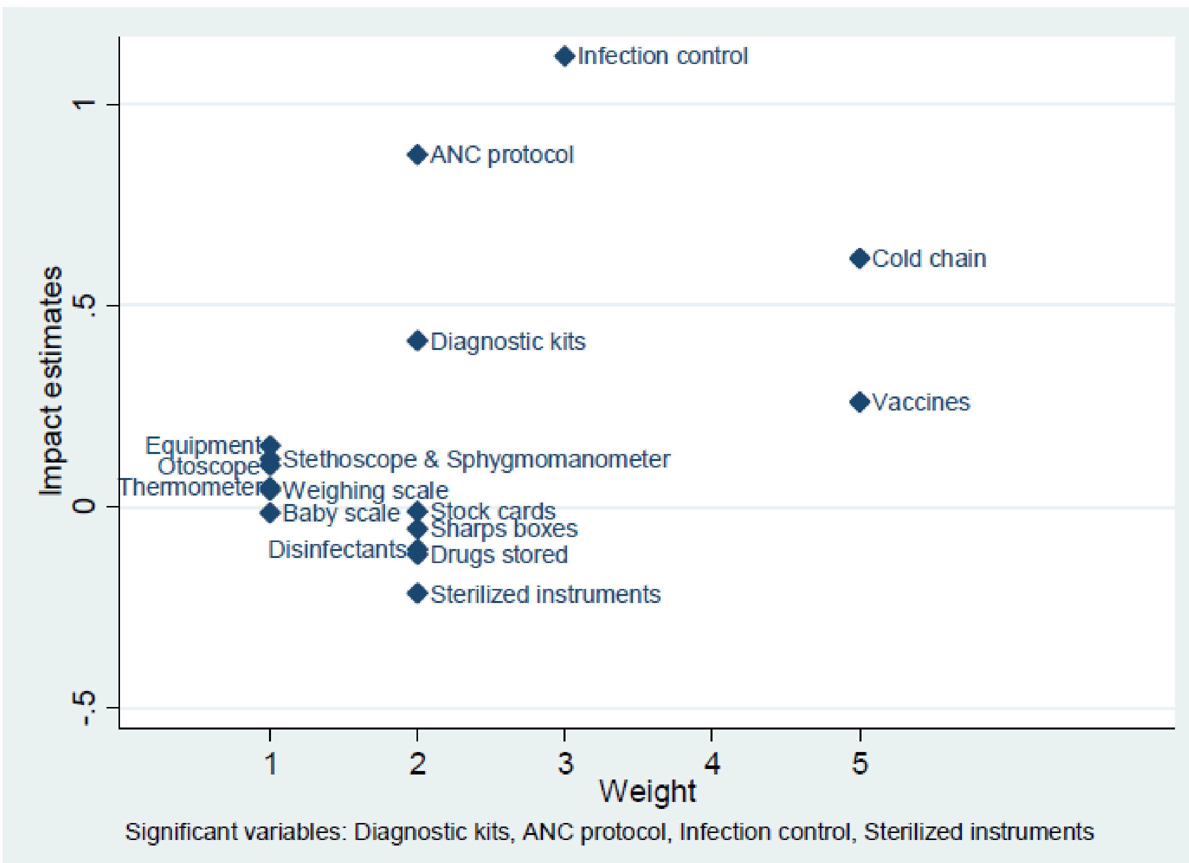
Impact estimates of individual quality items were plotted against their weights to observe if there was any relationship between these two – for instance items with higher weights showing higher estimates. The motivation behind this type of analysis was to diagnose if there was selective preference for the facilities on certain items because they were weighted heavily versus others (cherry picking). Quality sub-indices and their items were plotted separately. Among the sub-indices (figure 5.11), family and child health showed the highest impact estimate along with statistical significance, which was also the heavily weighted sub-index among the sub-indices that could be picked up from the facility survey data.

Figure 5.11: Plotting impact estimates of sub-indices by weight



When the items are plotted individually (figure 5.12), the highest estimates along with statistical significance come from moderately weighted services. These services were – availability and utilization of infection control policy (weighted 3 points), availability of ANC protocol and diagnostic kits (weighted 2 points each). Although moderately weighted at 2 points, sterilization of instruments according to standards showed significant negative gains.

Figure 5.12: Plotting impact estimates of items by weight



Chapter 6: Impact of P4P on Process Quality – Findings from the exit interviews

6.1 Overview

This chapter presents the effects of P4P on process quality of antenatal care. Here process quality implies adherence to standard national P4P guidelines with respect to antenatal care. Adherence to the standard guidelines has been elicited from the clients visiting the health facility through the client exit interviews data. The national standards on antenatal care consist of counseling, physical examinations, laboratory tests and prescription. Under the methods section (specific to process quality), construction of process quality index has been explained out of various sub-indices and items. Results are presented in the following sequence – descriptive statistics, sample balance at baseline, correlation among sub-indices, impact estimates, subgroup analysis, sensitivity and robustness verifications and finally, regression diagnostics.

6.2 Methods

The detailed description of the methods is given in Chapter 4. A summary of the methods and some specific information pertaining to the effects of P4P on process quality is described here. This study had a before-after design involving 32 districts, half implemented the pay for performance program (16 P4P districts with 374 health facilities) and the other half continued without any P4P program, i.e. business-as-usual (16 control districts with 331 health facilities).

6.2.1 Data collection

Data were collected at base line and two years after implementing P4P program by a local survey firm. The baseline survey was conducted during Dec, 2011 to Feb, 2012 and the follow up survey during May-August of 2014. Two survey instruments were administered during these surveys – health facility and client exit interviews. Both rounds of survey utilized the same instruments and the same set of health facilities, thus, creating a panel of health facilities for this research.

During the exit interviews, information was collected on – (a) background socio-economic information about the client (e.g. age, marital status, education, household structure and assets, distance of residence from the health center); (b) experiences with the provider (e.g. questions asked about medical history, diagnostic and physical examinations performed, medications and counseling provided during the consultation); and (c) satisfaction with the provider and services received. The client interviews were conducted in the vicinity of the health facility, but away from the providers or general public to maintain privacy of the respondent and confidentiality of the information. The data collection instruments are presented in Annex C.

6.2.2 Sampling

During the baseline survey, health facilities were randomly selected based on a simple random sampling method. The sampling frame was all rural health facilities from 32 study districts. The same baseline survey facilities were revisited during the follow up survey two years after the implementation of the P4P intervention. Thus, a panel of same health facilities was created with data for two survey rounds. Up to five ANC clients were sampled in each health facility for exit interviews through systematic random sampling. Systematic random sampling was based on ANC case load for the same week day (as that of the day of survey) from the previous week. Thus, every 'n'th woman was selected. The panel health facilities yielded 385 clients (208 P4P and 177 control) in the baseline survey and 374 (200 P4P and 174 control) in the follow up.

6.2.3 Data analysis

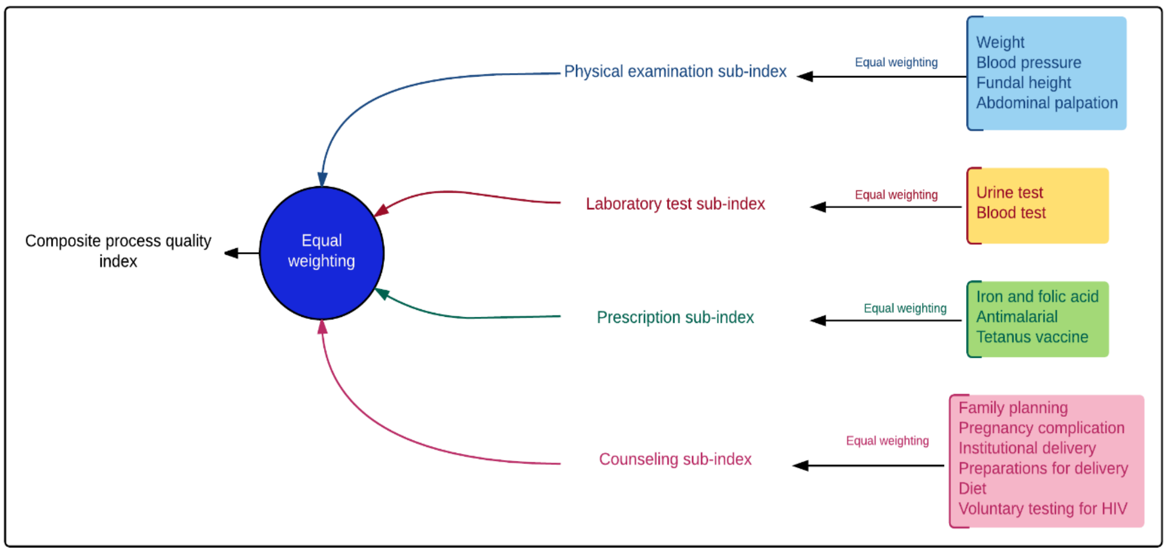
The following analyses were conducted: (a) descriptive analysis, (b) baseline balance, (c) correlation among items (d) impact estimate through multilevel modeling, (e) subgroup analysis, and (f) robustness and sensitivity checks. In the impact estimate analysis, the effect sizes were adjusted for health facility, provider and client determinants. Details about all analyses have been presented in the methods chapter (Chapter 4).

6.2.4 Outcome measure

The primary outcome measure is the process quality index. Process quality index was constructed from four process quality sub-indices and each sub-index in turn utilized a set of items to be built up (Figure 6.1). Equal weighting of components was applied while constructing sub-indices from the items, while both equal and differential weighting methods (PCA) were utilized to create process quality index from the sub-indices. All item variables were binary. For example, if a client reported to have been weighed, this variable would score '1' for that particular client and '0' otherwise.

Selection of items/components on process quality is based on the existing literature and the P4P program's adherence to the country's clinical protocols on ANC.[51–54,56–59] This has been explained in detail in the review of literature (Chapter 2).

Figure 6.1: Constructing process quality index and sub-indices



6.2.4.1 Constructing sub-indices

Four sub-indices (continuous variables) were created from their quality of antenatal care items/components.

1. Physical examination sub-index consisted of four items – measurement of weight, blood pressure, fundal height and abdominal palpation. Due to equal weighting of one point per item, the maximum possible score for this sub-index was "4".
2. Laboratory test sub-index was made out of tests for blood and urine (two items). Since the subjects of data were antenatal women, the items were broad-based than specific, i.e. blood test for HIV or syphilis. With equal weighting of one point per item, the maximum possible score for this sub-index was "2".

3. Prescription sub-index came out of three items – prescription of iron and folic acid, antimalarial and tetanus toxoid. Equal weighting of one point per item led to a maximum possible score of "3" for this sub-index.
4. Counseling sub-index was constructed from six items – counseling on family planning, pregnancy complications, institutional delivery, preparations for delivery, diet and voluntary testing for HIV. Due to equal weighting of one point per item, the maximum possible score for this sub-index was "6".

6.2.4.2 Constructing process quality index

The four sub-indices were first standardized on a scale of 0 to 1 so that all sub-indices could be equally weighted. The standardized sub-indices were combined with equal weighting to generate the composite process quality index (continuous variable). A standardized process quality index (z-score) was constructed based on the following equation.

$$Z = \frac{X - \mu}{\sigma}$$

Where Z – standard score, X – each value in the data, μ – sample mean, and σ – standard deviation

A standardized process quality index using variable weighting through principal component analysis (PCA) was also undertaken.

6.3 Results

6.3.1 Descriptive statistics

6.3.1.1 Sample characteristics

ANC exit interview client characteristics are shown in table 6.1. The mean age for the clients in the P4P arm was 25.05 years and in control arm was 24.05 years. The majority of the clients were educated up to secondary level in both arms (P4P = 63.46% and control = 66.1%), and a third had primary level of education (P4P = 33.65% and control = 32.77%). The P4P arm had a relatively higher representation from the most poor quintile group while the control arm had relatively higher proportion from the least poor quintile group.

About two-thirds (65.71%) were in their third trimester (P4P = 67.31% and control = 63.84%) with the rest being in their second trimester. There were almost no women (except one in the P4P arm) in their first trimester. A majority (67.01%) of women had come for their first antenatal visit (P4P = 66.83% and control = 67.23%). The mean gestational age was 30.65 weeks (P4P = 30.6 and control = 30.71) and mean number of visits for ANC was 3.36 (P4P = 3.37 and control = 3.36).

Average distance travelled by the women for the ANC visit was 8.44 kilometers. Women in the control arm reported a longer distance travelled (P4P= 7.73 and control = 9.27). The mean duration to travel to the health facility was 74.36 minutes (P4P = 73.89 and control = 74.91). Most of the women (80.52%) walked to the health facility (P4P = 79.81% and control = 81.36%). The clients had to wait for 52.22 minutes before being attended to by a provider. Women in the P4P arm had a longer waiting time (P4P = 56.06 and control = 47.71).

Table 6.1 Client Characteristics

Variable	**Control N=177**		**P4P N=208**		**Total N=385**	
	N	%	N	%	N	%
Mean age (years)	177	24.05	208	25.05	385	24.59
Education						
Primary	58	32.77	70	33.65	128	33.25
Secondary	117	66.1	132	63.46	249	64.68
Wealth quintile						
Lowest	33	18.64	44	21.15	77	20
Second	35	19.77	43	20.67	78	20.26
Third	33	18.64	43	20.67	76	19.74
Fourth	36	20.34	40	19.23	76	19.74
Highest	40	22.6	38	18.27	78	20.26
Trimester						
First	0	0	1	0.48	1	0.26
Second	64	36.16	67	32.21	131	34.03
Third	113	63.84	140	67.31	253	65.71
Gravidity						
First time	119	67.23	139	66.83	258	67.01
Multiple	58	32.77	69	33.17	127	32.99
Mean gestational age (weeks)	177	30.71	208	30.6	385	30.65
Mean ANC visit	125	3.36	128	3.37	253	3.36

number						
Mean distance (kilometers)	177	9.27	208	7.73	385	8.44
Mean travel time (minutes)	177	74.91	208	73.89	385	74.36
Travel by foot	144	81.36	166	79.81	310	80.52
Mean waiting time (minutes)	177	47.71	208	56.06	385	52.22

Table 6.2 shows that a greater share of clients came from government facilities (total = 62.34%; P4P = 62.5% and control = 62.15%) as the majority of the sampled facilities were owned by the government. Local government facilities represented 31.43% of clients (P4P = 28.85% and control = 34.46%). A higher proportion of clients visited rural health centers (P4P = 85.1% and control = 78.53%).

Table 6.2 Facility Characteristics

Variable	**Control N=177**		**P4P N=208**		**Total N=385**	
	N	%	N	%	N	%
Facility ownership						
Government	110	62.15	130	62.5	240	62.34
Mission	6	3.39	18	8.65	24	6.23
Local government	61	34.46	60	28.85	121	31.43
Facility type						
Rural health centers	139	78.53	177	85.1	316	82.08
Rural hospital	38	21.47	31	14.9	69	17.92

Nurses were the most consulted providers with 82.34% of the clients visiting them (P4P = 84.62% and control = 79.66%) (Table 6.3). The second most visited providers were midwives at 15.84% (P4P = 15.38% and control = 16.38%). Providers were mostly females (P4P = 80.29% and control = 61.02%).

Table 6.3 Provider Characteristics

Variable	**Control N=177**		**P4P N=208**		**Total N=385**	
	N	%	N	%	N	%
Cadre						
Midwife	29	16.38	32	15.38	61	15.84
Nurse	141	79.66	176	84.62	317	82.34
Nurse aid	6	3.39	0	0	6	1.56
Gender						

Male	69	38.98	41	19.71	110	28.57
Female	108	61.02	167	80.29	275	71.43

6.3.1.2 Physical Examinations

Abdominal palpation was performed on almost all women with a coverage of 98% (P4P = 99% and control = 98%) (Table 6.4). Measuring weight (P4P = 90% and control = 91%), blood pressure (P4P = 85% and control = 96%), and fundal height (P4P = 88% and control = 80%) were also high in both arms. However, only 20% of the clients had their height measured (P4P = 16% and control = 25%).

Table 6.4: Physical examinations during ANC visit

Variable	**Control N=177**		**P4P N=208**		**Total N=385**	
	N	%	N	%	N	%
Weight	177	91	208	90	385	91
Height	177	25	208	16	385	20
Blood pressure	177	96	208	85	385	90
Fundal height	177	80	208	88	385	84
Abdominal palpation	177	98	208	99	385	98

6.3.1.3 Laboratory tests

During the ANC visit, 42% of clients had a blood test (P4P= 46% and control = 38%) (Table 6.5). However, only 4% of the clients had their urine sample tested (P4P= 3% and control = 5%).

Table 6.5: Laboratory tests during ANC visit

Variable	**Control N=177**		**P4P N=208**		**Total N=385**	
	N	%	N	%	N	%
Urine test	177	5	208	3	385	4
Blood test	177	38	208	46	385	42

6.3.1.4 Prescription

Almost all women received a prescription of tetanus vaccine (P4P= 98% and control = 97%), and prescription for iron and folic acid (P4P = 96% and control = 98%) (Table

6.6). However, only 69% of clients (P4P = 66% and control = 72%) received a prescription for an antimalarial.

Table 6.6: Prescriptions during ANC visit

Variable	Control N=177		P4P N=208		Total N=385	
	N	%	N	%	N	%
Iron and folic acid	177	98	208	96	385	97
Antimalarial	177	72	208	66	385	69
Tetanus vaccine	177	97	208	98	385	98

6.3.1.5 Counseling

Women during the ANC visit are supposed to receive counselling on a myriad of healthy life styles, identifying danger signs of pregnancy, and making preparations for delivery (table 6.7). A high proportion of women (P4P= 98% and control = 97%) received counselling on voluntary testing for HIV. Over half of the women received counselling on delivering at a health facility (P4P = 61% and control = 57%) and preparing for delivery (P4P = 53% and control = 56%). However, only over a third of women received counselling on identifying danger signs of pregnancy (P4P = 37% and control = 39%), family planning (P4P = 36% and control = 38%), and a healthy diet (P4P = 35% and control = 29%).

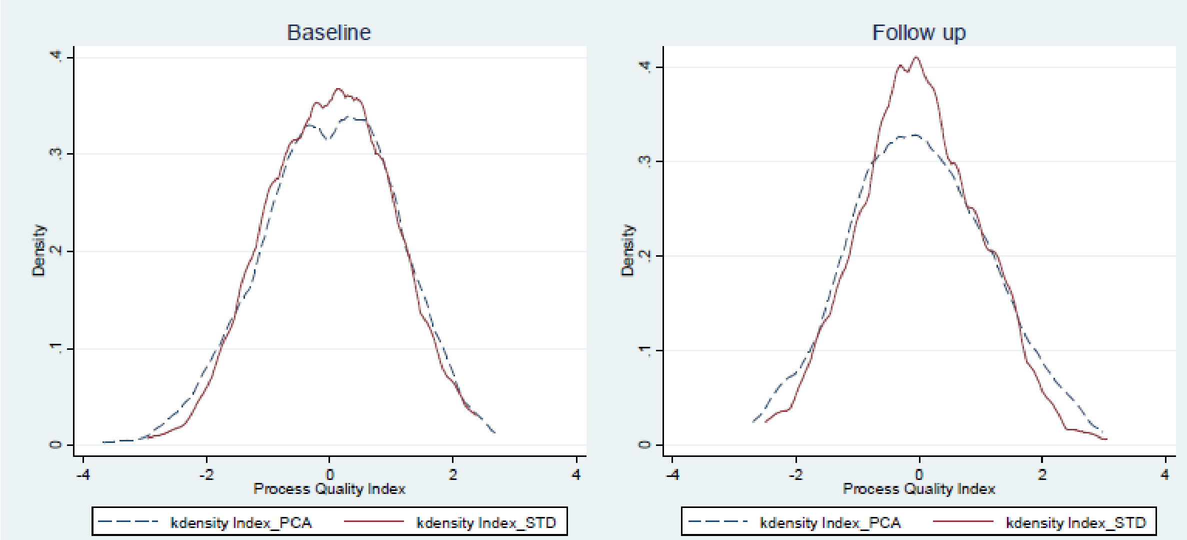
Table 6.7: Counseling during ANC visit

Variable	Control N=177		P4P N=208		Total N=385	
	N	%	N	%	N	%
Family planning	176	38	208	36	384	37
Pregnancy complication	177	39	208	37	385	38
Institutional delivery	177	57	208	61	385	59
Preparations for delivery	177	56	208	53	385	55
Diet	177	29	208	35	385	32
Voluntary testing for HIV	176	97	208	98	384	97

6.3.1.6 Comparison of quality indices by index construction

The estimates of quality indices determined by PCA and equal weighting were compared using kernel density and Bland-Altman plots. The kernel density distribution of both indices are shown in figure 6.2. Indices constructed by PCA and equal weighting show similar distribution in the baseline and post-intervention surveys.

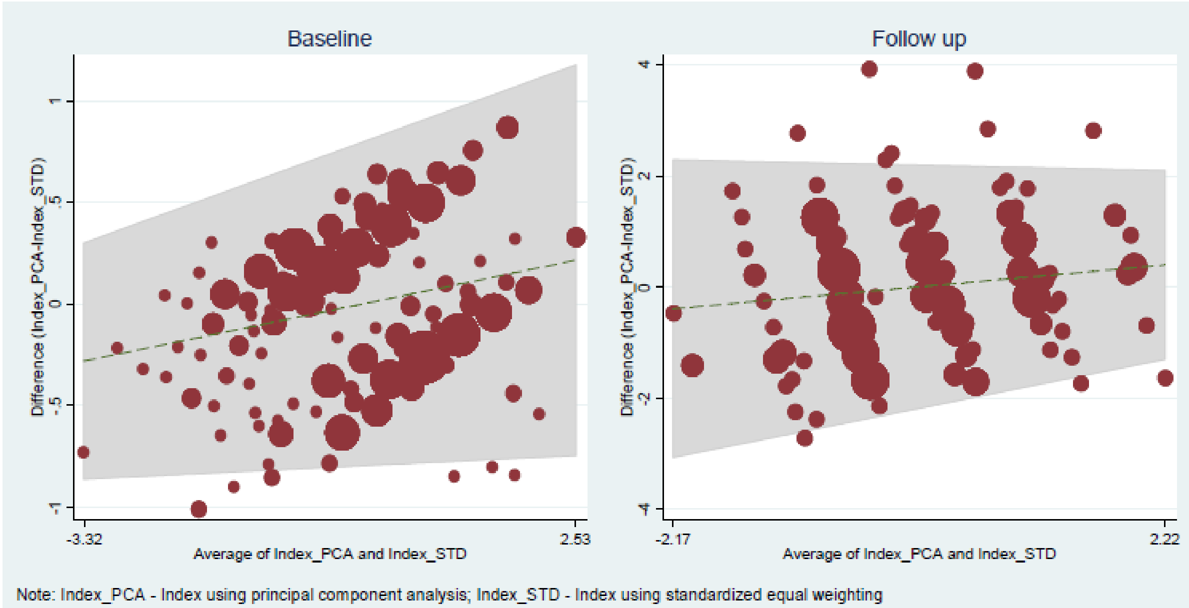
Figure 6.2: Distribution of process quality indices by index construction



Note: Index_PCA - Index using principal component analysis; Index_STD - Index using standardized equal weighting

As shown in the Bland-Altman plots comparing the differences in both ways of index construction by survey rounds (figure 6.3), majority of the data points fall within the recommended limits of agreement (within ± 1.96 SD of the mean difference). This means the indices are in high agreement and they can be used interchangeably.

Figure 6.3: Agreement of process quality indices by index construction



6.3.2 Baseline sample balance

6.3.2.1 Sample characteristics

Clients' characteristics were similar in both arms and none of these was significantly different between the arms (Table 6.8). Clients from the P4P arm were slightly older than that of the control arm (normalized mean difference 0.11), whereas control arm had a higher proportion of primary level educated clients (normalized mean difference – 4).

Table 6.8 Sample balance – Sample Characteristics

Variable	Control %	P4P %	Normalized difference	p value
Mean age (years)	24.05	25.05	0.11	0.120
Education				
Primary	66	63	-4	0.590
Secondary	1	1	3	0.660
Wealth quintile				
Lowest	19	21	4	0.541
Second	20	21	2	0.827
Third	19	21	4	0.619
Fourth	20	19	-2	0.786
Highest	23	18	-8	0.293
Trimester				
First	0	0	7	0.357

Second	36	32	-6	0.417
Third	64	67	5	0.477
Gravidity				
First time	67	67	-1	0.933
Multiple	33	33	1	0.933
Mean gestational age (weeks)	30.71	30.60	-0.01	0.880
Mean ANC visit number	3.36	3.37	0	0.968
Mean distance (kilometers)	9.27	7.73	-0.07	0.349
Mean travel time (minutes)	74.91	73.89	-0.01	0.887
Travel by foot	81	80	-3	0.703
Mean waiting time (minutes)	47.71	56.06	0.10	0.185

*** p<0.01, ** p<0.05, * p<0.1; sample size 385 women (P4P 208 and control 177)

The P4P arm had a significantly higher proportion of clients visiting mission owned health facilities (p value 0.033) (Table 6.9).

Table 6.9 Sample balance – Facility Characteristics

Variable	Control %	P4P %	Normalized difference	p value
Facility ownership				
Government	62	63	1	0.943
Mission	3	9	16	0.033**
Local government	34	29	-9	0.238
Facility type				
Rural health centers	79	85	12	0.095*
Rural hospital	21	15	-12	0.095*

*** p<0.01, ** p<0.05, * p<0.1; sample size 385 women (P4P 208 and control 177)

Table 6.10 shows a significantly higher proportion of clients visited nurse aid in the control arm (p value 0.007), whereas more clients visited female providers in P4P facilities (p value <0.001).

Table 6.10 Sample balance – Provider Characteristics

Variable	Control %	P4P %	Normalized difference	p value
Cadre				
Midwife	16	15	-2	0.790
Nurse	80	85	9	0.205
Nurse aid	3	0	-18	0.007***
Gender				

Male	39	20	-29	<0.001***
Female	61	80	29	<0.001***

*** p<0.01, ** p<0.05, * p<0.1; sample size 385 women (P4P 208 and control 177)

6.3.2.2 Physical Examinations

A significantly higher proportion of clients got their blood pressure (p value <0.001) and height (p value 0.028) measured in the control arm, whereas measuring fundal height was higher in the P4P arm (p value 0.037) (Table 6.11). There were no differences in measuring weight (p value 0.847) and abdominal palpation (p value 0.842).

Table 6.11: Sample balance – Physical examinations during ANC visit

Variable	Control %	P4P %	Normalized difference	p value
Weight	91	90	-1	0.847
Height	25	16	-16	0.028**
Blood pressure	96	85	-27	<0.001***
Fundal height	80	88	15	0.037**
Abdominal palpation	98	99	1	0.842

*** p<0.01, ** p<0.05, * p<0.1; sample size 385 women (P4P 208 and control 177)

6.3.2.3 Laboratory tests

There were no significant differences with regard to receipt of laboratory tests during the ANC visit among the study arms (table 6.12).

Table 6.12: Sample balance – Laboratory tests during ANC visit

Variable	Control %	P4P %	Normalized difference	p value
Urine test	5	3	-8	0.267
Blood test	38	46	11	0.122

*** p<0.01, ** p<0.05, * p<0.1; sample size 385 women (P4P 208 and control 177)

6.3.2.4 Prescription

The proportion of clients receiving prescriptions for medicines and tetanus vaccine were similar between the two arms (table 6.13).

Table 6.13: Sample balance – Prescriptions during ANC visit

Variable	Control %	P4P %	Normalized difference	p value
Iron and folic acid	98	96	-6	0.373
Antimalarial	72	66	-10	0.174
Tetanus vaccine	97	98	4	0.561

*** p<0.01, ** p<0.05, * p<0.1; sample size 385 women (P4P 208 and control 177)

6.3.2.5 Counseling

Similar proportions of clients from both arms received counselling services and there were no significant differences (table 6.14).

Table 6.14: Sample balance – Counseling during ANC visit

Variable	Control %	P4P %	Normalized difference	p value
Family planning	38	36	-4	0.615
Pregnancy complication	39	37	-3	0.693
Institutional delivery	57	61	5	0.486
Preparations for delivery	56	53	-5	0.479
Diet	29	35	9	0.190
Voluntary testing for HIV	97	98	4	0.557

*** p<0.01, ** p<0.05, * p<0.1; sample size 385 women (P4P 208 and control 177)

6.3.3 Correlation analysis

Correlation analyses were performed for each process quality sub-index as well as the composite index. None of the correlation coefficients was above the threshold of 0.8 (Table 6.15). The highest correlation coefficient was 0.27. Thus, all sub-index items as well as the sub-indices themselves were retained for the index construction.

Table 6.15: Correlation matrix – Process quality index and sub-indices

Physical examination sub-index items

	Weight	Height	Blood pressure	Fundal height	Abdominal palpation
Weight	1.00				
Height	0.07	1.00			
Blood pressure	0.04	0.07	1.00		
Fundal height	0.06	0.08	0.14	1.00	
Abdominal palpation	-0.03	0.03	0.05	0.14	1.00

Laboratory test sub-index items

	Urine	Blood
Urine	1	
Blood	0.09	1

Prescription sub-index items

	Iron folic acid	Antimalarial	Tetanus toxoid
Iron folic acid	1		
Antimalarial	0.15	1	
Tetanus toxoid	0.12	0.11	1

Counseling sub-index items

	Fam plan	Pregnancy complications	Inst delivery	Delivery preps	Diet	VCT for HIV
Family planning	1.00					
Pregnancy complications	0.22	1.00				
Institutional delivery	0.07	0.09	1.00			
Delivery preparations	0.20	0.27	0.11	1.00		
Diet	0.17	0.25	0.02	0.21	1.00	
VCT for HIV	0.11	0.12	0.07	0.13	0.10	1.00

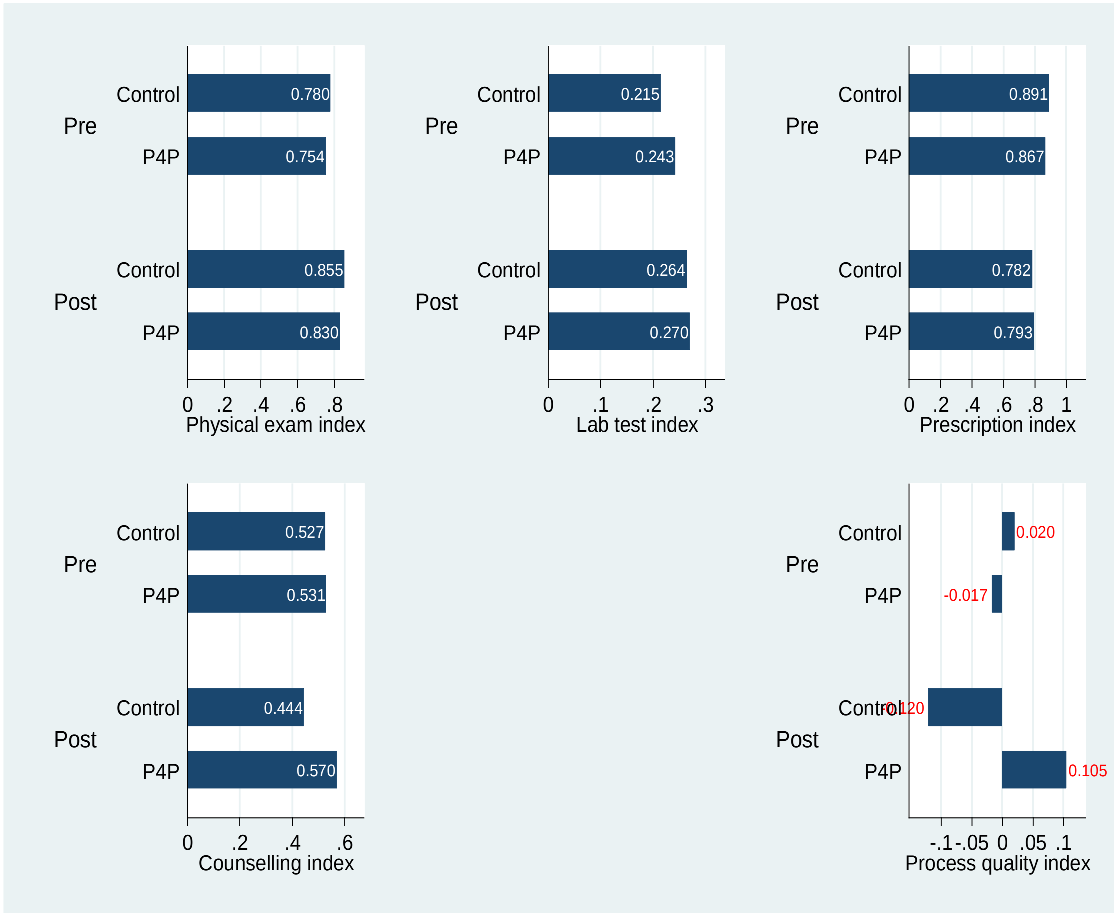
Process quality sub-indices

	Physical examination index	Lab test index	Prescription index	Counselling index
Physical examination index	1.00			
Lab test index	0.16	1.00		
Prescription index	-0.10	-0.01	1.00	
Counseling index	0.05	0.01	0.10	1.00

6.3.4 Process Quality

A comparison of the absolute unadjusted values of the standardized process quality indices between the P4P and control arms pre- and post-implementation of P4P is shown in Figure 6.4. Physical examination and laboratory test went up for both arms, whereas prescription index came down in both. The physical examination index rose from 0.754 to 0.830 points in the P4P arm, while it increased from 0.780 to 0.855 points in the control arm with a difference-in-difference of 0.001 points. Similarly, the difference-in-difference for laboratory test index was -0.022 points indicating a higher increment in the control arm. Both arms registered fall in the prescription index with a relative difference of 0.036 points. The relative difference for counselling index was 0.121 points where P4P arm showed an increase against a fall in the control arm. Finally, the composite process quality index went up in the P4P arm by 0.122 standard deviation (SD) points whereas it fell by 0.32 SD points in the control arm with a relative increase of 0.442 in favor of the P4P arm.

Figure 6.4: Unadjusted changes in process quality indices



6.3.5 Impact estimates

Impact of the P4P program on process quality was estimated as intention-to-treat with difference-in-difference estimates using multilevel modelling regression. Here the multilevel model considered four levels of analysis, i.e. client, health facility, district and province. The individual quality items were binary, thus multilevel mixed-effects logistic regression was carried out. Whereas, multilevel mixed-effects linear regression was undertaken for quality indices as they were continuous variables. The models ran the regressions while adjusting for covariates at the facility (ownership, type of facility, catchment population and distance to the nearest higher level facility, provider (gender and cadre), and client levels (age, education, wealth quintile, distance from home to health facility, parity, number of visit, and gestational age).

The impact estimates are difference-in-difference values, i.e. the relative difference between changes in P4P arm and control arm across two rounds of survey. For instance, an impact estimate of 0.231 for an index means the relative gain in the P4P arm was 0.231 units higher than that of the control arm between the baseline and post-implementation time points. The unit of measurement for estimating impact for the individual items was percentage points; for sub-indices it was absolute points; and for the composite index it was standard deviations.

6.3.5.1 Estimates for individual quality items

6.3.5.1.1 Physical Examinations

The impact of P4P on physical examinations during the ANC visit varied (table 6.16). While reported measurement of weight and blood pressure showed relative gains in the P4P facilities, the likelihood of abdominal palpation and measuring fundal height declined. All these changes were not statistically significant. Measuring weight increased by 4.3% points (SE 0.039; p value 0.272), and blood pressure by 1.4% points (SE 0.058; p value 0.815) in the P4P arm, while abdominal palpation decreased by 4.6% points (SE 0.026; p value 0.078) and measuring fundal height by 2% points (SE 0.053; p value 0.708).

Table 6.16: Impact estimates – physical examinations

		Weight	**Blood pressure**	**Fundal height**	**Abdominal palpation**
impact estimate*	**est**	0.043	0.014	-0.020	-0.046*
	se	(0.039)	(0.058)	(0.053)	(0.026)
	p	0.272	0.815	0.708	0.078
P4P	**est**	-0.018	-0.163***	-0.001	0.012
	se	(0.034)	(0.056)	(0.046)	(0.022)
	p	0.600	0.004	0.976	0.576
Period	**est**	0.033	-0.054	0.111***	0.006
	se	(0.029)	(0.043)	(0.040)	(0.019)
	p	0.255	0.213	0.006	0.767
rural health center	**est**	0.009	-0.076	-0.018	0.021
	se	(0.036)	(0.063)	(0.049)	(0.022)
	p	0.795	0.228	0.712	0.355
owner govt.	**est**	0.065**	-0.071	-0.015	-0.021
	se	(0.029)	(0.050)	(0.039)	(0.018)
	p	0.023	0.151	0.707	0.230
catch population	**est**	0.000	-0.000	-0.000	-0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.233	0.949	0.777	0.322
distance from	**est**	0.001	0.001	0.000	0.001*

hospital					
	se	(0.001)	(0.001)	(0.001)	(0.000)
	p	0.120	0.385	0.562	0.064
Provider-nurse	**est**	-0.010	-0.165	1.037***	0.019
	se	(0.151)	(0.222)	(0.205)	(0.100)
	p	0.947	0.458	0.000	0.849
Provider-female	**est**	0.019	0.060*	0.000	0.012
	se	(0.023)	(0.035)	(0.031)	(0.015)
	p	0.402	0.084	0.997	0.413
age	**est**	0.001	-0.003	-0.002	-0.002*
	se	(0.002)	(0.002)	(0.002)	(0.001)
	p	0.700	0.174	0.282	0.081
primary education	**est**	0.059***	0.087***	-0.069**	-0.010
	se	(0.020)	(0.029)	(0.027)	(0.013)
	p	0.003	0.003	0.010	0.468
gravidity	**est**	-0.007	-0.024	0.001	-0.050***
	se	(0.024)	(0.035)	(0.033)	(0.016)
	p	0.770	0.486	0.973	0.002
gestational age	**est**	0.001	0.001	0.006**	0.006***
	se	(0.002)	(0.002)	(0.002)	(0.001)
	p	0.574	0.694	0.014	0.000
#anc visit	**est**	-0.005	-0.014	-0.002	0.002
	se	(0.007)	(0.010)	(0.009)	(0.004)
	p	0.424	0.154	0.821	0.709
distance from house	**est**	-0.000	0.000	0.001	0.000
	se	(0.001)	(0.001)	(0.001)	(0.000)
	p	0.874	0.933	0.499	0.455
wealth quintile-lowest	**est**	0.011	-0.034	0.015	-0.008
	se	(0.023)	(0.033)	(0.031)	(0.015)
	p	0.640	0.306	0.635	0.614
Constant	**est**	0.842***	1.097***	-0.242	0.836***
	se	(0.186)	(0.280)	(0.253)	(0.122)
	p	0.000	0.000	0.339	0.000

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 759 women

6.3.5.1.2 Laboratory tests

Blood tests went up by 14.1% points (SE 0.072; p value 0.051) and urine tests were marginally lower by 0.9% points (SE 0.048; p value 0.851) in the P4P arm (Table 6.17).

Table 6.17: Impact estimates – laboratory tests

		Urine test	**Blood test**
impact estimate*	**est**	-0.009	0.141*
	se	(0.048)	(0.072)
	p	0.851	0.051
P4P	**est**	-0.029	-0.040
	se	(0.056)	(0.062)
	p	0.605	0.526

period	**est**	0.109***	-0.088
	se	(0.036)	(0.054)
	p	0.003	0.103
rural health center	**est**	0.076	0.124*
	se	(0.066)	(0.066)
	p	0.249	0.061
owner govt.	**est**	0.009	0.009
	se	(0.052)	(0.052)
	p	0.870	0.867
catch population	**est**	-0.000*	-0.000
	se	(0.000)	(0.000)
	p	0.076	0.233
distance from hospital	**est**	-0.000	0.002**
	se	(0.001)	(0.001)
	p	0.929	0.011
Provider-nurse	**est**	0.143	-0.824***
	se	(0.185)	(0.279)
	p	0.440	0.003
Provider-female	**est**	-0.018	0.059
	se	(0.030)	(0.042)
	p	0.558	0.156
age	**est**	0.002	-0.000
	se	(0.002)	(0.003)
	p	0.314	0.922
primary education	**est**	0.046*	0.003
	se	(0.024)	(0.037)
	p	0.056	0.928
gravidity	**est**	0.002	-0.017
	se	(0.029)	(0.044)
	p	0.942	0.710
gestational age	**est**	0.003*	0.005
	se	(0.002)	(0.003)
	p	0.087	0.117
#anc visit	**est**	-0.000	0.005
	se	(0.008)	(0.013)
	p	0.990	0.717
distance from house	**est**	-0.000	0.000
	se	(0.001)	(0.001)
	p	0.861	0.930
wealth quintile-lowest	**est**	-0.012	-0.067
	se	(0.028)	(0.042)
	p	0.661	0.112
Constant	**est**	-0.244	0.689**

	se	(0.241)	(0.344)
	p	0.311	0.045

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 759 women

6.3.5.1.3 Prescription

Table 6.18 shows that prescription of antimalarial drugs was higher in the P4P facilities by 19.9% points (SE 0.07; p value 0.004). However, the prescription of iron and folic acid increased by just 0.1% points (SE 0.037; p value 0.983) and the proportion of women receiving prescriptions for tetanus vaccine decreased (2.3% points; SE 0.04; p value 0.56) in the P4P arm.

Table 6.18: Impact estimates – prescription

		Iron & folic acid	**Antimalarial**	**Tetanus vaccine**
impact estimate*	**est**	0.001	0.199***	-0.023
	se	(0.037)	(0.070)	(0.040)
	p	0.983	0.004	0.560
P4P	**est**	-0.019	0.152**	0.025
	se	(0.029)	(0.071)	(0.033)
	p	0.515	0.032	0.437
period	**est**	-0.031	-0.336***	-0.057*
	se	(0.028)	(0.052)	(0.030)
	p	0.259	0.000	0.054
rural health center	**est**	-0.035	0.241***	-0.007
	se	(0.029)	(0.080)	(0.034)
	p	0.230	0.003	0.841
owner govt.	**est**	-0.031	0.038	-0.018
	se	(0.023)	(0.063)	(0.027)
	p	0.184	0.547	0.507
catch population	**est**	0.000	0.000*	-0.000
	se	(0.000)	(0.000)	(0.000)
	p	0.931	0.079	0.620
distance from hospital	**est**	0.000	0.000	-0.000
	se	(0.000)	(0.001)	(0.000)
	p	0.712	0.740	0.444
Provider-midwife	**est**	-0.133	0.350	-0.017
	se	(0.146)	(0.275)	(0.156)
	p	0.360	0.204	0.911
Provider-nurse	**est**	-0.113	0.406	-0.074
	se	(0.142)	(0.268)	(0.153)
	p	0.425	0.130	0.626
Provider-female	**est**	0.011	0.017	-0.006
	se	(0.021)	(0.042)	(0.022)
	p	0.603	0.689	0.798
age	**est**	0.000	-0.003	-0.001
	se	(0.002)	(0.003)	(0.002)
	p	0.793	0.380	0.659

primary education	**est**	-0.010	0.023	-0.020
	se	(0.019)	(0.035)	(0.020)
	p	0.578	0.510	0.323
gravidity	**est**	0.054**	0.037	-0.054**
	se	(0.023)	(0.042)	(0.024)
	p	0.019	0.374	0.028
gestational age	**est**	-0.000	-0.000	0.003*
	se	(0.002)	(0.003)	(0.002)
	p	0.898	0.966	0.091
#anc visit	**est**	-0.011*	-0.014	0.019***
	se	(0.006)	(0.012)	(0.007)
	p	0.097	0.245	0.005
distance from house	**est**	-0.001	-0.002	-0.000
	se	(0.001)	(0.001)	(0.001)
	p	0.280	0.145	0.960
wealth quintile-lowest	**est**	-0.045**	-0.057	-0.022
	se	(0.022)	(0.040)	(0.023)
	p	0.036	0.153	0.337
Constant	**est**	1.137***	-0.065	0.950***
	se	(0.173)	(0.340)	(0.187)
	p	0.000	0.849	0.000

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 759 women

6.3.5.1.4 Counseling

Except for counselling on diet, all other services showed gains in the P4P arm (table 6.19) and few were significantly higher. Counselling on delivery preparations moved up by 30.6% point (SE 0.084; p value <0.001) and family planning by 22.2% points (SE 0.085; p value 0.009). Though not significant, counselling on pregnancy danger signs (15.7% points; SE 0.092; p value 0.087), institutional delivery (10.4% points; SE 0.082; p value 0.203) and voluntary testing for HIV (5% points; SE 0.044; p value 0.254) were higher, whereas that of diet was marginally lower (1% points; SE 0.084; p value 0.902) in the P4P arm.

Table 6.19: Impact estimates – counseling

		Family planning	Pregnancy complication	Institutional delivery	Preparations for delivery	Diet	Voluntary testing HIV
impact estimate*	est	0.222***	0.157*	0.104	0.306***	-0.010	0.050
	se	(0.085)	(0.092)	(0.082)	(0.084)	(0.084)	(0.044)
	p	0.009	0.087	0.203	<0.001	0.902	0.254
P4P	est	-0.073	-0.153**	0.031	-0.053	-0.030	-0.043
	se	(0.070)	(0.078)	(0.063)	(0.065)	(0.071)	(0.034)
	p	0.299	0.050	0.623	0.415	0.677	0.209
period	est	-0.164**	-0.137**	0.091	-0.173***	-0.055	-0.116***
	se	(0.064)	(0.069)	(0.061)	(0.063)	(0.063)	(0.033)
	p	0.010	0.046	0.137	0.006	0.383	0.000
rural health center	est	0.209***	0.131	0.008	0.002	-0.070	-0.046
	se	(0.073)	(0.082)	(0.061)	(0.063)	(0.075)	(0.033)
	p	0.004	0.109	0.893	0.971	0.350	0.160
owner govt.	est	0.052	0.039	-0.039	-0.045	-0.011	0.002
	se	(0.057)	(0.065)	(0.048)	(0.049)	(0.059)	(0.026)
	p	0.360	0.549	0.414	0.367	0.850	0.944
catch population	est	0.000**	0.000	-0.000	0.000**	0.000*	0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.031	0.252	0.507	0.017	0.052	0.356
distance from hospital	est	-0.000	-0.000	-0.002*	-0.001	0.001	0.001
	se	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	p	0.642	0.854	0.058	0.163	0.624	0.104
Provider-midwife	est	0.423	0.497	-0.215	0.660**	0.218	-0.149
	se	(0.338)	(0.363)	(0.323)	(0.334)	(0.333)	(0.175)
	p	0.210	0.171	0.507	0.048	0.514	0.395
Provider-nurse	est	0.306	0.366	-0.220	0.548*	0.013	-0.201
	se	(0.329)	(0.355)	(0.316)	(0.326)	(0.326)	(0.171)
	p	0.354	0.303	0.486	0.093	0.969	0.241
Provider-female	est	0.110**	0.048	0.032	0.006	0.043	-0.011
	se	(0.049)	(0.053)	(0.045)	(0.046)	(0.048)	(0.024)
	p	0.024	0.359	0.479	0.897	0.380	0.664
age	est	0.007*	0.003	0.007*	0.003	0.002	0.001
	se	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)
	p	0.057	0.417	0.069	0.470	0.634	0.671
primary education	est	0.012	0.027	-0.065	0.024	0.038	0.017
	se	(0.044)	(0.047)	(0.042)	(0.043)	(0.043)	(0.023)
	p	0.776	0.568	0.120	0.578	0.373	0.461
gravidity	est	-0.209***	-0.089	-0.084	0.019	0.034	-0.023
	se	(0.053)	(0.057)	(0.052)	(0.053)	(0.052)	(0.028)
	p	0.000	0.116	0.101	0.723	0.512	0.405
gestational	est	0.004	0.004	0.021***	0.012***	0.001	0.000

age							
	se	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)
	p	0.223	0.262	0.000	0.001	0.868	0.984
#anc visit	**est**	0.006	0.018	0.017	0.006	0.009	0.013*
	se	(0.015)	(0.016)	(0.014)	(0.015)	(0.015)	(0.008)
	p	0.665	0.253	0.226	0.707	0.525	0.096
distance from house	**est**	-0.001	0.003	0.001	0.002	0.002	-0.001
	se	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
	p	0.702	0.143	0.727	0.337	0.222	0.390
wealth quintile-lowest	**est**	-0.017	-0.019	0.052	0.010	0.002	-0.018
	se	(0.050)	(0.054)	(0.048)	(0.050)	(0.049)	(0.026)
	p	0.737	0.722	0.280	0.839	0.971	0.483
Constant	**est**	-0.472	-0.415	0.052	-0.449	0.112	1.193***
	se	(0.403)	(0.436)	(0.383)	(0.395)	(0.400)	(0.207)
	p	0.242	0.341	0.892	0.256	0.780	0.000

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; standard errors in parentheses; estimate units are points; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 759 women

6.3.5.2 Estimates for quality indices

Individual quality items were combined to create quality sub-indices and these sub-indices further merged to generate the composite process quality index (table 6.20). Three out of four indices showed relative gains in the P4P arm. The highest increment was noted in counseling index at 13.9% points (SE 0.043; p value 0.001), followed by prescription index by 7% points (SE 0.033; p value 0.034), and laboratory test index by 6% points (SE 0.044; p value 0.173). However, physical examination index though not statistically significant showed a small relative decline of 0.2% points in P4P facilities (SE 0.026; p value 0.948).

There was a statistically significant increase of 0.556 standard deviation for the composite process quality index (SE 0.162; p value 0.001) in the P4P arm than the mean of the control arm.

Table 6.20: Impact estimates – process quality indices

		Physical exam	Lab test	Prescription	Counseling	Process quality index
impact estimate*	**est**	-0.002	0.060	0.070**	0.139***	0.556***
	se	(0.026)	(0.044)	(0.033)	(0.043)	(0.162)
	p	0.948	0.173	0.034	0.001	0.001
P4P	**est**	-0.077***	-0.023	0.051*	-0.054	-0.217
	se	(0.027)	(0.039)	(0.028)	(0.035)	(0.148)
	p	0.004	0.558	0.072	0.128	0.141
period	**est**	0.035*	0.020	-0.154***	-0.094***	-0.399***
	se	(0.020)	(0.033)	(0.025)	(0.032)	(0.121)
	p	0.080	0.550	0.000	0.003	0.001
rural health center	**est**	-0.017	0.115***	0.067**	0.039	0.415***
	se	(0.030)	(0.042)	(0.030)	(0.036)	(0.161)
	p	0.568	0.006	0.027	0.290	0.010
owner govt.	**est**	-0.051**	0.023	-0.003	-0.001	-0.081
	se	(0.024)	(0.033)	(0.024)	(0.029)	(0.127)
	p	0.034	0.478	0.915	0.982	0.523
catch population	**est**	-0.000	-0.000**	0.000	0.000**	0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.700	0.028	0.102	0.015	0.673
distance from hospital	**est**	0.000	0.001**	0.000	-0.000	0.003
	se	(0.000)	(0.001)	(0.000)	(0.001)	(0.002)
	p	0.225	0.034	0.875	0.466	0.134
Provider-midwife	**est**	0.104	-0.295*	0.058	0.244	0.203
	se	(0.105)	(0.174)	(0.130)	(0.169)	(0.639)
	p	0.319	0.090	0.658	0.149	0.751
Provider-nurse	**est**	0.092	-0.325*	0.064	0.135	-0.116
	se	(0.102)	(0.170)	(0.127)	(0.165)	(0.623)
	p	0.364	0.056	0.615	0.414	0.853
Provider-female	**est**	0.033**	0.009	0.001	0.034	0.188**
	se	(0.016)	(0.026)	(0.019)	(0.024)	(0.095)
	p	0.041	0.724	0.951	0.160	0.049
age	**est**	-0.002**	0.001	-0.001	0.004**	0.003
	se	(0.001)	(0.002)	(0.001)	(0.002)	(0.007)
	p	0.038	0.748	0.507	0.042	0.712
primary education	**est**	0.022	0.025	0.002	0.007	0.107
	se	(0.013)	(0.022)	(0.017)	(0.022)	(0.082)
	p	0.105	0.271	0.924	0.750	0.190
gravidity	**est**	-0.018	-0.011	0.010	-0.056**	-0.135
	se	(0.016)	(0.027)	(0.020)	(0.026)	(0.099)
	p	0.270	0.690	0.609	0.036	0.170
gestational age	**est**	0.002*	0.005**	0.001	0.007***	0.029***
	se	(0.001)	(0.002)	(0.001)	(0.002)	(0.007)
	p	0.094	0.014	0.489	0.000	0.000
#anc visit	**est**	-0.004	0.002	-0.002	0.012	0.016

	se	(0.005)	(0.008)	(0.006)	(0.007)	(0.028)
	p	0.434	0.760	0.733	0.107	0.557
distance from house	**est**	-0.000	0.000	-0.001	0.001	-0.000
	se	(0.000)	(0.001)	(0.001)	(0.001)	(0.003)
	p	0.805	0.986	0.223	0.296	0.972
wealth quintile-lowest	**est**	0.013	-0.047*	-0.043**	0.002	-0.145
	se	(0.015)	(0.026)	(0.019)	(0.025)	(0.094)
	p	0.411	0.066	0.026	0.952	0.123
Constant	**est**	0.740***	0.181	0.686***	0.007	-1.575**
	se	(0.129)	(0.210)	(0.156)	(0.202)	(0.776)
	p	0.000	0.388	0.000	0.974	0.042

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; standard errors in parentheses; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 759 women

6.3.5.3 Sub group analysis

Subgroup analyses were undertaken to ascertain the distribution of impact by various facility, provider and client characteristics.

Government facilities reported significant gains in laboratory test (0.124 points; SE 0.057; p value 0.028) and composite process quality (0.469 SD; SE 0.212; p value 0.027) indices in the P4P arm (Table 6.21). This differs from that was observed in the non-stratified analysis of the total sample including all facilities irrespective of their ownership. The gains in the laboratory test index was not significant and the composite quality index gains were higher (0.556 SD at p value 0.001) in the P4P arm in the total (non-stratified) sample. Local government facilities on the other hand reported higher increments in the counseling index at 0.217 points in the P4P arm (vs 0.139 points in the total sample at 1% level of significance), and smaller increments in the composite quality index at 0.511 SD (p=0.072) compared to the total sample (0.556 SD).

Table 6.21: Subgroup impact estimates – process quality indices by facility ownership

	Government facilities (n=450)			**Local government facilities (n=253)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical exam	0.006	0.031	0.849	-0.061	0.055	0.267
Lab test	0.124**	0.057	0.028	0.037	0.072	0.605

Prescription	0.015	0.042	0.726	0.05	0.062	0.423
Counseling	0.084	0.056	0.128	0.217***	0.081	0.007
Process quality index	0.469**	0.212	0.027	0.511*	0.284	0.072

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1

Rural hospital did not have any significant gains on any of the quality indices for the P4P arm (table 6.22), whereas rural health centers showed significant gains for all indices except physical examination at higher magnitudes. Rural health centers in the P4P arm had significant increase in many quality indices. The highest increase was in the composite quality index by 0.691 SD (SE 0.181; p value <0.001) followed by counseling index (0.149 points; SE 0.048; p value 0.002), laboratory test index (0.097 points; SE 0.049; p value 0.048) and prescription index (0.081 points; SE 0.038; p value 0.032).

Table 6.22: Subgroup impact estimates – process quality indices by facility type

	Rural hospital (n=143)			Rural health center (n=616)		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical exam	0.015	0.052	0.77	0.003	0.03	0.919
Lab test	-0.025	0.097	0.794	0.097**	0.049	0.048
Prescription	0.037	0.06	0.539	0.081**	0.038	0.032
Counseling	0.083	0.074	0.259	0.149***	0.048	0.002
Process quality index	0.252	0.327	0.441	0.691***	0.181	<0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1

Clients those visited nurses as provider reported higher gains (even more than that was observed in the total sample) for all indices except physical examination in the P4P arm (table 6.23), On the other hand, results from the clients visiting a nurse midwife showed declines in all indices except physical examination. However, among these declining indices, only laboratory test was statistically significant (0.69 points; SE 0.192; p value <0.001).

Table 6.23: Subgroup impact estimates – process quality indices by provider cadre

	Nurse midwife (n=83)			Nurse (n=667)		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical exam	0.179	0.151	0.238	-0.02	0.029	0.483
Lab test	-0.690***	0.192	<0.001	0.119**	0.048	0.013
Prescription	0.232	0.186	0.214	0.087**	0.036	0.015
Counseling	-0.257	0.22	0.243	0.211***	0.045	<0.001
Process quality index	-0.846	0.78	0.278	0.818***	0.172	<0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1

Clients visiting male providers reported higher relative gains in quality indices (except for prescription) for the P4P arm, more so with greater magnitudes and significance than the total sample (table 6.24). Whereas clients visiting female providers reported higher indices only for prescription (0.132 points; SE 0.04; p value 0.001) and counseling indices (0.13 points; SE 0.051; p value 0.011) in the P4P arm.

Table 6.24: Subgroup impact estimates – process quality indices by provider gender

	Male (n=230)			Female (n=529)		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical exam	0.175***	0.057	0.002	-0.029	0.031	0.356
Lab test	0.342***	0.092	<0.001	-0.068	0.053	0.202
Prescription	-0.066	0.065	0.313	0.132***	0.04	0.001
Counseling	0.272***	0.086	0.002	0.130**	0.051	0.011
Process quality index	1.451***	0.314	<0.001	0.321	0.203	0.114

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1

Among women in various stages of pregnancy from the P4P arm (table 6.25), clients in the second trimester (0.75 SD; p value 0.043) had a higher relative gain in the composite process quality index, though clients in their third trimester (0.398 SD; p value 0.026) also had a significant gain. However, gains in counseling index (0.101 points; p value 0.037) remained significant only for the third trimester, while women in second trimester (0.129 SD; p value 0.033) posed higher gains in physical examination index.

Women pregnant for the first time in the P4P arm reported higher impact estimates (magnitude and significance) than women pregnant for multiple times. The impact on counseling index was not significant among women pregnant multiple times even though it was significant in the total sample in the P4P arm.

Women aged 20 to 34 years had a better gain in the P4P arm for prescription, counseling and the composite indices. Women with secondary level of education reported higher gains in all indices except physical examination in the P4P arm. The estimates were as follows – laboratory test index by 0.138 points (SE 0.057; p value 0.015); prescription index by 0.095 points (SE 0.041; p value 0.019); counseling index by 0.179 points (SE 0.053; p value 0.001); and finally, the composite process quality index by 0.839 SD (SE 0.196; p value <0.001). However, no gains were observed in any index among the clients with primary education.

Table 6.25: Subgroup impact estimates – process quality indices by client characteristics

		Physical exam	**Lab test**	**Prescription**	**Counseling**	**Process quality index**
				Trimester		
Second (n=255)	**est**	0.129**	0.019	0.090	0.079	0.750**
	se	(0.061)	(0.081)	(0.085)	(0.089)	(0.372)
	p	0.033	0.810	0.291	0.369	0.043
Third (n=495)	**est**	-0.006	0.042	0.049	0.101**	0.398**
	se	(0.030)	(0.051)	(0.036)	(0.048)	(0.178)
	p	0.830	0.416	0.174	0.037	0.026
				Gravidity		
First time (n=526)	**est**	0.019	0.060	0.075*	0.146***	0.658***
	se	(0.031)	(0.054)	(0.041)	(0.050)	(0.194)
	p	0.535	0.269	0.066	0.003	0.001
Multiple (n=233)	**est**	-0.011	0.111	0.101**	0.049	0.493*
	se	(0.051)	(0.069)	(0.051)	(0.076)	(0.268)
	p	0.830	0.108	0.046	0.521	0.066
				Age		
< 20	**est**	-0.046	0.117	0.118**	-0.005	0.496
	se	(0.054)	(0.083)	(0.049)	(0.088)	(0.313)

(n=180)	**p**	0.392	0.159	0.017	0.959	0.114
20-34 (n=510)	**est**	0.013	0.073	0.101**	0.143***	0.712***
	se	(0.033)	(0.056)	(0.045)	(0.055)	(0.204)
	p	0.686	0.190	0.026	0.009	<0.001
				Education		
Primary (n=244)	**est**	-0.046	-0.053	0.056	0.130	0.118
	se	(0.051)	(0.075)	(0.056)	(0.080)	(0.319)
	p	0.371	0.482	0.323	0.104	0.711
Secondary (n=501)	**est**	-0.003	0.138**	0.095**	0.179***	0.839***
	se	(0.031)	(0.057)	(0.041)	(0.053)	(0.196)
	p	0.919	0.015	0.019	0.001	<0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; standard errors in parentheses; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 759 women

Process quality indices were separately analyzed for different wealth quintiles (table 6.26). Physical examination index was lower in P4P arm among the lower wealth quintiles, whereas it was higher among higher wealth groups. However, it was significant only among second (impact -0.12 points; p value 0.031) and fourth (impact 0.147 points; p value 0.017) wealth groups. The impact on laboratory test index, similarly was lower among the lower wealth quintiles. P4P's impact on prescription and counseling indices were similar across various wealth quintiles. Finally, the composite process quality index showed significant relative gains for the third (impact 1.127 SD; p value 0.006) and fifth (impact 0.679 SD; p value 0.022) wealth quintile groups, and these estimates were higher than the total sample.

Table 6.26: Subgroup impact estimates – process quality indices by wealth quintile

		Physical exam	Lab test	Prescription	Counseling	Process quality index
Lowest (n=149)	**est**	-0.036	-0.028	0.055	0.170**	0.325
	se	(0.060)	(0.093)	(0.074)	(0.086)	(0.335)
	p	0.549	0.761	0.459	0.048	0.332
Second (n=166)	**est**	-0.120**	-0.149*	0.119**	0.069	-0.126
	se	(0.056)	(0.087)	(0.055)	(0.076)	(0.290)
	p	0.031	0.088	0.031	0.364	0.664
Third	**est**	0.024	0.021	0.164*	0.299***	1.127***
	se	(0.073)	(0.092)	(0.084)	(0.108)	(0.407)

(n=138)	p	0.745	0.817	0.051	0.006	0.006
Fourth	est	0.147**	0.095	0.137	0.231**	0.738
	se	(0.061)	(0.113)	(0.087)	(0.100)	(0.451)
(n=152)	p	0.017	0.399	0.113	0.021	0.101
Fifth	est	0.008	0.276***	0.016	0.074	0.679**
	se	(0.054)	(0.058)	(0.061)	(0.090)	(0.296)
(n=154)	p	0.875	<0.001	0.789	0.409	0.022

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; standard errors in parentheses; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value

6.3.5.4 Sensitivity and robustness checks

Alternative ways of generating the composite process quality index was explored through a principal component analysis (PCA). In this analysis, the composite index was obtained from the four sub-indices (physical examination, laboratory tests, prescription and counseling), and only one principal component was considered. The process quality index shows 0.123 point relative increase in the P4P arm but is not statistically significant (SE 0.179; p value = 0.493) (Table 6.27).

Table 6.27: Impact estimates – creating the quality index by principal component analysis and equal weighting

		Composite process quality index (PCA)	Composite process quality index (equal weights)#
impact estimate*	**est**	0.123	0.556***
	se	(0.179)	(0.162)
	p	0.493	0.001
P4P	**est**	-0.508***	-0.217
	se	(0.157)	(0.148)
	p	0.001	0.141
period	**est**	-0.443***	-0.399***
	se	(0.134)	(0.121)
	p	0.001	0.001
rural health center	**est**	0.330*	0.415***
	se	(0.169)	(0.161)
	p	0.050	0.010
Provider-female	**est**	0.257**	0.188**
	se	(0.104)	(0.095)
	p	0.014	0.049
gestational age	**est**	0.028***	0.029***
	se	(0.008)	(0.007)
	p	0.000	0.000
Constant	**est**	-0.183	-1.575**
	se	(0.853)	(0.776)
	p	0.830	0.042

Observations	515	515

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; standard errors in parentheses; estimate units are points for the PCA index and standard deviations otherwise; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value, # - final model; sample size 759 women

Model specification parameters were altered to observe the changes in the impact estimates. Models were fitted with four levels (client, facility, district, and province) or three levels (client, facility and district). Models were also built without covariates. Table 6.28 shows impact estimates determined by these various models. The impact estimates remain similar across all models and there were no changes by altering the levels. However, models with covariates show higher impact estimates with higher levels of significance.

Table 6.28: Sensitivity of impact estimates by levels and covariates

	Physical exam	**Lab test**	**Prescription**	**Counseling**	**Process quality index**
			Three levels without covariates		
estimate*	-0.005	-0.013	0.041	0.115***	0.299**
SE	(0.021)	(0.044)	(0.028)	(0.034)	(0.139)
P value	0.797	0.768	0.133	0.001	0.032
			Three levels and covariates		
estimate*	-0.002	0.060	0.070**	0.139***	0.556***
SE	(0.026)	(0.044)	(0.033)	(0.043)	(0.162)
P value	0.948	0.173	0.034	0.001	0.001
			Four levels without covariates		
estimate*	-0.005	-0.013	0.041	0.115***	0.299**
SE	(0.021)	(0.044)	(0.028)	(0.034)	(0.139)
P value	0.797	0.768	0.133	0.001	0.032
			Four levels and covariates (final model)		
estimate*	-0.002	0.060	0.070**	0.139***	0.556***
SE	(0.026)	(0.044)	(0.033)	(0.043)	(0.162)
P value	0.948	0.173	0.034	0.001	0.001

* Multilevel modeling estimates adjusted for district pair matching; standard errors in parentheses; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; sample size 759 women

Sensitivity of the regression models were also tested for district pair matching. Table 6.29 shows the impact estimate from the model without accounting for district pair matching was lower than the final model that considered the pair matching for the two significant variables. For instance, the gain in the P4P arm for the composite quality index was 0.556 standard deviations (0.47 SD for without district pair match) and prescription index was 0.07 points (0.068 points for without district pair match).

Table 6.29: Sensitivity of impact estimates by district pair matching

	Without adjusting for district pair-matching			**Accounting for district pair-matching (final model)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical exam	-0.018	0.026	0.482	-0.002	0.026	0.948
Lab test	0.049	0.044	0.268	0.06	0.044	0.173
Prescription	0.068**	0.033	0.041	0.070**	0.033	0.034
Counseling	0.139***	0.042	0.001	0.139***	0.043	0.001
Process quality index	0.470***	0.162	0.004	0.556***	0.162	0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; sample size 759 women

Estimating the impact along with its robust clustered standard errors generated similar significance for the process quality indices (table 6.30). However, the statistical significance of the gain in the P4P arm was higher for prescription (p value 0.034 vs. 0.067) and composite quality indices (p value 0.001 vs. 0.005).

Table 6.30: Sensitivity of impact estimates by robust SE

	With robust standard errors			**Without robust standard errors (final model)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical exam	-0.002	0.034	0.959	-0.002	0.026	0.948
Lab test	0.06	0.078	0.442	0.06	0.044	0.173
Prescription	0.070*	0.038	0.067	0.070**	0.033	0.034
Counseling	0.139***	0.042	0.001	0.139***	0.043	0.001
Process quality index	0.556***	0.2	0.005	0.556***	0.162	0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; sample size 759 women

When the status of structural quality is inadequate, despite having necessary knowledge and skills the providers may not be able adhere to the care standards. For instance, if there is no functional weighing scale in the health facility, the providers will not be able to weigh the clients during the ANC consultation. The impact on the measures of process quality was estimated by adjusting the levels of structural quality in the health facilities. However, the impact estimates remained similar in terms of both magnitude and statistical significance even after linearly adjusting for structural quality (Table 6.31).

Table 6.31: Sensitivity of impact estimates by adjusting structural quality

	Adjusting for structural quality			**Without adjusting for structural quality (final model)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical exam	-0.014	0.027	0.596	-0.002	0.026	0.948
Lab test	0.066	0.045	0.142	0.06	0.044	0.173
Prescription	0.071**	0.034	0.035	0.070**	0.033	0.034
Counseling	0.120***	0.043	0.005	0.139***	0.043	0.001
Process quality index	0.502***	0.164	0.002	0.556***	0.162	0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; sample size 759 women

Sensitivity of the model was tested with a fully interacted model. In this model, apart from the specifications mentioned in the “final model”, all covariates were interacted separately with the study groups, period of implementation of P4P and interaction of study groups and period. As shown in table 6.32, the fully interacted model returns higher impact estimates at lower levels of significance for counseling (0.803 points; SE 0.379; p value = 0.034) and composite process quality (2.796 SD; SE 1.402; p value = 0.046) indices, whereas gives a non-significant estimate for prescription index.

Table 6.32: Sensitivity of impact estimates by fully interacted model

	Fully interacted model			**Partial interacted model (final model)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Physical exam	0.081	0.248	0.743	-0.002	0.026	0.948
Lab test	0.257	0.380	0.498	0.06	0.044	0.173

Prescription	0.341	0.298	0.253	0.070**	0.033	0.034
Counseling	0.803**	0.379	0.034	0.139***	0.043	0.001
Process quality index	2.796**	1.402	0.046	0.556***	0.162	0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; sample size 759 women

While testing the goodness-of-fit (table 6.33), models with covariates were generally better fit than their without covariate counterparts. There were not much difference on the variations in the levels of analysis.

Table 6.33: Tests for model goodness-of-fit

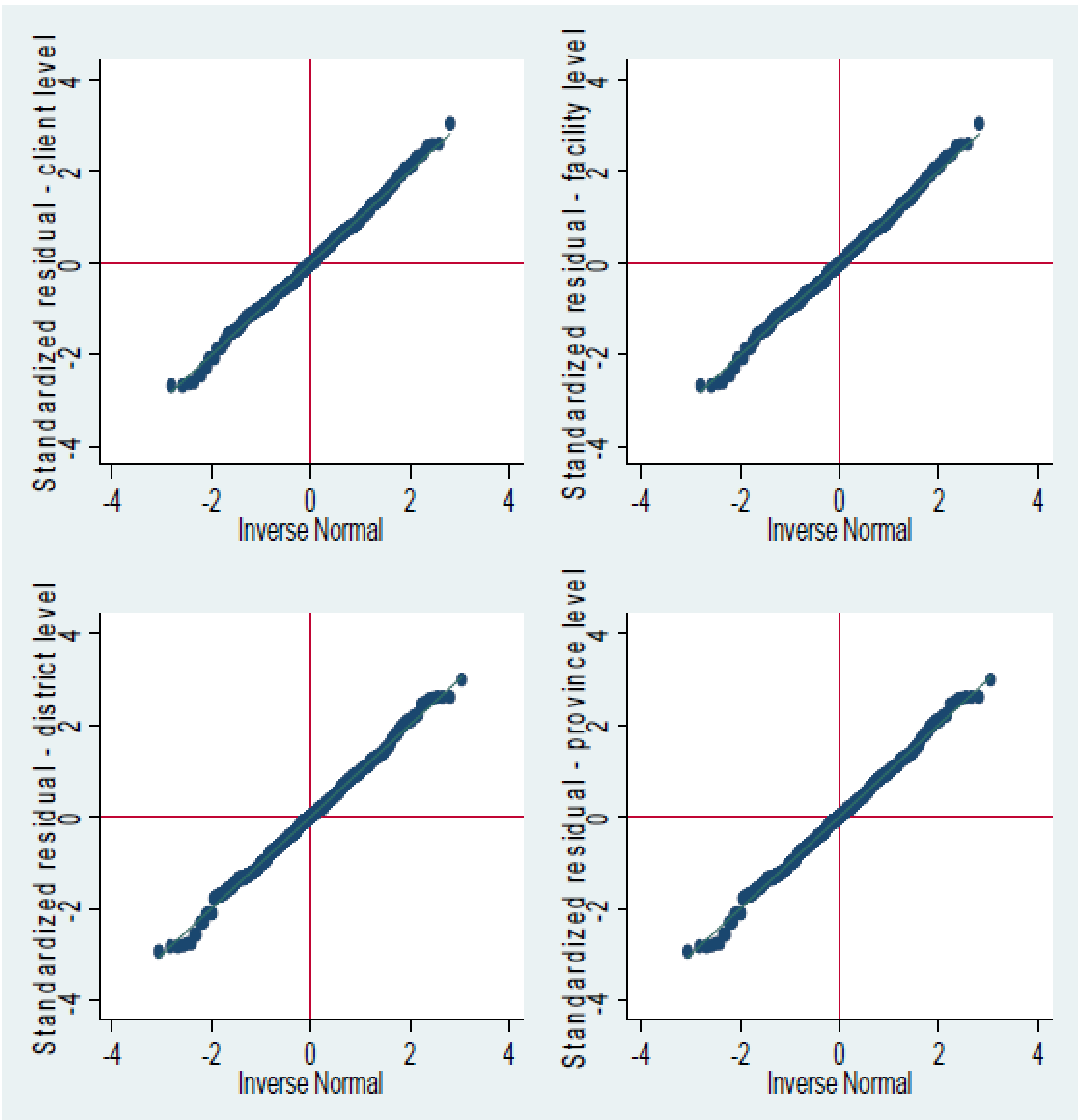
Model fit statistics	**Three levels without covariates**	**Three levels and covariates**	**Four levels without covariates**	**Four levels and covariates (final model)**
Observations	759	515	759	515
loglikelihood	571.0168	451.653	571.0168	451.653
df	19	33	20	33
AIC	-1104.03	-837.306	-1102.03	-837.306
BIC	-1016.03	-697.248	-1009.39	-697.248
Deviance	-1142.03	-903.306	-1142.03	-903.306

df – degrees of freedom; AIC – Akaike Information Criterion; BIC – Bayesian Information Criterion

6.3.5.5 Regression diagnostics

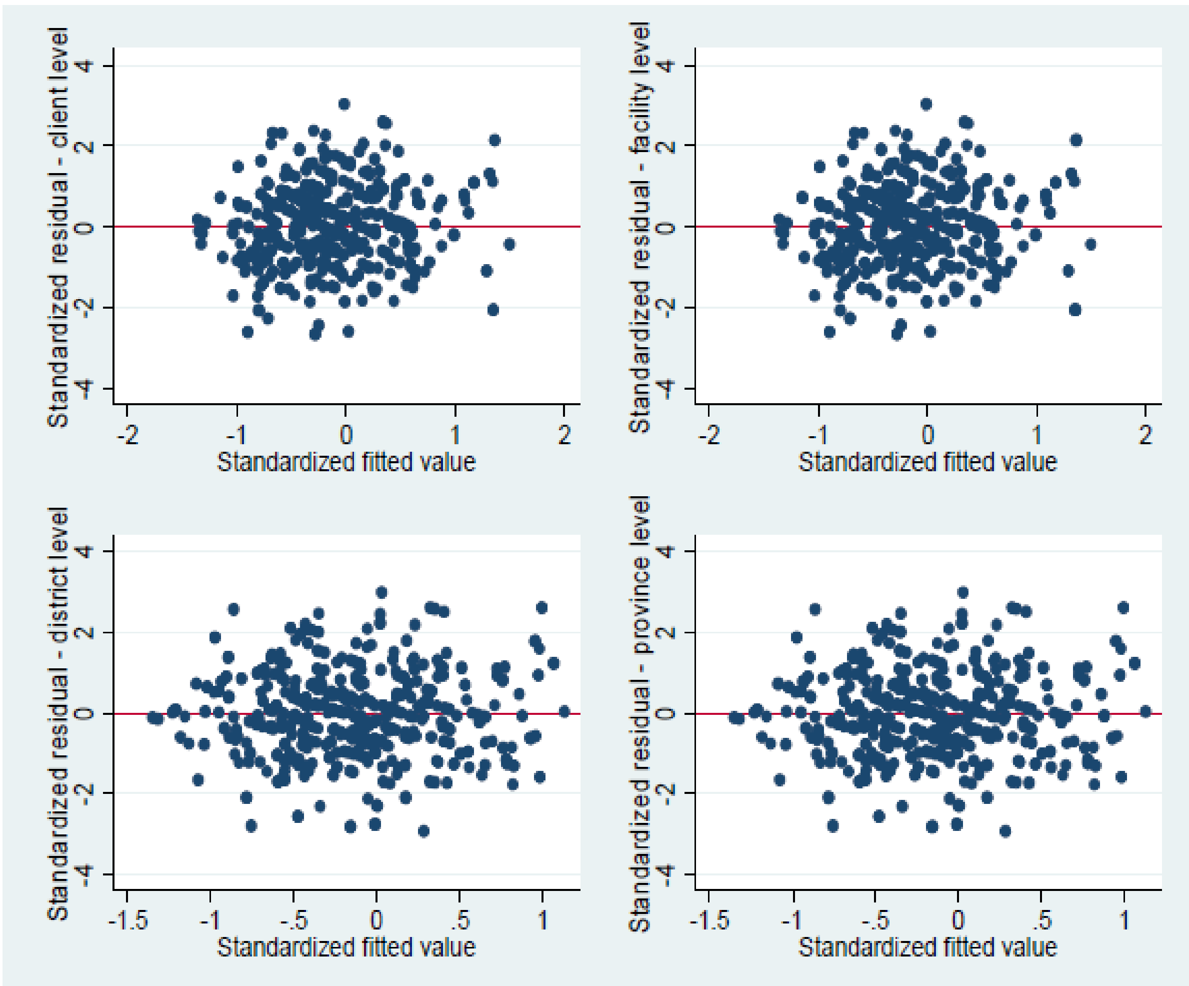
The normality of the regression residuals for the composite process quality variable was verified by the standardized values of the residuals at various levels of analysis. As it can be seen from figure 6.5, the residuals seem closer to normal distribution at all levels.

Figure 6.5: Normality of residuals



Homogeneity of variance of the residuals was checked through graphs plotting residuals against the fitted values. The residuals could be said as homoscedastic as the plot (figure 6.6) shows no particular pattern of the distribution of the residuals.

Figure 6.6: Homoscedasticity of residuals



Chapter 7: Impact of P4P on Client Satisfaction – Findings from the exit interviews

7.1 Overview

This chapter presents the effects of P4P on client satisfaction. Results are presented in the following sequence – descriptive statistics, sample balance at baseline, correlation among items, impact estimates, subgroup analysis, sensitivity and robustness verifications and finally, regression diagnostics.

7.2 Methods

Methods used for this analysis have been explained in detail in Chapter 4. A summary of the methodology is thus given in this section along with some specific information on the objective that pertains to the effects of P4P on client satisfaction. This is a controlled before-after design consisting of eight provinces with four districts in each province. Out of the 32 districts, half implemented the pay for performance program (16 P4P districts with 374 health facilities) and the other half continued without any P4P program, i.e. business-as-usual (16 control districts with 331 health facilities). To assess the impact of P4P program, two rounds of surveys were conducted – one at baseline and the second one after the program's implementation.

7.2.1 Data collection

The baseline survey was conducted during Dec, 2011 to Feb, 2012 and the post-implementation survey during May-August of 2014. Client exit interviews were administered during these surveys. Both rounds of survey utilized the same instruments and the same set of health facilities, thus, creating a panel of health facilities for this research.

During the exit interviews, information was collected on – (a) background socio-economic information about the client (e.g. age, marital status, education, household structure and assets, distance of residence from the health center); (b) experiences with the provider (e.g. questions asked about medical history, diagnostic and physical examinations performed, medications and counseling provided during the consultation); and (c) satisfaction with the provider and services received. The client interviews were conducted in the vicinity of the health facility, but away from the providers or general public to maintain privacy of the respondent and confidentiality of the information. The data collection instruments are presented in Annex C.

7.2.2 Sampling

During the baseline survey, health facilities were randomly selected based on a simple random sampling method. The sampling frame was all rural health facilities from 32 study districts. The same baseline survey facilities were revisited during the follow up survey two years after the implementation of the P4P intervention. Thus, a panel of same health facilities was created with data for two survey rounds. Up to five ANC clients were sampled in each health facility for exit interviews through systematic random sampling. Systematic random sampling was based on ANC case load for the same week day (as that of the day of survey) from the previous week. Thus, every 'n'th woman was selected. The panel health facilities yielded 385 clients (208 P4P and 177 control) in the baseline survey and 374 (200 P4P and 174 control) in the follow up.

7.2.3 Data analysis

Data analysis was undertaken in the following sequence – (a) descriptive analysis, (b) baseline balance, (c) correlation among items (d) impact estimate through multilevel modeling, (e) subgroup analysis, and (f) robustness and sensitivity checks. In the impact estimate analysis, the effect sizes were adjusted for health facility, provider and client determinants. Details about all analyses are presented in the methods chapter (Chapter 4).

7.2.4 Outcome measure

The primary outcome measure, client satisfaction index was created out of individual satisfaction items applying equal weighting. As shown in figure 7.1, the individual satisfaction items were - satisfaction with operating hours, cleanliness, privacy, waiting time, provider attitude, time spent with provider, and availability of medicines. Though cost of care was initially planned to be included as a satisfaction item in the index, it was dropped because of too many missing values (72%). Selection of items for client satisfaction is based on the existing literature. This has been explained in detail in the review of literature (Chapter 2).

Client satisfaction items were collected against a four-point Likert Scale where the scores ranged from 1 (least satisfied) to 4 (most satisfied). While estimating the composite index, the values of individual satisfaction items were treated as continuous variables. For instance, if a client reported highest satisfaction (value 4 in the Likert Scale) in all seven items, the composite index will be 28 points. Thus, the composite index turned out to be a continuous variable.

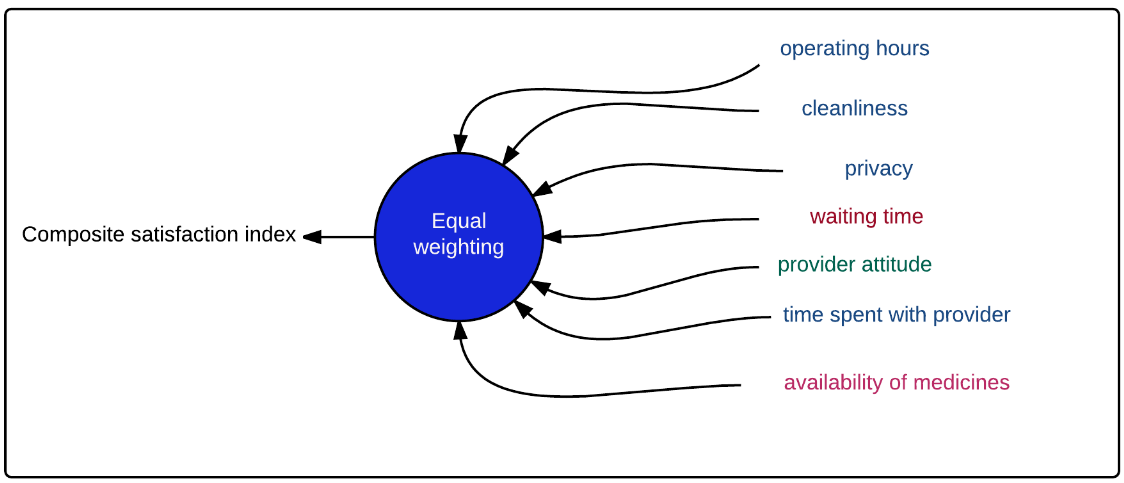
This composite index was further standardized to enable comparison between other quality outcomes (i.e. research questions 1 and 2). Standardized satisfaction index (z-score) was constructed based on the following equation.

$$Z = \frac{X - \mu}{\sigma}$$

Where Z – standard score, X – each value in the data, μ – sample mean, and σ – standard deviation

Generating the index using variable weighting through principal component analysis (PCA) was also undertaken.

Figure 7.1: Constructing satisfaction index



7.3 Results

7.3.1 Descriptive statistics

Table 7.1 presents reported clients' satisfaction from the baseline survey on various elements of service delivery. A very high proportion of clients reported satisfaction on operating hours (P4P = 96% and control = 96%), privacy during consultation (P4P= 95% and control = 98%), time taken for consultation (P4P= 94% and control = 97%), attitude of staff (P4P = 94% and control = 93%), availability of medicines (P4P= 93% and control = 93%) and cleanliness (P4P = 85% and control = 85%). Clients reported relative lower levels of satisfaction on waiting time in both arms (P4P = 76% and control = 79%) and registration fee (P4P= 63% and control = 62%).

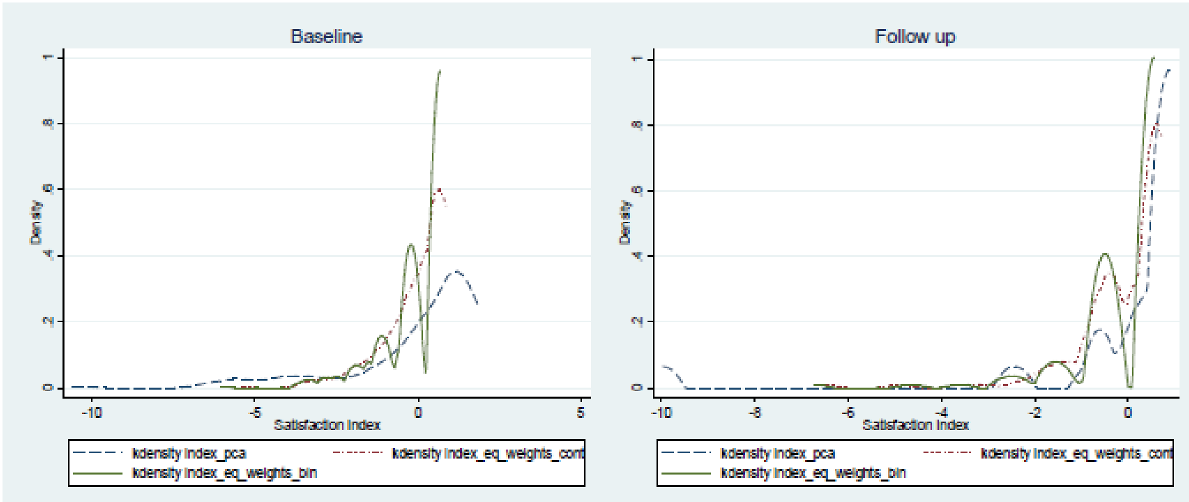
Table 7.1: Proportion of clients reporting satisfaction

Variable	**Control N=177**		**P4P N=208**		**Total N=385**	
	N	**%**	**N**	**%**	**N**	**%**
Operating hours	177	96	207	96	384	96
Cleanliness	177	85	208	85	385	85
Privacy	177	98	208	95	385	96
Waiting time	175	79	205	76	380	77
Staff attitude	177	93	208	94	385	94
Consultation time	177	97	208	94	385	95
Medicine	164	93	197	93	361	93
Registration fee	55	62	98	63	153	63

7.3.1.1 Comparison of satisfaction index by index construction

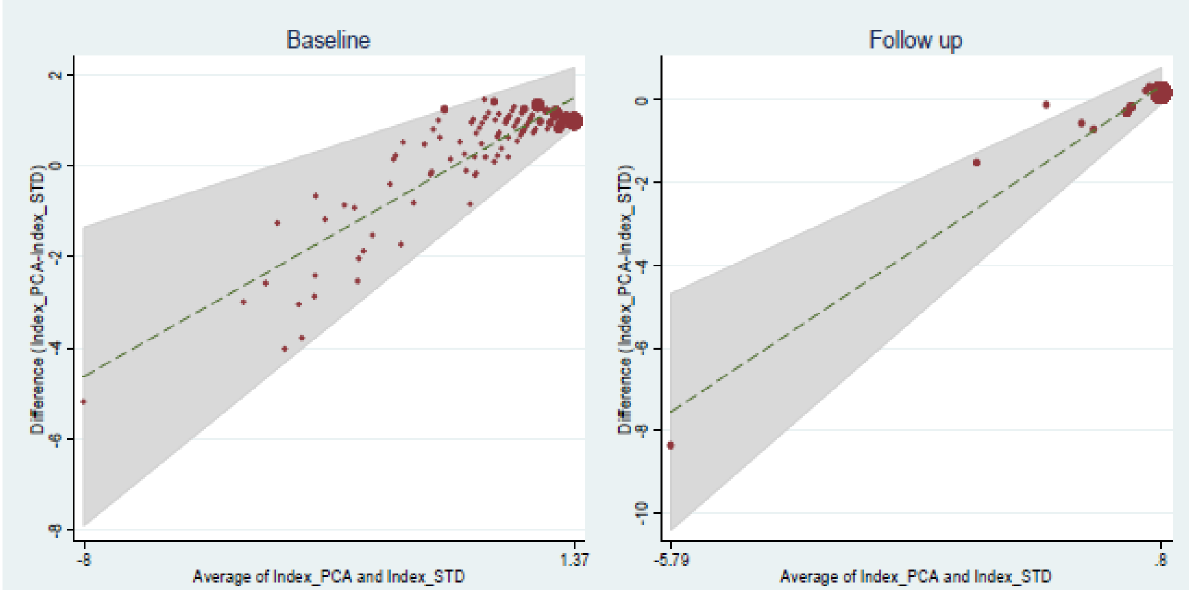
Alternative ways of generating the composite satisfaction index was explored through a principal component analysis (PCA), and converting ordinal satisfaction variables to binary (lower satisfaction values 1 and 2 were treated as unsatisfied, while higher satisfaction values 3 and 4 were considered as satisfied) and then constructing the composite index out of the binary variables. With the principal component analysis, the composite satisfaction index was obtained from the seven sub-indices (operating hours, cleanliness, privacy, waiting time, staff attitude, consultation time, and medicine) and only one principal component was considered. Figure 7.2 shows the distribution of indices constructed in three ways – PCA, equally weighted continuous index and equally weighted binary index. Indices constructed through different methods show similar sample distribution within each survey round, i.e. baseline and follow up.

Figure 7.2: Distribution of client satisfaction estimates by index construction



As shown in the Bland-Altman plots comparing the differences in both ways of index construction by survey rounds (figure 7.3), majority of the data points fall within the recommended limits of agreement (within ± 1.96 SD of the mean difference). This means the indices are in high agreement and they can be used interchangeably.

Figure 7.3: Agreement of client satisfaction estimates by index construction



Note: Index_PCA - Index using principal component analysis; Index_STD - Index using standardized equal weighting

7.3.2 Baseline sample balance

Balance of sample characteristics was tested with Wilcoxon Rank Sum Test for ordinal variables. As shown in table 7.2, clients' reported satisfaction on various dimensions of service delivery were similar in both arms. Only one variable – staff attitude was statistically significant.

Table 7.2: Sample balance – satisfaction

Variable	Control N=177	P4P N=208	Adjusted variance*	p value
Operating hours	177	207	461061.05	0.822
Cleanliness	177	208	942789.93	0.205
Privacy	177	208	216000.27	**0.060**
Waiting time	175	205	816390.40	0.391
Staff attitude	177	208	635272.11	**0.042**
Consultation time	177	208	470305.35	**0.058**
Medicine	164	197	568982.51	0.338
Registration fee	55	98	62968.51	0.131

* Adjusted variance obtained through Wilcoxon Rank Sum test for ordinal variables

7.3.3 Correlation analysis

Correlation analyses was performed for the satisfaction index (table 7.3). None of the correlation coefficients was above the threshold of 0.8, the highest being 0.57 between privacy and consultation time. Thus, all index items were retained for the index construction.

Table 7.3: Correlation matrix – Satisfaction index

	Work hours	Cleanliness	Privacy	Waiting time	Staff attitude	Consultation time	Medicine	Reg. fee
Work hours	1.00							
Cleanliness	0.23	1.00						
Privacy	0.30	0.25	1.00					
Waiting time	0.22	0.27	0.17	1.00				
Staff attitude	0.30	0.51	0.35	0.25	1.00			
Consultation time	0.31	0.31	0.57	0.25	0.51	1.00		
Medicine	0.05	0.17	0.04	0.14	0.25	0.04	1.00	
Registration fee	0.11	0.21	0.16	0.29	0.22	0.12	0.25	1.00

7.3.4 Impact estimates

Impact of the P4P program on client satisfaction was estimated as intention-to-treat with difference-in-difference estimates using multilevel modelling regression. Here the multilevel model considered four levels of analysis, i.e. client, health facility, district and province. Since the individual items were collected on a Likert Scale, the analysis followed a multilevel mixed-effects ordered logistic regression. The composite index, however was analyzed with a multilevel mixed-effects linear regression adjusting for contextual factors at the facility, provider and client levels as it was a continuous variable. The models ran the regressions while adjusting for covariates at the facility (ownership, type of facility, catchment population and distance to the nearest higher level facility, provider (gender and cadre), and client levels (age, education, wealth quintile, distance from home to health facility, parity, number of visit, and gestational age).

The impact estimates are difference-in-difference values, i.e. the relative difference between changes in P4P arm and control arm across two rounds of survey. For instance, an impact estimate of 0.231 for an index means the relative gain in the P4P arm was 0.231 units higher than that of the control arm between the baseline and follow up time periods. There are two different units of measurement as far as the impact estimates are concerned. For the individual items, the unit of measurement was points, whereas it was standard deviations for the composite index as it was standardized.

7.3.4.1 Estimates for individual items

As shown in table 7.4, all individual satisfaction items showed gains in the P4P arm with five out of total seven showing statistically significant impact. Among all individual items, satisfaction on privacy showed the highest gain with a relative increase by 1.785 points (SE 0. 785; p value = 0. 023), followed by waiting time at 1.291 points (SE 0. 385; p value = 0. 001), and cleanliness at 0.78 points (SE 0. 374; p value = 0. 037). There were no significant gains for satisfaction on – facility operating hours (effect size 0.985; SE 0.536), staff attitude (effect size 0.874; SE 0.479), consultation time (effect size

0.093; SE 0.609) and medicine (effect size 0.254; SE 0.42) also posed relative gains though at non-significant levels

Table 7.4: Impact estimates – satisfaction

		Operating hours	Cleanliness	Privacy	Waiting time	Staff attitude	Consultation time	Medicine
impact estimate*	**est**	0.985*	0.780**	1.785**	1.291***	0.874*	0.093	0.254
	se	(0.536)	(0.374)	(0.785)	(0.385)	(0.479)	(0.609)	(0.420)
	p	0.066	0.037	0.023	0.001	0.068	0.879	0.546
P4P	**est**	0.509	0.077	-0.845	-0.389	-0.060	-0.516	0.094
	se	(0.474)	(0.390)	(0.673)	(0.396)	(0.427)	(0.474)	(0.308)
	p	0.283	0.843	0.209	0.326	0.888	0.276	0.760
period	**est**	-0.055	0.310	-0.776	-0.966***	0.154	1.158**	0.252
	se	(0.351)	(0.278)	(0.550)	(0.277)	(0.366)	(0.482)	(0.325)
	p	0.876	0.265	0.158	0.000	0.673	0.016	0.438
rural health center	**est**	0.321	-0.524	1.255*	-0.190	-0.088	0.235	-0.305
	se	(0.560)	(0.488)	(0.664)	(0.476)	(0.521)	(0.544)	(1.393)
	p	0.566	0.283	0.059	0.690	0.865	0.666	0.826
owner govt.	**est**	-0.738	0.099	-0.863	-0.408	-0.227	-0.703	0.671
	se	(0.489)	(0.379)	(0.648)	(0.364)	(0.411)	(0.488)	(0.542)
	p	0.131	0.793	0.183	0.262	0.581	0.149	0.215
catch population	**est**	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	se	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	p	0.166	0.600	0.444	0.772	0.851	0.507	0.993
Provider-female	**est**	-0.327	-0.349	-0.718	0.121	-0.328	-0.623*	-0.132
	se	(0.363)	(0.249)	(0.506)	(0.249)	(0.319)	(0.359)	(0.413)
	p	0.368	0.160	0.156	0.629	0.304	0.083	0.750
age	**est**	0.024	0.013	0.027	0.024	0.002	0.056**	0.034*
	se	(0.024)	(0.016)	(0.035)	(0.016)	(0.021)	(0.027)	(0.019)
	p	0.317	0.399	0.435	0.140	0.909	0.037	0.076
distance from house	**est**	0.003	-0.002	-0.017*	-0.012*	-0.002	-0.002	-0.001
	se	(0.011)	(0.007)	(0.009)	(0.007)	(0.010)	(0.009)	(0.012)
	p	0.790	0.768	0.070	0.058	0.824	0.862	0.926
wealth quintile-lowest	**est**	0.239	0.006	-0.759*	0.166	-0.485*	0.151	0.221
	se	(0.342)	(0.217)	(0.429)	(0.232)	(0.267)	(0.340)	(0.273)
	p	0.484	0.978	0.077	0.476	0.069	0.657	0.418

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are points; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 759 women

7.3.4.2 Estimates for satisfaction index

Individual satisfaction items were combined to create composite satisfaction index (table 7.5). The composite satisfaction index showed a relative improvement of 0.6 standard deviations in the P4P arm (SE 0.182; p value = 0.001) above the mean of the control arm, which was statistically significant.

Table 7.5: Impact estimates – satisfaction index

	estimate*	**SE**	**P value**
impact estimate*	0.600***	0.182	0.001
P4P	-0.24	0.171	0.16
period	-0.433***	0.137	0.002
rural health center	0.189	0.188	0.316
owner govt.	0.046	0.149	0.756
catch population	0	0	0.75
distance from hospital	-0.002	0.003	0.361
Provider-midwife	1.310*	0.72	0.069
Provider-nurse	1.103	0.702	0.116
Provider-female	0.034	0.108	0.755
age	0.014*	0.008	0.075
primary education	0.161*	0.092	0.081
gravidity	0.059	0.111	0.596
gestational age	0.013*	0.008	0.084
#anc visit	0.01	0.031	0.758
distance from house	-0.001	0.003	0.79
wealth quintile-lowest	0.134	0.106	0.205
Constant	-2.392***	0.878	0.006

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations; *** p<0.01, ** p<0.05, * p<0.1; sample size 759 women

7.3.4.3 Sub group analysis

Subgroup analyses were undertaken to ascertain the distribution of impact by various facility, provider and client characteristics.

As shown in table 7.6, clients visiting local government facilities reported higher satisfaction compared to the clients visiting government facilities. Reported satisfaction among local government facility clients was also similar to the satisfaction results from the full sample. However, the magnitude and significance levels were higher than the full sample except for the satisfaction on privacy.

The effect sizes for the satisfaction variables among local government facility clients were as follows – operating hours 0.346 points (SE 0.113; p value 0.002), waiting time 2.976 points (SE 0.946; p value 0.002), provider attitude 2.227 points (SE 1.13; p value 0.049), and the composite satisfaction index 0.844 standard deviations (SE 0.269; p value 0.002). Significant gains were not observed for satisfaction on cleanliness, privacy, consultation time and medicines.

Clients from the government facilities, on the other hand reported significant satisfaction only on one area –waiting time (effect size 1.586 points; p value 0.002). The rest (satisfaction on operating hours, cleanliness, privacy, staff attitude, consultation time, medicines and the composite satisfaction index) did not show any significant changes.

Table 7.6: Subgroup impact estimates – satisfaction by facility ownership

	Government facilities (n=450)			**Local government facilities (n=253)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Operating hours	0.552	0.648	0.394	0.346***	0.113	0.002
Cleanliness	0.920*	0.515	0.074	1.346*	0.741	0.07
Privacy	0.105	0.925	0.91	0.076*	0.039	0.051
Waiting time	1.586***	0.507	0.002	2.976***	0.946	0.002
Staff attitude	0.669	0.637	0.294	2.227**	1.13	0.049
Consultation time	-0.68	0.765	0.374	2.222	1.722	0.197
Medicine	0.247	0.601	0.681	-1.21	0.83	0.145
Satisfaction index	0.413*	0.239	0.084	0.844***	0.269	0.002

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1

In terms of the types of facilities (table 7.7), clients from the rural hospitals reported higher gains in satisfaction on all but three of the dimensions (operating hours, privacy and staff attitude). Those with significant effect sizes were satisfaction on cleanliness by 0.519 points (SE 0.195; p value 0.008), waiting time by 2.241 points (SE 0.326; p value <0.001), consultation time by 0.494 points (SE 0.224; p value 0.027), and medicines by 0.506 points (SE 0.188; p value 0.007). The composite satisfaction index also showed gains (effect size 1.593 SD; p value <0.001), higher than that of the full sample.

Clients from rural health centers however, reported lower gains on satisfaction overall compared to their counterparts from the rural hospitals. Effect size on operating hours (1.482 points at p value 0.013) was significant. No significant gains were noted for satisfaction on cleanliness, privacy, waiting time, staff attitude, consultation time, medicine and the composite satisfaction index.

Table 7.7: Subgroup impact estimates – satisfaction by facility type

	Rural hospital (n=143)			**Rural health center (n=616)**		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Operating hours	-0.04	0.261	0.879	1.482**	0.593	0.013
Cleanliness	0.519***	0.195	0.008	0.393	0.424	0.354
Privacy	0.376	0.241	0.119	1.401	1.086	0.197
Waiting time	2.241***	0.326	<0.001	0.691*	0.417	0.097
Staff attitude	0.261	0.227	0.249	0.663	0.544	0.223
Consultation time	0.494**	0.224	0.027	-0.635	0.781	0.416
Medicine	0.506***	0.188	0.007	0.075	0.498	0.880
Satisfaction index	1.593***	0.353	<0.001	0.351*	0.199	0.078

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1

Table 7.8 shows reported satisfaction by cadre of providers. Overall, clients visiting nurses for consultation reported higher satisfaction than those consulting nurse midwives. Reported satisfaction was high in all dimensions except for consultation time and medicines. However, declines in satisfaction were observed among clients visiting nurse midwives. Satisfaction on privacy declined by 2.924 points (p value <0.001), staff attitude by 3.194 points (p value <0.001), whereas for the composite satisfaction index a decline of 1.959 SD was noticed (p value 0.004).

Table 7.8: Subgroup impact estimates – satisfaction by provider cadre

	Nurse midwife (n=83)			Nurse (n=667)		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Operating hours	-0.542	0.481	0.26	1.132**	0.551	0.04
Cleanliness	0.719	0.775	0.353	0.950**	0.405	0.019
Privacy	-2.924***	0.633	<0.001	2.752***	0.909	0.002
Waiting time	1.697**	0.764	0.026	1.451***	0.415	<0.001
Staff attitude	-3.194***	0.72	<0.001	1.267**	0.519	0.015
Consultation time	-0.398	0.541	0.462	0.344	0.639	0.59
Medicine	-1.519	1.001	0.129	-0.001	0.478	0.998
Satisfaction index	-1.959***	0.687	0.004	0.683***	0.204	0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1

Higher gains in satisfaction was observed among clients visiting male providers (table 7.9). Significant effect sizes among clients visiting male providers were observed on cleanliness (effect size 2.259; p value 0.016), waiting time (effect size 3.832; p value <0.001) and staff attitude (effect size 4.549; p value 0.007). Effect size on the composite index was 0.914 standard deviations (p value 0.01), which was higher than that of the full sample. Clients visiting female providers reported gains in satisfaction only on the composite satisfaction index, whereas no significant changes were observed for the remaining dimensions (satisfaction on operating hours, cleanliness, privacy, waiting time, staff attitude, consultation time and medicine).

Table 7.9: Subgroup impact estimates – satisfaction by provider gender

	Male (n=230)			Female (n=529)		
	estimate*	**SE**	**P value**	**estimate***	**SE**	**P value**
Operating hours	1.603	1.371	0.242	1.085*	0.652	0.096
Cleanliness	2.259**	0.942	0.016	0.565	0.465	0.224
Privacy	0.028	0.162	0.862	1.361	0.937	0.146
Waiting time	3.832***	0.971	<0.001	0.586	0.485	0.227
Staff attitude	4.549***	1.697	0.007	0.44	2.249	0.845
Consultation time	2.37	1.984	0.232	-0.711	0.795	0.371
Medicine	0.239	1.337	0.858	-0.057	0.495	0.908
Satisfaction index	0.914***	0.354	0.01	0.523**	0.236	0.027

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1

As shown in table 7.10, subgroup analyses were undertaken by clients' duration of pregnancy, gravidity, age and education. Women in their third trimester reported higher gains in satisfaction on privacy, waiting time, and the composite satisfaction index. On the other hand, no effect was observed on any satisfaction dimension among second trimester clients.

Women pregnant for the first time in the P4P arm reported higher gains in satisfaction in all dimensions except cleanliness and medicine; while those pregnant multiple times reported no significant gains in any dimension.

The effect sizes were higher among clients of 20 to 34 age group specifically with satisfaction on waiting time (effect size 1.288; p value 0.009), staff attitude (effect size 1.277; p value 0.037) and the composite index (effect size 0.568; p value 0.013).

Apart from the composite satisfaction index, clients with primary level of education reported higher gains in satisfaction on waiting. On the other hand, higher gains in satisfaction on privacy, waiting time and the composite index were reported by clients with secondary education.

Table 7.10: Subgroup impact estimates – satisfaction by client characteristics

		Operating hours	Cleanliness	Privacy	Waiting time	Staff attitude	Consultation time	Medicine	Satisfaction index
Trimester									
	est	0.583	-0.102	3.394	1.112	0.471	-1.438	1.645*	0.004
Second	se	(0.966)	(0.829)	(2.404)	(0.718)	(0.917)	(1.224)	(0.990)	(0.566)
(n=255)	p	0.546	0.902	0.158	0.122	0.608	0.240	0.097	0.994
	est	1.266*	0.935*	2.205**	1.537***	1.132*	0.718	-0.337	0.663***
Third	se	(0.698)	(0.490)	(1.092)	(0.489)	(0.634)	(0.774)	(0.554)	(0.175)
(n=495)	p	0.070	0.056	0.043	0.002	0.074	0.353	0.544	<0.001
Gravidity									
	est	1.286**	0.587	2.932***	1.735***	1.397**	1.586**	0.640	0.704***
First time	se	(0.654)	(0.459)	(1.037)	(0.467)	(0.615)	(0.792)	(0.796)	(0.214)
(n=526)	p	0.049	0.201	0.005	<0.001	0.023	0.045	0.421	0.001
	est	0.016	1.021	2.530	0.281	0.040	-0.232	-0.720	0.541
Multiple	se	(1.093)	(0.693)	(1.819)	(0.740)	(0.891)	(0.185)	(0.948)	(0.342)
(n=233)	p	0.988	0.141	0.164	0.704	0.964	0.208	0.447	0.114
Age									
	est	0.536	1.712*	0.285	-0.010	-0.529	-0.432	-0.451	0.668*
< 20	se	(0.979)	(0.884)	(0.180)	(0.886)	(1.048)	(0.231)	(1.025)	(0.386)
(n=180)	p	0.584	0.053	0.113	0.991	0.613	0.061	0.660	0.083
	est	1.248	0.646	1.696*	1.288***	1.277**	1.156	0.563	0.568**
20-34	se	(0.778)	(0.474)	(1.000)	(0.491)	(0.611)	(0.779)	(0.518)	(0.229)
(n=510)	p	0.109	0.172	0.090	0.009	0.037	0.138	0.277	0.013
Education									
	est	2.005*	1.763*	0.027	1.655**	1.642*	-1.072	1.435	1.167***
Primary	se	(1.112)	(0.922)	(0.088)	(0.764)	(0.903)	(1.403)	(2.845)	(0.350)
(n=244)	p	0.071	0.056	0.758	0.030	0.069	0.444	0.614	0.001
	est	0.848	0.386	2.781***	1.477***	0.583	0.040	0.109	0.538**
Secondary	se	(0.689)	(0.480)	(1.040)	(0.492)	(0.603)	(0.783)	(0.644)	(0.222)
(n=501)	p	0.219	0.421	0.008	0.003	0.333	0.960	0.865	0.015

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; standard errors in parentheses; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value

Clients from lower socio-economic quintiles reported higher gains in satisfaction in waiting time, and staff attitude (table 7.11). Higher wealth groups reported declines in satisfaction. The composite satisfaction posted higher effect sizes among the lower three wealth quintiles with estimates higher than the full sample, whereas the same was lower in the higher two wealth quintiles without any statistical significance.

Table 7.11: Subgroup impact estimates – satisfaction by wealth quintile

	Operating hours	Cleanliness	Privacy	Waiting time	Staff attitude	Consultation time	Medicine	Satisfaction index
				Lowest (n=149)				
est	0.257	2.050*	0.189	4.737***	3.844***	0.218	2.725*	1.492***
se	-0.182	-1.083	-0.187	-1.28	-1.359	-0.183	-1.465	-0.319
p	0.158	0.058	0.312	<0.001	0.005	0.231	0.063	<0.001
				Second (n=166)				
est	0.365	2.493*	0.348	1.247	2.743*	0.295	-0.642	1.349***
se	-0.14	-1.333	-0.102	-0.881	-1.466	-0.104	-1.078	-0.331
p	0.009	0.061	0.001	0.157	0.061	0.005	0.551	<0.001
				Third (n=138)				
est	0.19	1.441	-0.365	3.149***	6.665	0.011	-1.883	1.040***
se	-0.159	-1.249	-0.127	-1.202	-4.156	-0.231	-1.509	-0.349
p	0.232	0.249	0.004	0.009	0.109	0.961	0.212	0.003
				Fourth (n=152)				
est	-0.753	-0.341	-0.113	1.403	1.98	0.02	1.707	0.17
se	-1.373	-0.835	-0.131	-1.216	-1.282	-0.163	-1.167	-0.428
p	0.583	0.683	0.388	0.249	0.123	0.904	0.144	0.692
				Fifth (n=154)				
est	3.357**	-2.276*	8.524**	-0.808	-2.723	-3.123*	0.635	0.293
se	-1.522	-1.181	-3.95	-1.111	-1.967	-1.869	-1.617	-0.514
p	0.027	0.054	0.031	0.467	0.166	0.095	0.695	0.569

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; standard errors in parentheses; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value

7.3.4.4 Sensitivity and robustness checks

Alternative ways of generating the composite satisfaction index was explored through a principal component analysis (PCA), and converting ordinal satisfaction variables to binary (lower satisfaction values 1 and 2 were treated as unsatisfied, while higher satisfaction values 3 and 4 were considered as satisfied) and then constructing the composite index out of the binary variables. With the principal component analysis, the composite satisfaction index was obtained from the seven sub-indices (operating hours, cleanliness, privacy, waiting time, staff attitude, consultation time, and medicine) and only one principal component was considered.

Based on the alternate ways of creating composite index (table 7.12), the satisfaction index shows lower effect sizes of 0.255 (PCA) and 0.464 (binary) at similar levels of significance.

Table 7.12: Impact estimates – creating the satisfaction index by principal component analysis and equal weighting

		Composite index (PCA)	**Composite index (equal weights) continuous [final model]**	**Composite index (equal weights) binary**
impact estimate*	**est**	0.255***	0.600***	0.464***
	se	(0.076)	(0.182)	(0.179)
	p	0.001	0.001	0.010
P4P	**est**	-0.104	-0.240	-0.223
	se	(0.072)	(0.171)	(0.168)
	p	0.148	0.160	0.187
period	**est**	-0.085	-0.433***	-0.363***
	se	(0.057)	(0.137)	(0.135)
	p	0.137	0.002	0.007
rural health center	**est**	0.080	0.189	0.132
	se	(0.079)	(0.188)	(0.185)
	p	0.310	0.316	0.476
Provider-female	**est**	0.014	0.034	0.097
	se	(0.045)	(0.108)	(0.107)
	p	0.751	0.755	0.362
gestational age	**est**	0.005*	0.013*	0.010
	se	(0.003)	(0.008)	(0.008)
	p	0.089	0.084	0.208
Constant	**est**	2.617***	-2.392***	-2.652***
	se	(0.367)	(0.878)	(0.864)
	p	0.000	0.006	0.002

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; standard errors in parentheses; estimate units are points for the PCA index and standard deviations for others; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 759 women

Model specification parameters were altered to observe the changes in the effect sizes. For example, the level parameters were fixed at four levels (client, facility, district, and province) or three levels (client, facility and district). Models were also built without covariates. Table 7.13 shows impact estimates for these various models. Among individual variables, adding covariates reduces the effects sizes of satisfaction on operating hours, cleanliness and staff attitude; whereas increases marginally the effect sizes of privacy and waiting time. The changes were minimal after altering the levels.

Table 7.13: Sensitivity of impact estimates by levels and covariates

	Operating hours	Cleanliness	Privacy	Waiting time	Staff attitude	Consultation time	Medicine	Satisfaction index
Three levels without covariates								
est	1.324***	1.000***	1.419**	1.203***	1.028**	0.352	0.303	0.513***
se	(0.505)	(0.355)	(0.675)	(0.354)	(0.446)	(0.586)	(0.396)	(0.143)
p	0.009	0.005	0.036	0.001	0.021	0.548	0.444	<0.001
Three levels and covariates								
est	0.988*	0.780**	1.785**	1.293***	0.875*	0.094	0.251	0.600***
se	(0.524)	(0.373)	(0.775)	(0.385)	(0.473)	(0.607)	(0.410)	(0.182)
p	0.059	0.036	0.021	0.001	0.064	0.877	0.540	0.001
Four levels without covariates								
est	1.319**	0.999***	1.416**	1.202***	1.026**	0.349	0.299	0.513***
se	(0.513)	(0.356)	(0.671)	(0.356)	(0.453)	(0.588)	(0.392)	(0.143)
p	0.010	0.005	0.035	0.001	0.023	0.553	0.446	<0.001
Four levels and covariates (final model)								
est	0.985*	0.780**	1.785**	1.291***	0.874*	0.093	0.254	0.600***
se	(0.536)	(0.374)	(0.785)	(0.385)	(0.479)	(0.609)	(0.420)	(0.182)
p	0.066	0.037	0.023	0.001	0.068	0.879	0.546	0.001

* Multilevel modeling estimates adjusted for district pair matching; standard errors in parentheses; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; est – impact estimate, se – standard error, p – p value; sample size 759 women

Sensitivity of the multilevel models were also tested by adjusting district pair matching. As far as the composite satisfaction index is concerned, table 7.14 shows that the impact estimate for the model without accounting for district pair matching was slightly lower than the final model that considered the pair matching.

Table 7.14: Sensitivity of impact estimates by district pair matching

	Without adjusting for district pair-matching			Accounting for district pair-matching (final model)		
	estimate*	SE	P value	estimate*	SE	P value
Operating hours	1.111**	0.535	0.038	0.985*	0.536	0.066
Cleanliness	0.631*	0.369	0.087	0.780**	0.374	0.037
Privacy	1.813**	0.742	0.015	1.785**	0.785	0.023
Waiting time	1.305***	0.369	<0.001	1.291***	0.385	0.001
Staff attitude	0.802*	0.458	0.08	0.874*	0.479	0.068
Consultation time	0.287	0.591	0.627	0.093	0.609	0.879
Medicine	0.256	0.398	0.52	0.254	0.42	0.546
Satisfaction index	0.587***	0.18	0.001	0.600***	0.182	0.001

* Multilevel modeling estimates adjusted for facility, provider and client covariates; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; sample size 759 women

Models were also built with robust clustered standard errors (table 7.15). Significance level of variables was lower, i.e. higher p values and SEs with robust standard errors.

Table 7.15: Sensitivity of impact estimates by robust SE

	With robust standard errors			Without robust standard errors (final model)		
	estimate*	SE	P value	estimate*	SE	P value
Operating hours	0.985	0.853	0.248	0.985*	0.536	0.066
Cleanliness	0.78	0.574	0.174	0.78**	0.374	0.037
Privacy	1.785	1.271	0.16	1.785**	0.785	0.023
Waiting time	1.291**	0.582	0.027	1.291***	0.385	0.001
Staff attitude	0.874**	0.418	0.037	0.874*	0.479	0.068
Consultation time	0.093	0.911	0.919	0.093	0.609	0.879
Medicine	0.254	0.857	0.767	0.254	0.42	0.546
Satisfaction index	0.600*	0.316	0.058	0.600***	0.182	0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; sample size 759 women

Impact on satisfaction was estimated after adjusting for structural and process quality as they could influence the former. For example, if there was no functional blood pressure measuring equipment (structural quality) in the health facility, the providers would not be able to measure the client's blood pressure (process quality) during the ANC consultation and this might have led to the dissatisfaction of the client through the "staff attitude" dimension. As it can be seen from table 7.16, the effects sizes are similar even after adjusting for structural and process quality.

Table 7.16: Sensitivity of impact estimates by adjusting structural and process quality

	Operating hours	Cleanliness	Privacy	Waiting time	Staff attitude	Consultation time	Medicine	Satisfaction index
Adjusting for structural quality								
estimate*	0.996*	0.725*	2.201***	1.155***	0.751	0.290	0.104	0.552***
SE	(0.560)	(0.386)	(0.834)	(0.395)	(0.508)	(0.625)	(0.433)	(0.185)
P value	0.075	0.060	0.008	0.003	0.139	0.642	0.810	0.003
Adjusting for process quality								
estimate*	0.952*	0.783**	1.737**	1.293***	0.881*	0.090	0.223	0.642***
SE	(0.540)	(0.374)	(0.792)	(0.385)	(0.479)	(0.611)	(0.420)	(0.184)
P value	0.078	0.036	0.028	0.001	0.066	0.883	0.595	<0.001
Adjusting for structural and process quality								
estimate*	0.958*	0.728*	2.140**	1.157***	0.757	0.288	0.070	0.593***
SE	(0.563)	(0.386)	(0.838)	(0.395)	(0.508)	(0.626)	(0.435)	(0.186)
P value	0.089	0.059	0.011	0.003	0.136	0.645	0.872	0.001
No adjustment for structural or process quality (final model)								
estimate*	0.985*	0.780**	1.785**	1.291***	0.874*	0.093	0.254	0.600***
SE	(0.536)	(0.374)	(0.785)	(0.385)	(0.479)	(0.609)	(0.420)	(0.182)
P value	0.066	0.037	0.023	0.001	0.068	0.879	0.546	0.001

* Multilevel modeling estimates adjusted for district pair matching; standard errors in parentheses; estimate units are standard deviations for the index and points for others; *** p<0.01, ** p<0.05, * p<0.1; sample size 759 women

Sensitivity of the model was tested with a fully interacted model. In this model, apart from the specifications mentioned in the "final model", all covariates were interacted separately with the P4P intervention, period and interaction of intervention and period. As shown in table 7.17, the fully interacted model returns higher effect sizes for satisfaction on waiting time (5.218 points; p value = 0.004) and composite satisfaction index (4.528 SD; p value = 0.005). While, it produces higher effect sizes at non-significance levels for satisfaction on cleanliness (2.631 points; p value = 0.071) and privacy (1.358 points; p value = 0.077).

Table 7.17: Sensitivity of impact estimates by fully interacted model

	Fully interacted model			**Partial interacted model (final model)**		
	estimate*	SE	P value	estimate*	SE	P value
Operating hours	1.356	1.009	0.179	0.985*	0.536	0.066
Cleanliness	2.631*	1.457	0.071	0.780**	0.374	0.037
Privacy	1.358*	0.767	0.077	1.785**	0.785	0.023
Waiting time	5.218***	1.814	0.004	1.291***	0.385	0.001
Staff attitude	0.307	0.978	0.753	0.874*	0.479	0.068
Consultation time	-0.483	0.883	0.585	0.093	0.609	0.879
Medicine	0.505	1.175	0.668	0.254	0.42	0.546
Satisfaction index	4.528***	1.628	0.005	0.600***	0.182	0.001

* Multilevel modeling estimates adjusted for facility, provider, client covariates and district pair matching; estimate units are standard deviations for the index and points for others; *** $p<0.01$, ** $p<0.05$, * $p<0.1$; sample size 759 women

While testing the goodness-of-fit (table 7.18), models with covariates were generally better fit than their without covariate counterparts. There were no differences after altering the levels of analysis, i.e. three levels versus four.

Table 7.18: Tests for model goodness-of-fit

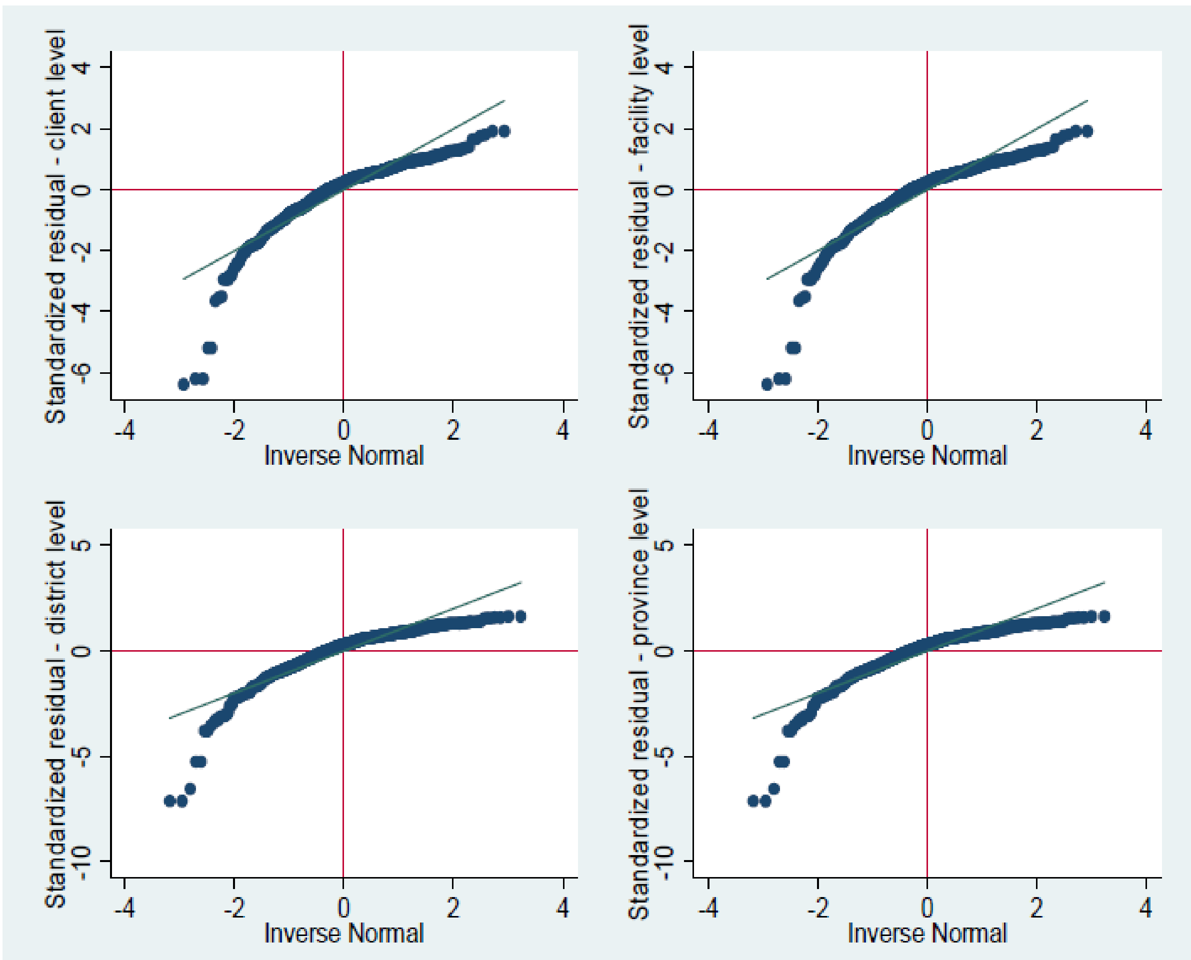
Model fit statistics	**Three levels without covariates**	**Three levels and covariates**	**Four levels without covariates**	**Four levels and covariates (final model)**
Observations	757	515	757	515
loglikelihood	-376.461	-238.764	-376.461	-238.764
df	19	33	19	33
AIC	790.9222	543.5282	790.9222	543.5282
BIC	878.8801	683.5857	878.8801	683.5857
Deviance	752.9222	477.5282	752.9222	477.5282

df – degrees of freedom; AIC – Akaike Information Criterion; BIC – Bayesian Information Criterion

7.3.4.5 Regression diagnostics

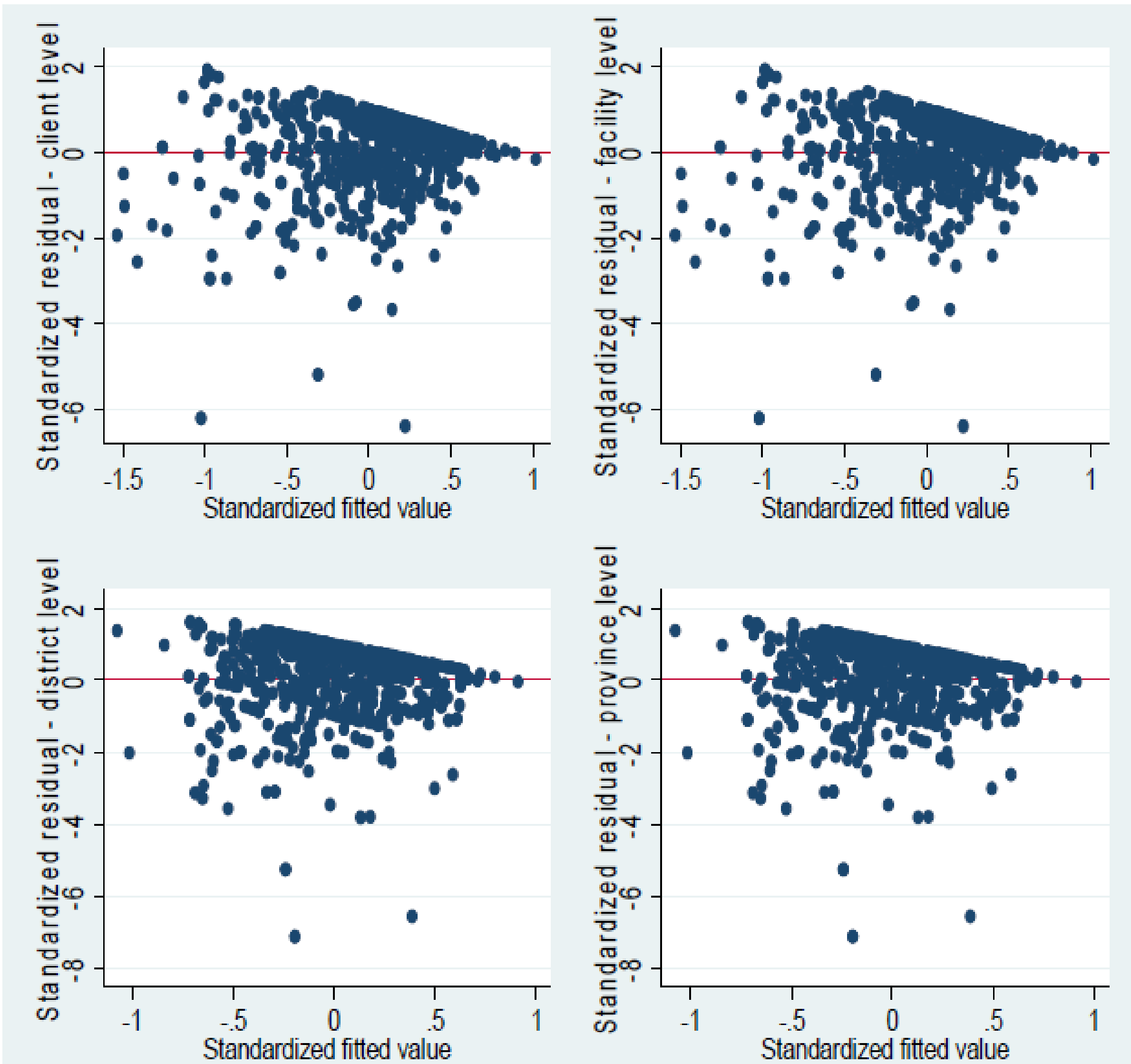
The normality of the regression residuals for the composite satisfaction index variable was verified by the standardized values of the residuals at various levels of analysis. Though there is a slight deviation from normality at the tails, the residuals overall seem closer to normal distribution at all levels (Figure 7.4).

Figure 7.4: Normality of residuals



Homogeneity of variance of the residuals was checked through graphs plotting residuals against the fitted values. The residuals could be said as homoscedastic as the plot (figure 7.5) shows no particular pattern of the distribution of the residuals.

Figure 7.5: Homoscedasticity of residuals



Chapter 8: Discussion

8.1 Overview

This chapter first presents the summary of the effectiveness of P4P program on all three dimensions of the quality of antenatal care observed in Zimbabwe and triangulates the findings by comparing and contrasting with the experience of P4P programs reported from other LMICs. Further, it discusses the contextual determinants of P4P program's effectiveness on quality of ANC in Zimbabwe and compares these observations with the relevant evidence reported from other LMICs. Finally, it describes potential research and policy implications for P4P programs, and suggests the way forward.

8.2 Summary of results

Table 8.1 summarizes key findings from the study. Indicators that reported statistically significant changes are presented in the table. There was no indicator in the study that had a statistically significant relative decline. The following sections describe the results in detail by the element of quality.

Table 8.1: Summary of effects

Quality element	Item
Structural quality	Availability of iron and folic acid tablets Availability of urine tests Availability of refrigerator Composite structural quality index
Process quality	Prescription of antimalarials Counseling on family planning Counseling for delivery preparations Prescription index Counseling index Composite process quality index
Satisfaction	Cleanliness Waiting time Privacy Composite satisfaction index

Note: indicators presented in the table report statistically significant improvements for the P4P arm

8.2.1 Structural quality

Individual structural quality items that showed gains for the P4P facilities were – availability of iron (component of drugs and vaccines index), availability of urine tests (component of diagnostic test index), and availability of functional refrigerator (components of equipment index).

P4P facilities had a relative increase in skilled staff. However, this increment was not statistically significant. There was a relative reduction in the availability of tetanus toxoid among P4P facilities.

All five sub-indices (physical infrastructure, staff, diagnostic test, drugs and vaccines, and equipment) showed relative gains in the P4P arm, but none demonstrated a significant gain. However, the composite structural quality index in the P4P arm showed a statistically significant relative improvement of 0.595 standard deviations above the mean in the control arm.

In the subgroup analyses though the composite structural quality was significantly better in both Ministry of Health (MoHCC) and local government facilities, the improvement was higher among local government facilities. In addition, MoHCC facilities reported increases in the availability of drugs and equipment indices; whereas the local government facilities showed enhancements in the diagnostic index, which was not observed in the total sample. Among the two types of health facilities by level (rural health centers and rural hospitals), both echoed the findings from the total sample. In addition, rural health centers reported a higher relative increase in equipment index, whereas rural hospitals on diagnostic index.

Another composite structural quality index that included (a) medicines stock management, (b) outpatient department, (c) family and child health, and (d) infection control and waste management also showed gains in the P4P arm (by 0.83 standard deviations above the mean in the control arm). Among individual quality items for this composite index, significant increments were noticed in availability of diagnostic kits, display of focused antenatal care protocol, and use of infection control policy, whereas sterilization as per standards score went down.

The improvements in the composite quality index and family and child health sub-index among the MoHCC and local government facilities were similar to the total sample. In addition to these two indices (composite quality and FCH indices), the outpatient index was also higher in the rural health center sub-sample than the total sample. The magnitude of improvement and the level of significance of the family and child health index and the composite index were better in the rural health center sub-sample than the total sample. Rural hospitals however, reported the increase only in the infection control index and that too at a lower level of significance and magnitude than the total sample.

8.2.2 Process quality

Among the individual process quality items, P4P facilities showed relative gains in prescription of antimalarial drugs (component of prescription index), counselling on delivery preparations and family planning (components of counseling index). None of the items from physical examination index had a significant increase in the P4P facilities. Three out of four sub-indices showed relative gains, however only two were statistically significant. The highest increase was noted in counseling index, followed by prescription index. Laboratory test and physical examination indices though not statistically significant the former showed a relative increase and latter showed a decline for P4P facilities. Finally, the composite process quality index in the P4P arm registered a statistically significant increase of 0.556 standard deviations above the mean in the control arm.

MoH facilities reported significant gains in laboratory test and composite process quality indices for the P4P arm. Local government facilities on the other hand reported higher increments in the counseling index, and smaller increments in the composite quality index. Rural hospitals did not record any significant gains on any of the quality indices for the P4P arm, whereas rural health centers showed significant gains for all indices similar to the total sample.

In the P4P arm, all process quality indices except for the physical examination index were higher when clients were seen by nurses. On the other hand, all indices except physical examination index were lower when seen by a nurse midwife. However, among these declining indices, only laboratory test was statistically significant. Clients visiting male providers reported higher relative gains in quality indices for the P4P arm, more so with greater magnitudes and significance than the total sample.

Subgroup analyses showed that women in the second trimester had a higher relative gain in the composite process quality index, though clients in their third trimester also had a significant gain. However, gains in counseling index remained significant only for women in the third trimester, while women in second trimester had higher gains in physical examination index. In the P4P arm, primigravida women reported higher effects than multigravida. The increase in counseling index was not significant among multigravida even though it was significant in the total sample. The age and level of education of women were associated with the reported effects of P4P program. All indices were higher for women between 20 and 34 years of age than in the total sample. Women with secondary level of education reported higher gains in all indices except physical examination.

Physical examination index was lower in P4P arm among the lower wealth quintiles, whereas it was higher among higher wealth groups. However, it was significant only among second and fourth wealth groups. The increase in laboratory test index, similarly was lower among the lower wealth quintiles. P4P's effect on prescription and counseling indices were similar across various wealth quintiles. Finally, the composite process quality index showed significant relative gains for the third and fifth wealth quintile groups, and these estimates were higher than the total sample.

The effect of P4P on process quality index estimated by adjusting the levels of structural quality in the health facilities was similar between the study arms in terms of both magnitude and significance.

8.2.3 Client satisfaction

All individual satisfaction items showed gains in the P4P arm with three items out of total seven showing statistically significant effect. Among all individual items, satisfaction on privacy showed the highest gain, followed by waiting time and cleanliness.

The P4P program did not have any effect on satisfaction on facility operating hours, staff attitude, consultation time and availability of medicines. The composite satisfaction index in the P4P arm showed a relative improvement of 0.6 standard deviations above the mean in the control arm, which was statistically significant.

Clients visiting local government facilities reported higher satisfaction compared to the clients visiting MoH facilities. Specifically, clients in local government facilities reported a higher satisfaction level on operating hours, cleanliness, privacy, waiting time and provider attitude. These facilities did not show any improvement on consultation time, while although not statistically significant, there was a decline in the client satisfaction for medicine availability. Clients from the MoH facilities, on the other hand reported significant satisfaction on cleanliness and waiting time, and the composite satisfaction index.

Clients from the rural hospitals reported higher satisfaction on cleanliness, waiting time, consultation time, medicine availability, while their reported satisfaction on staff attitude and operating hours did not improve. The composite satisfaction index was also higher among clients seen at rural hospitals than that of the total sample.

Clients from rural health centers however, reported lower gains on satisfaction overall compared to their counterparts from the rural hospitals. The effect of P4P on operating hours and waiting time was statistically significant though lower in magnitude. For rural health centers, client satisfaction on operating hours and waiting time had improved, while there was a negative trend for consultation time.

Overall, clients visiting nurses for consultation reported higher satisfaction than those consulting nurse midwives. Reported satisfaction was high in all dimensions except the availability of medicines. However, declines in satisfaction were observed among clients visiting nurse midwives specifically on privacy and staff attitude. Higher gains in satisfaction on cleanliness, waiting time and staff attitude were observed where clients were seen by male health workers, while those visiting female providers were satisfied on operating hours only. Although not statistically significant, ANC clients' visiting female providers reported a lower satisfaction on consultation time.

Women in their third trimester reported higher gains in satisfaction on operating hours, cleanliness, privacy, waiting time, staff attitude and the composite satisfaction index. On the other hand, among women in their second trimester a higher effect of P4P was observed only on satisfaction related to medicine. Primigravida women in the P4P arm reported higher gains in satisfaction whereas multigravida reported no significant gains in any dimension. Women in the 20 to 34 age group reported higher satisfaction specifically on waiting time, staff attitude and the composite index.
Clients from lower socio-economic quintiles reported higher gains in satisfaction in cleanliness, waiting time, and staff attitude. However, higher wealth quintiles reported declines in the composite satisfaction index. The lower three wealth quintiles reported a higher composite satisfaction index than the total sample, whereas the two higher wealth quintiles reported a lower satisfaction index though not statistically significant. The effect size of satisfaction did not change after adjusting for structural and process quality.

8.3 Effectiveness of P4P on ANC quality in Zimbabwe vis-à-vis evidence from other P4P programs in LMICs

8.3.1 Structural Quality

The P4P program in Zimbabwe showed a positive effect on the aggregate structural quality index (0.595 SDs; p=0.023). Evaluations of P4P program in Burundi (17.24% points; p=0.062), DRC (26% points; p<0.001) and Cambodia (12% points; p<0.1) also showed that P4P improved the facility structural quality score.[89,95,167] In Zimbabwe, irrespective of the type of ownership (MoH, local government and mission) and level (primary vs. secondary) of facilities there was improvement in the overall structural quality index. The existing evaluations of P4P programs in several LMICs also reflect that irrespective of the type of ownership of facilities, P4P programs are effective to improve structural quality of maternal and child healthcare.[89,95,96,98,109,168–171] While there are similarities in the effects of P4P on structural quality, the differences in effect sizes are likely due to variations in context, organization of local healthcare delivery system including decentralization and capacity of health facilities, program design, evaluation methods and measurement of effects.[24,101,172,173] For instance, in the Zimbabwe P4P study, the focus was on antenatal care. Thus, the structural quality index was constructed out of ANC related elements. The list of equipment, drugs and diagnostics included those items that were pertinent to delivering ANC services.

In Zimbabwe, the P4P program significantly improved the overall structural quality for ANC services. It could be due to the fact that the primary aim of the P4P program in the country was to improve maternal (including ANC) and child health and hence the program was structured or designed to improve the quality for MCH services.[174] Also, these elements of structural quality were part of the incentive mechanism where it was a pre-condition to achieve gains for these elements to receive P4P incentives. The P4P evaluation in Burundi also reflects that if improving quality of a particular service (e.g. maternal health) is an objective of the program, then there is a higher possibility of improving any element of quality under a P4P even partially.[95] On the contrary, if the program does not target improvements in quality other than service usage, then the probability of enhancing quality is limited as shown in the P4P programs of Rwanda and Cambodia.[15,167] Another major reason for increased structural quality under P4P in Zimbabwe could be regular monitoring and supervision of health facility performance by the higher authority. Similar findings have been reported by Bangladesh, Tanzania and Rwanda in their P4P programs.[15,169,173] These supportive supervision and regular feedback led to constant democratic planning and implementation of performance targets of facilities towards structural quality improvements.[169] Provision of autonomy and local level decision making for the health facilities could be two more reasons for these positive changes.

On the contrary, another P4P program in the Democratic Republic of Congo had a negative effect on the structural quality index (-0.53 SDs; p=0.014). The negative effect in DRC comes out of a lower resource situation in the P4P arm.[98] As the P4P was introduced in DRC, the user fees were withdrawn in an attempt to attract clients. However, the P4P incentives could not make up for the losses on the facility income due to the removal of user fees. Thus, the P4P facilities encountered difficulties in investing in infrastructure, equipment, and drugs for routine service provision.

P4P did not show any effect on the availability of qualified staff in Zimbabwe (5.4% points; p=0.262), which was also the case in the Democratic Republic of Congo (-0.92 points; p=0.309).[98] This could again be dependent on the autonomy at the level of the health facility to recruit new staff, availability of adequate funds and skilled health workers. A P4P pilot program in Zambia showed local level recruitment of data clerks, volunteers and midwives utilizing the incentives.[175] However, the health facilities in Zimbabwe did not have the autonomy to recruit health workers using the P4P incentives. As such the incentives were too small to hire an additional health worker.

The P4P program in Zimbabwe enhanced the availability of urine tests (22% points; p value = 0.027). In contrast, two studies from Burundi reported that P4P did not have any effect on the availability of overall diagnostic services (9% points and p=0.539 in Rudasingwa *et al*; 0.32 points and p=0.452 in Bonfrer *et al*).[95,176] The equipment index did not change significantly in the Zimbabwe P4P program (0.063 points; p value = 0.109). This is similar to the situation in Tanzania (3.8 % points; p=0.391) and Afghanistan (-1.4 % points; p=0.1), where no significant improvement in the availability of medical equipment was observed.[173,177] In contrast, a P4P program in DRC reported a negative effect on the availability of equipment (-0.64 SDs; p=0.026).[98] Similar to Zimbabwe (0.051 points and p=0.4 for availability of drugs; 0.048 points and p=0.226 for physical infrastructure), the P4P program in Afghanistan did not show any improvement in the availability of drugs (-4 % points; p=0.4) and physical infrastructure (-11.2 % points; p=0.3).[177] Health managers and staff in Rwanda and Afghanistan reported that P4P had limited effect on infrastructure improvements for ante natal care and other maternal care services.[170,171] Qualitative evaluations from several countries have reported that centralization in the functioning of healthcare system and bureaucratic procedures in the procurement systems delay timely procurement of drugs and equipment in facilities.[15,95,169,172] These delays often lead to drug stock out and inadequate availability of equipment and supplies. Sometimes, procurement of drugs and equipment is beyond the complete authority of particular health facilities, rather a higher authority (e.g. district or provincial level authority) may be authorizing the process.[172] Hence, there can be delays in the ultimate availability of these items at the health facility. These findings are consistent with the observation in the Zimbabwe P4P program that not all types of facilities had gains on equipment and drug indices, although there were not any declines in their availability. A mid-term review evaluation of the Zimbabwe program indicated that although local government-owned facilities are supposed to have more autonomy, yet they followed a centralized procurement system to purchase drugs to comply with the local standards.[174] This could be the reason that they did not report considerable gains on the availability of drugs and equipment. In LMIC settings, there are serious concerns on the quality of available drugs.[178,179] Even though one obtains the autonomy to procure drugs and equipment at a decentralized level, real availability and quality of commodities could be questionable. On the contrary, P4P improved availability of drugs (8.4 % points; p=0.002) in Tanzania.[173] The availability of medicines was a precondition to achieve certain performance targets in the Tanzania P4P. Secondly, facilities were able to use incentives to procure drugs and supplies. Thirdly, district health officials were also incentivized to minimize drug stock-outs.

The financial capacity of health facilities can determine their ability to build or renovate physical infrastructures such as waiting area and toilets.[13,95,172] As reported by other P4P programs, financial capacity of the facilities depends to a large extent on the revenue they get from the performance incentive program.[13,95,169,172] Thus, it can be said that the amount of incentives for each service indicator or performance indicator can influence a health facility’s scope to improve structural quality. Under the Zimbabwe P4P program, facilities had shown improvement on building small physical infrastructure. The mid-term evaluation of the P4P program in Zimbabwe indicated that the P4P program had improved the facility’s financial capacity to build physical infrastructure (small waiting area, water supply, electricity) for maternal and child health services.[174] However, qualitative evaluations of several P4P programs including that in Zimbabwe show that the revenue generated through the performance incentives alone may not be sufficient for large improvements in physical infrastructure such as building an operation theater or buying an expensive medical equipment.[95,172,174] In the design of the programs, incentives are developed in such a way that the amount of performance incentive does not seem to be high enough to give large revenues to facilities.[172]

The literature mentions about cherry picking in P4P programs where more attention is given to indicators with higher incentives.[25,26,77] However, these findings confine to only high income settings. For diabetes care in Taiwan, older patients and patients with severe conditions were more likely to be excluded from the P4P programs.[97] In the Zimbabwe P4P, a comparative analysis of the impact estimates of the indicators vis-à-vis indicator weights could be performed only for the structural quality (figure 5.12). The highest estimates along with statistical significance came from moderately weighted services. Although moderately weighted, one indicator (sterilization of instruments according to standards) showed significant negative gains. Thus, it can be said that there was no cherry-picking among the structural quality indicators.

8.3.2 Process Quality

The evaluations of P4P programs in several LMICs have shown that they are effective to improve process quality of antenatal care considerably similar to that observed in Zimbabwe.[15,98,110,176] However, there were also some negative results from these evaluations where the procedures of P4P for a pregnant woman during her antenatal visit either did not improve or came down under P4P program as explained further in this section. Similar to this Zimbabwe study that showed an increase in the process quality index (0.556 standard deviations; $p = 0.001$), there was a considerable but lower increase in the overall process quality score for ANC care (0.157 standard deviations; $p = 0.02$) in the Rwandan P4P program.[15] A study in Burundi as well reported an improvement in overall process quality of ANC (66% points; $p<0.001$).[176] In DRC, however, providers' compliance with the standardized clinical standards in the country for ANC did not show any change in the P4P program (0.004; $p = 0.818$).[98] Apart from the differences in the scale of measurement for the quality index (standard deviations versus percentage points) in these studies, another key divergence is the method for ascertaining quality. In Zimbabwe, the process quality was captured from ANC clients upon exit from the facility, whereas in Burundi and DRC it came from household survey interviews with a longer recall period. Interestingly, the Rwandan program utilized both exit and household interview sources. Apart from including the process quality indicators in the performance payment matrix, the evaluation of P4P programs attribute these improvements in quality of care to two factors – 1) regular and systematic performance review within facilities on quality assurance, and 2) regular monitoring, feedback and supportive supervision from external bodies on quality assurance and compliance.[14,15,169]

There were no significant changes in the physical examination index (0.002 points; $p = 0.948$) in the Zimbabwe study. Similar to the findings in Zimbabwe, a study in Tanzania shows no change in the ANC content of care index (0.06 points; $p = 0.118$).[180] In Egypt, during the ANC visit of a pregnant woman, incentivized providers performed better on examination of her blood pressure (8.4 % points; $p < 0.01$).[110] Similarly, the Burundi P4P program also reported an increase of six percentage points ($p < 0.1$) in the possibility of a pregnant women getting her blood pressure checked during ANC visits.[107] As the baseline values for the physical examination indicators were high (>90%) in both arms in Zimbabwe, the possibility of further improvements on already high indicators was difficult. The changes with the advice for laboratory tests were insignificant (0.06 points; $p = 0.173$) in the Zimbabwe P4P program. Facilities under the P4P program in Egypt showed positive gains on providers asking for blood test (12 % points; $p < 0.01$) and urine analysis (20 % points; $p < 0.01$) during ANC.[110] The P4P program in Zimbabwe showed improvement in prescription of drugs and vaccines index (0.07 points; $p = 0.001$). The P4P in Rwanda increased dispensing tetanus vaccine (5 % points; $p = 0.07$),[28] and in Burundi, P4P increased the likelihood of a pregnant women getting anti-tetanus vaccine (10 % points; $p < 0.1$) during her ANC visits.[107] Regular supportive supervision would have helped the health workers to follow national guidelines on prescription of drugs and vaccines. In contrast, the evaluation of a P4P program in Egypt did not show any improvement in prescription of iron, vitamins and tetanus toxoid to pregnant women.[110]

In Zimbabwe, both MoH facilities and rural health centers had significant gains on process quality of ANC compared to that of local government-owned facilities and rural hospitals respectively. In Bangladesh, the effect of P4P on process quality of maternal care was better in district hospitals than other lower levels of facilities.[169] In Burundi, there was no difference in the process quality of care between the government and private facilities.[95] Under the Egyptian P4P program, there were differences in the performance of facilities based on geographies.[110] Facilities with a low baseline for quality had a better room for improvement under P4P in Burundi.[95] In line with this finding from Burundi, it could also be true for Zimbabwe that MoH facilities and rural health centers had relatively lower level of quality for ANC before the intervention.[174] Therefore, their relative gains were prominent compared to that in local government and rural hospitals.

The heterogeneity of effects of P4P on the facility by ownership and level was reverse for improvements on structural quality in Zimbabwe, i.e. both MoH facilities and rural health centers had lower gains compared to that of local government-owned facilities and rural hospitals respectively. As reported by other studies from elsewhere, increased work load with the providers and the resultant 'burn-out' could be the reasons for this low gains on process quality in rural hospitals and local government-owned facilities, despite high gains on structural quality.[15,98] In some studies, increased patient load under P4P had a negative effect on providers' job satisfaction and their ability to comply with the clinical guidelines.[15,98] These studies have also indicated that with more patient load, staff felt 'burnt out'. In DRC, there was a 14% reduction in staff job satisfaction and around 60% of the staff reported increased work load and being tired.[98]

There are few studies that report any association between process quality and types of providers under P4P. [28,95,169] A study from Burundi reported that process quality of care was not different across types of providers such as doctor, nurse and nurse midwife.[95] In Zimbabwe, process quality was better with male providers and nurses. Based on the professional training nurse midwives receive compared to that of nurses, there is a possibility for nurse midwives possessing higher knowledge, skills and confidence on ANC in Zimbabwe.[133] However, this increased knowledge and skill did not translate to higher gains on process quality with nurse midwives. This resonates with the findings from an evaluation of P4P program in Rwanda.[28] This evaluation had shown that although knowledge gain for providers on ANC protocol was higher (0.40 standard deviation increase) in the P4P facilities, this knowledge gain did not have any positive relation with the improvement in their performance on ANC.[28] Therefore, this study attributes improved provider performance on quality to incentives.[28] It is worth noting that in the sharing of incentives among staff, nurse midwives had a higher share as per the structure of incentive scheme in Zimbabwe.[120] Above all, the P4P program had the mandate to enforce adherence to the clinical practice guidelines on ANC. Nurse midwives are higher in terms of education and hierarchy with more responsibilities. However, a study looking at the health workforce effects of P4P in Zimbabwe reports lower motivation for nurse midwives in the P4P arm compared to nurses.[144]This reduced motivation comes out of a relatively higher patient load and lower supportive supervision. As nurse midwives were higher in terms of skills and experience, the facility heads directed more clients towards them leading to burnout.[144] Similarly, the supportive supervision teams from the district health office spent considerably more time with the nurses as they needed more technical support than the midwives.[144] A higher process quality by male providers in Zimbabwe could be due to the fact that the male providers had better training and experience.[144] A point to note here is that most of the male providers in the study sample were nurses.[144] A process evaluation of P4P program in the Gambia also reported higher competence and performance from male providers.[172]

Women in the second and third trimesters had higher gains on process quality in Zimbabwe. This finding is due to the fact that all the interviewed women for assessing process quality were either in second or third trimesters and none in the first trimester. Process quality gain on ANC was higher for wealthier and educated women in Zimbabwe. Other studies from elsewhere also had reported that wealthier and educated women obtained better quality of care in P4P programs.[15,107] In Burundi, there was increased possibility of richer pregnant women to have their blood pressure measurement done compared to poorer women. This inequitable practice under P4P reflects that P4P program is not able to address the existing practices on addressing equity.[13] Despite being incentivized on the performance targets equally, providers seem to offer better care towards the well-off.[28]

8.3.3 Client Satisfaction

In this study, the client satisfaction index showed significant improvement in the P4P arm (0.6 standard deviations higher than the mean of control arm at p = 0.001). This is consistent with that has been reported from a P4P evaluation in DRC. The P4P program in DRC improved the overall quality of ANC perceived by clients (15 % points; p = 0.05).[89] The elements of satisfaction index in this study included – operating hours, cleanliness, privacy, waiting time, staff attitude, consultation time and medicine. While, in the DRC study, the elements were – medicine, waiting time, staff attitude, felt cured and perceived quality. Apart from the variations in the construction of the satisfaction index, the DRC evaluation included only post-test case control comparison for client satisfaction. Compared to the sample in the DRC study (22 health facilities in two districts) for the evaluation, the sample in this research was larger and spread across the country (consisting of 77 health facilities in 32 districts).

Among all individual items in the Zimbabwe P4P that were used to construct the composite satisfaction index, satisfaction on privacy showed the highest gain (1.8 points; p = 0.023), followed by waiting time (1.3 points; p = 0.001) and cleanliness (0.8 points; p = 0.037). Improvements on staff attitude (0.87 points) and operating hours (0.98 points) were marginal with statistical significance at the 10% level. As far as evaluating pregnant women's satisfaction within a P4P program is concerned, this

Zimbabwe P4P study is the first to investigate and show positive effects on privacy and cleanliness aspects of facilities. As mentioned in chapter 3, health facilities in the Zimbabwe P4P were incentivized based on the service utilization (quantity) and quality of services (figure 3.6). The quality further consisted of a quality bonus measured through a quality checklist (75% weightage) and client satisfaction (25% weightage). As client satisfaction was a determining factor in the facility earning from P4P, this Zimbabwe P4P study shows a positive effect on satisfaction – on the composite index as well as on the individual elements satisfaction. Moreover, cleanliness of the facilities was one of the incentivized indicators under the quality checklist. Unlike this Zimbabwe P4P study (1.3 points; p value = 0.001), P4P facilities in DRC and Burundi did not show increased satisfaction on reasonable waiting time.[89,95] Increase in the efficiency of the health workers and longer facility operating hours in Zimbabwe are two possible reasons for higher satisfaction on waiting time.[174] In this Zimbabwe P4P study, reported satisfaction on medicine availability did not improve (0.3 points; p value = 0.546), so as in Burundi (4 % points; p = 0.492). On the contrary, patient reported availability of drugs improved in the Democratic Republic of Congo (37 % points; $p < 0.001$).[89] Under the structural quality, this Zimbabwe P4P study does not show any improvement in the availability of drugs due to factors beyond the control of the health facilities. Reported client satisfaction on medicine availability reinforces the finding from the structural quality. The effect of P4P on patient perceived attitude of providers varied in two different P4P programs, while this Zimbabwe P4P study showed marginal improvement in this dimension (0.87 points; p value = 0.068). The P4P evaluations in Burundi and Tanzania did not find any change on satisfaction with provider attitude. However, patients perceived an increase in the providers' respect for patients in DRC (12 % points; $p < 0.1$).[89]

With respect to the type of health facilities, this study found a variety of results on client satisfaction. Client satisfaction was high for rural hospitals and local government-owned health facilities. The existing literature shows that client satisfaction can be subjective as it is based on patient's perceptions.[181] Patient perceptions are often based on their existing knowledge, expectations and judgments.[96] However, as both these types of facilities had significant gains on structural quality improvements, there could be also a possibility that while reporting their satisfaction, clients would have thought of structural quality in particular than process quality. In Bangladesh, women who rated structural quality for ANC as high (waiting area, drinking water and clean toilet) were more satisfied with the overall quality of ANC.[169]

The existing evidence also shows that pregnant women visiting higher cadres or staff with higher education and training had better satisfaction on ANC. A study from Ethiopia had reported a relatively higher client satisfaction for doctors compared to nurses on ANC.[182] In India, pregnant women were more satisfied with nurses with higher cadres during their ANC visit.[183] However, in this Zimbabwe P4P study the situation was reverse. Clients reported more satisfaction with the nurses than the nurse midwives. As already explained in the previous section (section 8.3.2), nurse midwives reported lower motivation to perform.[144] This lower motivation is also reflected in lower process quality and client satisfaction. Clients were perhaps able to perceive the sub-optimal delivery of process quality from the midwives, thus resulting in lower satisfaction.

Unlike the findings from Zimbabwe, studies elsewhere had shown higher satisfaction with female providers for ANC. Pregnant women in countries such as Nigeria, Lebanon, Senegal, India, Saudi Arabia and Thailand were more satisfied with female providers.[63,181,184–186] This higher satisfaction could be due to women's gender-based comfort in communications with females than males.[181] On the contrary, it can be said that in Zimbabwe, women as clients would have looked more at the competence and skills of providers while reporting their level of satisfaction. A qualitative study on the quality of care undertaken in Zimbabwe has shown women trust male providers more as they have higher confidence on their skills than the women providers.[187]

One could expect client satisfaction to be lower among highly educated and richer women as far as MCH services are concerned in an LMIC setting.[186] As the levels of education and wealth increase, women's expectations from a provider increase. Therefore, they are less likely to be satisfied on different elements of ANC in reality.[188] A study from Ethiopia showed that patient satisfaction on ANC decreased with increasing levels of education and income.[189] The same situation was observed in the P4P program in Zimbabwe. Though satisfaction improved in all wealth quintiles, it was higher and significant only among the lower three quintiles.

Women's satisfaction had increased in Zimbabwe along with the gestational age. This could be due to the fact that they experienced more physical examinations and procedures related to screening of high risk cases in the second and third trimesters. Women in the third trimester reported higher satisfaction. In addition, almost all respondent women were from either second or third trimesters in this study. A patient satisfaction survey on ANC in Bangladesh found that there was no association between patient's age, parity and trimester on their satisfaction with care.[190] Studies from Ethiopia and Iran had shown that mothers in the age group 25-34 were more likely to be satisfied on ANC.[182,191]

8.4 Strengths and Limitations

This study is probably the first one that examined the impact of P4P on the three dimensions of antenatal care quality elements in a low income country setting. Although quality of maternal care has been a performance indicator for most of the evaluations of P4P programs in LMIC settings, the existing evidence focus more on program's impact on usage of services than quality of care.[101]

The existing literature exploring the impact of any health system intervention in general and P4P in particular in LMICs so far did not investigate comprehensively into the intervention's effect on all three dimensions of quality of care i.e. structure, process and outcome quality. The structured analysis of quality elements of these dimensions presented is relatively robust and relevant to understand how an intervention can effectively contribute towards quality of maternal care. Such a thematic examination of quality elements under P4P program can also reveal which aspect of the intervention needs to be improved further. For example, if the effect of a P4P program on process quality of care is less, the program needs to pay additional attention to the competence and performance motivation of health workers.

To enhance the rigor of the findings, multilevel modelling was undertaken to account for the hierarchical nature of the data. Even though many evaluations of P4P programs in LMICs involved hierarchical data (for instance – health facilities implementing P4P nested under districts and districts nested under provinces), none of the evaluations utilized multilevel modeling analysis. Multilevel modelling is currently known as one of the best techniques to adjust for hierarchy of data to ensure appropriate estimation of impact estimate.[159] Further, robustness and sensitivity checks were undertaken to ensure the internal validity of the findings. Thematic selection of quality elements in the study and application of multilevel modelling are potential for adaptation in evaluations of similar P4P programs on MCH in other LMICs.

To quantitatively measure quality of care, indices were constructed. The quality indices were created using various means to collapse the multiple dimensions to one tangible quantitative measure. Collapsing multiple dimensions to one quantitative measure helped to compare across various elements of quality. However, the dimensions were also analyzed individually so as not to lose capturing the effects of the intervention on them.

Finally, this study assessed quality of antenatal care in a country-wide maternal health intervention in Zimbabwe by the Government. P4P program is considered to be a leading approach by the Government to improve maternal and neonatal health in the country. Study findings are potential to inform relevant changes in the program design and implementation. In particular, the observation of less gains on specific structural quality elements such as equipment can lead to a review of the prevailing procurement systems for equipment, adequacy of incentives to purchase equipment and managerial efficiency of facilities in procurement. Other areas for strengthening the implementation are building capacity of the health workers and ensuring adherence to clinical protocols.

Despite its novelty and contribution to the global knowledge base, this thesis has a few limitations. These limitations are pertaining to the program design, evaluation design, data collection, recall and misclassification bias, and analytic methods.

Although randomized controlled trial (RCT) is considered as a gold standard to assess the effectiveness of health systems interventions,[192] an RCT was not feasible in this study as the intervention districts were selected non-randomly by the MoH. Health system interventions are sometimes country-wide like the Zimbabwe P4P program, restricting a counterfactual. However, in this evaluation, there is an attempt to match the districts to create valid counterfactuals to enhance the robustness of the evaluation. As this study analyzed several outcomes simultaneously, there could be a possibility for a few outcomes showing statistically significant values merely by chance. Accounting for multiple hypotheses testing during the analyses would have taken care of this limitation.

While estimating the wealth index, the exit interview sample was considered as the universe. The principal component analysis created asset weights based on the exit interview clients only. This estimation may be biased as the socio-economic profile of the exit interview clients could be different from that of the entire population. It would have been ideal to apply the asset weights from the most recent demographic and health survey that takes in to account the socio-economic profile of the entire population while estimating the wealth index.

Client satisfaction was analyzed through the four-point Likert Scale responses with the highest satisfaction being valued at four times more than the least satisfaction. Alternate ways of quantifying the responses could have been explored such as assigning negative values to responses with lower levels of satisfaction. For instance, highly satisfied could be scored 2, slightly satisfied 1, slightly dissatisfied -1, and highly dissatisfied -2.

Even though P4P rewards performance, in essence it increases the funding to health centers. Some improvements in service delivery can be observed merely by increasing the amount of funds. It would have been ideal to balance the effect of this additional financing by creating an intervention arm where P4P equivalent financing would have been provided to health centers without any conditionality. In this way the actual effect of financing tied with performance could have been measured. It was not feasible in the context of this intervention to create such an intervention arm. Similarly, P4P by nature of the intervention includes stringent verification of the achievements to ensure the program is rewarding genuine performance. This can be perceived as another layer of supervision in addition to the routine supervision. In the context of the intervention in Zimbabwe, it was not feasible to create another intervention arm of enhanced supervision without additional financial rewards to balance out the effect of additional supervision.

Several contextual factors and unintended consequences have been identified from the literature and presented in the conceptual framework. However, all of the contextual factors could not be validated within this study considering the focus was only on quality of care aspects of P4P and quantitative nature of the data. Lack of qualitative data also limits the implications of findings to a deeper understanding of 'why' and 'how' the quality of care improved as a result of the P4P intervention. Other interventions in the study districts could have influenced the outcomes. It was not possible to ascertain the influence of other interventions from the health facility survey data.

Process quality was measured through exit interviews. Exit interviews might be prone to recall bias. It could have been strengthened with other methods such as direct observation or review of records. However, the short duration (up to 20 mins approx.) between receipt of services and exit interviews might in fact have reduced the bias due to recall. There is a possibility of misclassification of certain elements in the quality domains, specifically for structural quality. For instance, the enumerators might have failed to accurately distinguish between medical equipment. First of all, most enumerators were trained nurses or midwives with substantial experience in the public health system. Further, the enumerators were rigorously trained in classroom and health facility settings. Thus, any misclassification related to the structural elements would be insignificant. There is also the possibility of misclassification of the performed physical examinations on the part of the exit interview respondents. However, this misclassification would be very minimal because of translation of the data collection instruments to the local language and relatively lesser number of questions on physical examinations.

Certain quality elements were available only in the follow up survey data such as checking for fetal heart rate, anemia, and edema during the receipt of service. Due to the nature of the analysis where differences in the outcome elements were compared between the P4P and control arms over two rounds of data (difference-in-difference), these elements of quality had to be dropped from the analysis. Considering the focused antenatal care (FANC) protocol of Zimbabwe, some elements of quality related to HIV and AIDS would have added value to the research. These HIV and AIDS related elements are testing of HIV, CD4 count if found positive, counseling on HIV prevention, prevention of mother to child transmission, dispensing anti-retroviral treatment and condoms.[193]

This PhD research hinges on to the overall evaluation of the Zimbabwe RBF project. As mentioned earlier, the RBF project was a complex health systems intervention. While, the overall evaluation was comprehensive considering various health systems elements, the PhD research was limited in its scope as it focused only on assessing the effects on quality of care. Various components of the overall evaluation were managed by different research teams and not all of them followed the same timeline. For instance, the research component on costs was delayed due to availability of data. Lack of timely data and completeness of information echo with the findings from a systematic review of the effects of P4P on the quality of maternal and child health care.[101] The systematic review highlighted the challenges of evaluating P4P programs in the context of complex health systems interventions in low- and middle-income country settings.

It would have been ideal to delve deeper in to the financial data on quality of care along with the timeliness of incentives disbursements. For instance, facilities’ overall earning vis-à-vis income from quality and within that share of various quality items. Similarly, linking the results from this research with that of the overall impact evaluation study would have allowed to view them in a broader perspective. Unfortunately, data related to cost and overall impact evaluation outcomes were not available for the PhD research.

8.5 Implications for research

This study examined the effect of P4P on quality of ANC alone. It tried to look into the available information to ascertain if there was a higher utilization among certain quality elements versus others considering their unit price. However, due to limited information, it was inconclusive to say if cherry picking existed in the Zimbabwean P4P program. Only a few variables could be extracted from the facility survey which had unit prices for the P4P program. In addition, all these extracted variables with unit prices were related to structural quality only. Similarly, this study could not explore other unintended consequence – cream skimming (selecting patients with less critical health conditions) as the clients were homogenous in terms of the services they received, i.e. antenatal care. Also, this study did not attempt to either classify or select clients with health conditions of varied severity under routine ANC. Therefore, it is beyond the purview of this research to demonstrate performance incentives could result in unintended consequences.[14,98] However, it may be worth to examine this element in the Zimbabwe P4P program after enlarging the scope of the study and obtaining relevant information.

This study found that process quality was reportedly higher among women with better education and wealth status. As observed by another study from Burundi, this situation raises a concern if P4P is effective among the most needy to improve maternal and child health in resource-constraint settings to address MDG 4 and 5.[107] It is however, not possible to identify the exact cause of this distortion. For instance, women with higher socio-economic status might be aware of the available package of services in the health facilities during ANC and thus could be demanding relevant services. Alternatively, the health workers might be discriminating against clients of lower socio-economic groups.

In this context, further research needs to explore the effects of P4P on equity and demand-side barriers in Zimbabwe.

In order to assess quality of care, there are multiple methods and each has its own merits and demerits.[39] Since no method is absolute, it may be worth applying multiple methods on the same component of care (e.g. structure, process and satisfaction) and validate the findings.[39] For instance, process quality can be measured through direct clinical observations, clinical vignettes, exit interviews and clinical chart abstraction. Depending on the context, availability of data and local capacity, it may be wise for the impact evaluation of P4P programs to apply multiple methods for triangulation. Similarly, quantitative studies are limited in explaining the contextual factors for the findings beyond ascertaining causality. It will be worthwhile to implement mixed-methods study in these evaluations. By supplementing the quantitative studies with deeper explorations of qualitative methods, one would understand the contextual determinants.[101] Specifically, more evidence is needed on contextual factors such as role of user fees on quality of care, especially on patient satisfaction. In addition, it is worth exploring how the revenue of facilities affected the level of quality of ANC. P4P was supposed to enhance revenue of facilities through incentives, while there was an equal chance of revenue loss through user fee removal.[120]

8.6 Implications for policy

Women with better education and wealth status reported of higher process quality. The study, thus urges policy makers to address equity and demand-side barriers under P4P, while simultaneously working with the health workers to ensure standard clinical practice guidelines are followed to all clients regardless of their socio-economic status. Further, in collaboration with the health center committees and community based organizations, awareness generation activities can be undertaken in the facility catchment areas about the availability of services in the facilities. Learning lessons from the Zimbabwe RBF project, the government has started the implementation of a P4P program in the urban areas that includes components of both supply and demand sides.

Reported process quality and client satisfaction for ANC were higher for nurses than nurse midwives in this study. A process evaluation of P4P program in the Gambia also reported similar findings.[172] A Zimbabwean nurse midwife has one more year of specialized training on maternal and child health than the nurse apart from the common three-year basic nurse training. Given the fact that nurse midwives have higher formal training, it is necessary to explore their practices on adherence to national clinical guidelines specifically on maternal and child health.[174] It is also prudent to initiate on-the-job training along with supportive supervision to improve their competence.[169] In a resource-constraint setting like Zimbabwe, it would be difficult to get adequate number of physicians and nurses, especially in rural areas in the short-run.[133] Therefore, optimally enhancing the skills of existing health workers will be a feasible strategy to improve quality of antenatal care.

Findings from Zimbabwe indicate that without any considerable improvements in the supply of skilled staff, quality of ANC services has improved across the structure, process and satisfaction dimensions. This could potentially be the effect of performance based payments in this case. It also shows within the current limitations of supply of skilled health workers, P4P has the ability to improve quality of services in a low income country setting. However, one should consider the relatively short timeframe (two year) of implementation that is covered in this evaluation. In most innovative health systems interventions, it takes a while to establish the systems of implementation (e.g. capacity, supervision, verification, funds flow) considering the low income country setting.[194] As time passes, the short spike in quality improvement can really plateau or decline. Further, with enhancement in demand generation, utilization of services is likely to increase along with workload for the health workers.[195] This increased work-load can gradually reach a point where staff would feel burnt-out to perform, adversely affecting the quality of ANC (mostly process) and other components of maternal health.[195] Continuous burn-out can demotivate staff to perform, leading to further reductions in quality of care.[195] It has to be explored if increased workload leading to burn-out was the reason for the non-compliance of nurse midwives in this context. If indeed this was the case, then the program needs to ensure that there is adequate supply of skilled staff to meet the increased workload under P4P.

8.7 Conclusion

Zimbabwe, a country with adverse maternal and child health indicators, implemented a P4P program in 2012. This controlled before – after study of P4P's effect on structural quality, process quality and client satisfaction of antenatal care showed that although the P4P program had significant improvements in the structural quality, process quality and client satisfaction indices, certain elements within these indices such as equipment, drugs, and physical examination did not show much improvements. Remarkably, the improvements in the quality of antenatal care has been achieved without any inputs in the supply of skilled staff. However, the P4P did not address the issue of inequity in the perceived quality of antenatal care. Further research is needed to understand the mechanisms through which P4P had led to the observed improvements in the quality of antenatal care in order to replicate and scale up in similar settings. Thus, there is a need for further exploration of the contextual factors that would explain the mechanisms of these improvements.

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Annex

Annex A: Calculation of individual staff incentives

Table A1: Calculation of individual staff incentives

A	**Position**	**% points**
1	Nurse in charge	100
2	Nurse	90
3	EHT	90
4	Nurse aide	50
5	General Hand	40
6	Primary Counsellor	30
B	**Number of years worked**	**% points**
1	1 to 5 years	1
2	6-10 years	2
3	11+ years	3
C	**Responsibility**	**% points**
1	Nurse in charge	25
2	Nurse	20
3	EHT	15
4	Nurse Aide	12
5	General Hand	8
6	Primary Counsellor	5
D	**Extra or less hours worked**	**% points**
1	Extra hours nighttime	0.30
2	Less hours worked daytime	-0.25

Annex B: Systematic Review Paper

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SECTION A – Student Details

Student	Ashis Kumar Das
Principal Supervisor	Daniel Chandramohan
Thesis Title	Effect of pay for performance on the quality of antenatal care in Zimbabwe: a controlled before-after study

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?	BMC Public Health		
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Student Signature: Ashis Das **Date:** 03 April 2017

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RESEARCH ARTICLE Open Access

Effect of pay for performance to improve quality of maternal and child care in low- and middle-income countries: a systematic review

Ashis Das[1,2*], Saji S. Gopalan[1] and Daniel Chandramohan[1]

Abstract

Background: Pay for Performance (P4P) mechanisms to health facilities and providers are currently being tested in several low- and middle-income countries (LMIC) to improve maternal and child health (MCH). This paper reviews the existing evidence on the effect of P4P program on quality of MCH care in LMICs.

Methods: A systematic review of literature was conducted according to a registered protocol. MEDLINE, Web of Science, and Embase were searched using the key words maternal care, quality of care, ante natal care, emergency obstetric and neonatal care (EmONC) and child care. Of 4535 records retrieved, only eight papers met the inclusion criteria. Primary outcome of interest was quality of MCH disaggregated into structural quality, process quality and outcomes. Risk of bias across studies was assessed through a customized quality checklist.

Results and discussion: There were four controlled before after intervention studies, three cluster randomized controlled trials and one case control with post-intervention comparison of P4P programs for MCH care in Burundi, Democratic Republic of Congo, Egypt, the Philippines, and Rwanda. There is some evidence of positive effect of P4P only on process quality of MCH. The effect of P4P on delivery, EmONC, post natal care and under-five child care were not evaluated in these studies. There is weak evidence for P4P's positive effect on maternal and neonatal health outcomes and out-of-pocket expenses. P4P program had a few negative effects on structural quality.

Conclusion: P4P is effective to improve process quality of ante natal care. However, further research is needed to understand P4P's impact on MCH and their causal pathways in LMICs.

Trial registration: PROSPERO registration number CRD42014013077.

Keywords: Pay for performance, Quality of healthcare, Maternal and child health, Low- and middle income countries

Background

Pay for performance (P4P) is an emerging health sector strategy to improve availability, quality and utilization of essential healthcare services. P4P aims at incentivizing performance of the providers and clients for uptake of key services and behavior changes [1]. P4P belongs to the category of innovative financing mechanisms that includes similar type of payment systems such as results based financing, performance-based financing, performance-based contracting, output-based aid, conditional cash transfer and cash on delivery [1]. In supply-side P4P, incentives are provided to achieve a pre-agreed set of results (outputs and outcomes) by improving the performance of health workforce and health facilities [2] and involves a strict monitoring of results in a stipulated time-frame. Typically, performance in a P4P program is measured through health outcomes, utilization of services, and quality of care [3]. Though P4P has been widely implemented in both high- and low-income settings, its primary focus and trajectory are context specific [3]. In low- and middle-income countries (LMICs), P4P is commonly used to achieve unmet millennium development goals (MDG)

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4 and 5 on maternal and child health (MCH) [4]. However, the exiting knowledge on the effects of P4P is limited to utilization of a few services than quality of care [4]. Even in high-income countries, rigorous evidence on the effect of P4P on quality of care is limited [5–8].

Several LMICs in Asia and Africa have experimented P4P to improve MCH since 1990s, mainly to mitigate the burden of maternal and child conditions [4, 9, 10]. Clinical evidence indicates that quality of MCH care is a pre-requisite to reduce maternal and child mortalities [11]. An increased uptake of MCH services such as skilled birth attendance and newborn care without adequate quality cannot guarantee an improved MCH status [12]. Studies conducted in Cambodia, Democratic Republic of Congo, Burundi, Rwanda, Haiti have demonstrated improvements in maternal and child healthcare service utilization and to some extent better financial and management capacities with health facilities [13]. There is no synthesized evidence supporting the positive effect of P4P on quality of care. In addition, a systematic review conducted on P4P in LMICs asserts that the evidence is weak to conclude the impact of provider incentives on quality of care [4]. If P4P positively impacts only service utilization without corresponding improvements in quality of care, current investments on P4P in low-income countries may not be cost-effective to improve MDGs 4 and 5 [3]. In this systematic review, we assessed the effect of supply-side pay for performance on the quality of maternal and child health services in LMICs. While identifying the knowledge gaps in this area, we also explored the appropriateness of methods adopted by different studies to measure quality of MCH care under P4P.

Defining quality of healthcare: definition and measures

Institute of Medicine (IOM) defines quality in healthcare as the "degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" [14]. Donabedian describes healthcare service delivery as a continuum which includes structures, processes, and outcomes and asserts quality of care is an end product when the structures are translated to outcomes through the processes [15]. In the service delivery continuum, there is equal emphasis on each of the above mentioned aspects of quality. *Structural quality* consists of human and key material resources such as infrastructure, equipment, drugs and supplies, communication, and transport. Apart from having the needful material resources, it is also essential that they are put to practice to provide services. To deliver optimal quality of care, adequately skilled and motivated human resources should be available [15]. *Process* simply means whether services are provided optimally and safely following the standards of service delivery through technical and non-technical performance [15]. Technical performance entails delivering scientifically proven services at the appropriate time. For instance, during routine antenatal visit, a woman should undergo weighing; testing of blood and urine samples for infection and signs of pre-eclampsia; palpation of abdomen; and measurement of blood pressure and abdominal girth. Non-technical performance relates to interpersonal relationship, provider behavior, privacy, and confidentiality [13, 16–18]. Key consequences of the service delivery such as morbidity, mortality, out-of-pocket expenses, and client satisfaction constitute the *outcomes* [12]. In this review, we adopt Donabedian's definition of quality in healthcare.

Methods

Protocol and registration

This study is registered with the PROSPERO international prospective register of systematic reviews (registration number CRD42014013077) [19]. A peer-reviewed protocol guided the conduct of review. This review is reported as per PRISMA guidelines [20].

Selection of studies

Studies from low- and middle-income countries as defined by the World Bank income criteria were included [21]. Two of the authors (AD and SG) independently searched the literature, screened abstracts and retrieved full papers. Final selection of studies against the inclusion criteria was done independently by these authors and disagreements were resolved through a consultative process.

Inclusion criteria

1. Evaluation reporting results of any supply-side (i.e. facility/provider) P4P on a quantitative measure of MCH care quality
2. Study conducted in low- and middle-income countries
3. Published in English between January, 1990 and June, 2014. This selection is based on the fact that P4P programs started from the 1990s.
4. Presence of at least one comparison group
5. Study reporting statistical significance of the intervention than only descriptive analysis
6. Study meeting a minimum quality score of six, defined by two reviewers

Exclusion criteria

1. Study presenting the impact of P4P on only access to and usage of MCH care without any quality of care measures
2. Qualitative study or review

3. Study on P4P presenting non-MCH care
4. Study reporting only descriptive analysis
5. Study with a quality score of less than six

Type of studies

Studies were selected if they met the criteria used by the Cochrane Effective Practice and Organization of Care group (EPOC) [22]. The EPOC study designs are: randomized controlled trials (RCTs), clustered randomized controlled trials (c-RCT), controlled clinical trials (CCT), controlled before-after studies (CBAs) and quasi-experimental studies including interrupted time series. Given the dearth of literature on P4P and quality of MCH care, in addition studies having at least one intervention and one comparison group were included.

Types of participants

Study population comprised of women during pregnancy and post-partum period; children younger than five years; and health workers under assessment for a P4P program.

Type of interventions

P4P interventions in public or private sector, providing conditional financial incentives to facilities and/or providers to achieve certain performance measures on MCH services including quality were selected.

Operational definitions

Maternal health care included any routine or illness care received during the antenatal, delivery and postpartum period. Child health care included any care received from birth up to five years of age for any routine or illness conditions. Health workers were defined as medically trained personnel (doctors, clinical officers, midwives, and nurses) working at a primary or secondary care level in LMIC settings.

Outcomes of interest

Primary outcome of interest was quality of MCH disaggregated into structural quality, process quality and outcomes. Under structural quality, we considered availability of health facility infrastructure, skilled staff, equipment, commodities, and drugs. For process quality, we included adherence to standard protocols and guidelines for management of health conditions. Morbidity, mortality, out-of-pocket expenses for medical services in the healthcare facility, and client satisfaction constituted the outcomes.

Information sources and search

Records were searched in several electronic search engines and databases namely MEDLINE, EMBASE, Global Health, PsycINFO, Econlit and Web of Science. Additionally, Google Scholar was searched electronically. Websites of key organizations involved in P4P programs (World Bank, DFID and NORAD) were purposively searched for published articles or working papers. A hand search enabled to retrieve certain relevant papers from the selected records. Contacts were made to authors and scholars in the field of P4P to identify additional studies.

The literature search was conducted during May-August 2014. Records published between January, 1990 and June, 2014 were selected. Each database had different search words as a combination of MeSH (medical subject heading) and non-MeSH terms using Boolean operators "AND" and "OR". The search algorithm was developed based on a preliminary search in PubMed and Google Scholar. The thematic search words are given in Table 1.

Data items and extraction

Country and year of study, study settings and design, sample size, type of incentive (recipient, conditionality and frequency), comparison groups, outcome measures, and quality element of the outcome measures were extracted using a data extraction form. The primary author extracted the data and a second author validated the process.

Summary measures and data synthesis

Where possible we presented either odds ratio or coefficient along with the confidence interval. Net effects of the interventions were calculated as the difference between intervention and control groups at baseline and follow up, and presented as percentage points, coefficients or absolute numbers in natural units. We considered an outcome statistically significant at 5 % level ($p < 0.05$). The reported outcomes were presented by the elements of quality, i.e. structure, process and outcomes. Due to heterogeneity of

Table 1 Search strategy

Thematic Search
"provider performance" OR "provider incentives" OR "pay for performance" OR "performance-based financing" OR "performance-based incentives" OR "supply-side incentive" OR "provider performance" OR "results-based financing"
AND
"quality of care" OR "clinical standards" OR "structural quality" OR "process quality"
AND
"Maternal health/" [MeSH] OR "ante natal/pre natal" OR "post natal/postpartum" OR "child birth/delivery/institutionalized" OR "newborn/neonatal" OR "immunization/vaccination" OR "children/child" OR "nutrition/stunting/anemia"
Adjunct Search
"Developing countries/less developed nations/third world countries"[MeSH] OR "developing health Systems" [MeSH] OR Africa/sub-Saharan africa" [MeSH] "Central/south/latin america"[MeSH] OR "asia/central/south east Asia"[MeSH] OR "commonwealth of independent states"[MeSH] OR "indian ocean islands"[MeSH] OR "eastern europe"[MeSH] OR "south asia" OR "low income countries/low and middle income Countries"

studies and presentation of results, no meta-analysis could be performed.

Appraising methodological and reporting quality of included studies

We developed a customized quality assessment tool for appraising methodological quality of studies, adapted from Downs and Black [23]. The quality tool took into account methodological quality (randomization, baseline balance of key variables), external validity (representativeness of study sample, contamination of interventions), and reporting quality (clear description of objectives, interventions, outcomes, power calculations, findings). Our adaptation was reflected in scoring various types of studies with the highest score assigned to RCTs, replacing representativeness of patients with facilities, and removal of items related to blinding of randomization and patient adverse events. There were 18 quality indicators for RCTs and 17 for CBAs and each indicator had an indicative score. Wherever the description did not include a particular item mentioned in the quality assessment tool or it was unclear, we scored that item zero. Because of the variation in scoring between studies (i.e. RCT and CBA), we standardized the absolute scores to percentage to ensure comparability. Based on the aggregate quality score, studies were ranked as low (<34 %), moderate (34-66 %) and high (>66 %). Two of the authors (AD and SG) independently assessed the quality of studies, with any disagreements resolved through discussions.

Results

Study selection

Search from the databases identified 4535 records, and an additional 113 records were retrieved from other sources and personal communications with researchers. Screened records were 188 after removing duplicates and excluding records that did not mention P4P and quality. From 13 articles eligible for full-text assessment, only eight were included in the review. Details of the study selection are given in the Fig. 1.

Study characteristics and settings

There were four CBAs, three cluster RCT and one case control with post-intervention comparison [24–31] of P4P programs on MCH care in Burundi, Democratic Republic of Congo (DRC), Egypt, the Philippines, and Rwanda (Table 2). Five studies took place in primary care health centers [24–27, 31], two reported results from district level hospitals [28, 29] and one was conducted in both primary and secondary level facilities [30].

Two cluster randomized trials of performance based salary bonus to health care providers were reported from the Philippines [28, 29]. In these two RCTs, 30 district hospitals from districts matched by socio-economic, demographic and health profile were randomized to one of the two intervention arms or to the control arm. In the cluster randomized trial in DRC, 96 health facilities in one district were randomly assigned to intervention and control arms [30]; the intervention arm received performance-based incentives, while control arms only input-based financing.

The CBA in Rwanda randomly assigned 80 health facilities from 12 districts to receive a P4P intervention and 86 health facilities from seven districts to receive an equivalent input-based financing [27]. The CBA of a P4P program in DRC [24] allocated two districts to receive performance-based incentives and compared the outcomes with another two districts having similar socio-economic characteristics. From Egypt, a post-test only comparison study that assessed a P4P program in primary health centers receiving incentives for more than two years [31] was reported. Comparison groups received equivalent additional incentives as salary top-off without any performance conditionality. Two studies of P4P program were reported from Burundi. One study used a CBA for the pilot phase [26] and the second study compared population level outcomes on quality of antenatal care between P4P and non-P4P provinces in the nation-wide roll-out phase [25].

Characteristics of performance measures and payments on quality of care

Studies described diverse performance measurement and payment mechanisms for quality of care. Performance mechanisms included achieving a certain level of volume and quality of MCH services. Three programs incentivized quality of care with limited set of indices [26–29, 32]. Three others utilized a composite index including availability of human and material resources, compliance to national standards, proper record keeping, and client satisfaction [24, 30, 31].

Payment systems included payment for individual health workers [28, 29, 31] or for facilities [24–27]. Incentives accounted for 5 % of physician's salary in the Philippines [29] and 275 % times the base salary of a primary health facility staff in Egypt [31]. In DRC, the monthly payments to facilities ranged from $200 to $4000 [24].

In DRC, apart from incentivizing utilization of MCH services, the program offered a bonus of up to 15 % of the subsidies to facilities on quality of care [24]. Performance indicators in Egypt consisted of preventive, curative and quality of care measures (completeness of medical records, patient satisfaction and waiting time) on MCH [31]. The Rwandan program incentivized facilities on a combination of service volume and quality for MCH [27]. The P4P facilities in the Philippines

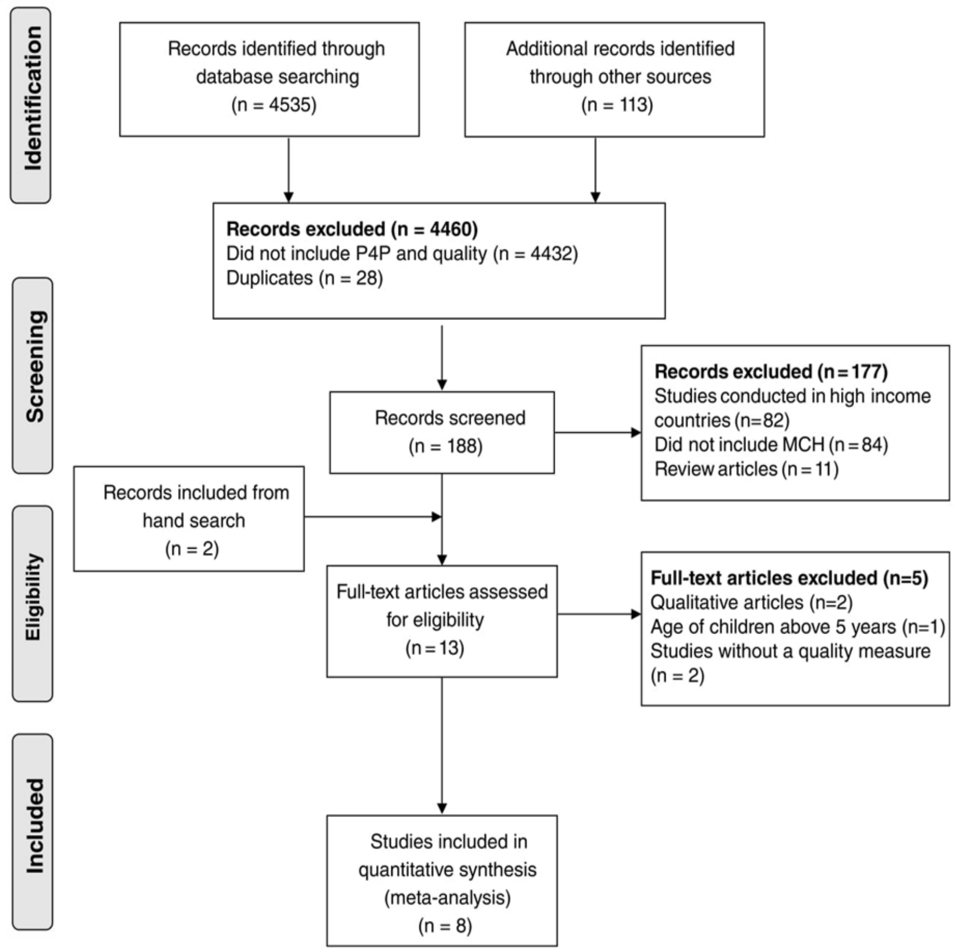

Fig. 1 Flow diagram for selection of articles

received incentives linked with the average clinical competence scores of physicians, facility caseload, and average utilization of services (quantity) and adherence to national standards and protocols (quality) [28]. This adherence to treatment guidelines was assessed for vaccinations, family planning, tuberculosis, HIV and antenatal care.

Reporting of quality of care in studies

Studies adopted different methods to report quality of care outcomes. Generally, quality was reported either objectively (direct observation of availability and receipt of services as per national standards of care) or reported by patients (e.g. receipt of services, perceptions on staff attitude, waiting time, quality of services). Means of verification of quality were through exit and household interviews (patient perception and experiences), review of records, direct observation (infrastructure, drugs and equipment) and vignettes. Six studies utilized household interviews to measure quality [24–27, 29, 30], while two studies each employed exit interviews [30, 31], review of records [24, 26], and direct observations [24, 26]. Only one study applied vignettes as a means of verification [28].

Risk of bias across studies

The mean quality of studies score was 63.8 % with a range of 41 to 88 %. Two RCTs were of high quality with a score of 78 % [29, 30] and one RCT had a score of 72 %

Table 2 Study characteristics and Quality score

Author, year; Country	Study Design	Program setting	Incentives			Comparison Group	Outcome measures	Quality element	Methodological Quality score (%)
			Recipient	Conditionality	Frequency				
Peabody et al., 2011; Philippines [28]	CRT	30 District hospitals (DH)	Providers	Physician competence score, case load and patient satisfaction	Quarterly	DHs from matched districts without P4P	Quality of care, utilization of services of children under-five	Process quality	13(72)
Peabody et al., 2014; Philippines [29]	CRT	30 District hospitals	Providers	Physician competence score, case load and patient satisfaction	Quarterly	DHs from matched districts without P4P	Quality of care, utilization of services of children under-five	Clinical outcomes for under-five children	14(78)
Huillery and Seban 2014; DRC [30]	CRT	152 Facilities (primary and secondary level)	Facilities	Utilization of services	Monthly	Facilities in control districts receiving equivalent fixed payment	User fees, service accessibility, service quality and utilization, population health status, health facility revenue, health workers' satisfaction, anxiety, motivation	Patient perceived quality and structural quality	14(78)
Basinga et al., 2011; Rwanda [27]	Controlled before and after	Rural health centers - 80 in intervention and 86 in control	Facilities	Utilization of 14 key MCH services and quality of services delivery	Quarterly	Facilities under input-based financing received funds equivalent to P4P payments	Prenatal visits, institutional delivery, quality of ANC, child preventive care visits and immunization	Process quality of ANC	15(88)
Bonfrer et al., 2014; Burundi [25]	Controlled before and after	700 facilities	Facilities	Obtaining quality and quantity of services	Monthly for quantity and quarterly for quality	Households in the provinces where P4P was not implemented	Utilization and quality of MCH services	Process quality of ANC	10(59)
Bonfrer et al., 2014; Burundi [26]	Controlled before and after	700 facilities	Facilities	Obtaining quality and quantity of services	Monthly for quantity and quarterly for quality	Facilities in control districts receiving normal input financing and salary bonus	Maternal and under-five services	Structural and process quality	9(53)
Soeters et al 2011; DRC [24]	Controlled before and after	Two districts	Facilities	Utilization of services	Monthly for quantity and quarterly for quality	Two control districts with characteristics similar to intervention districts receiving essential drugs, equipment and fixed staff performance bonuses	Not mentioned	Patient perceived quality, structural and process quality	7(41)
Huntington et al., 2010; Egypt [31]	Case control post-test only	Primary health centers	Providers	Quantity and quality of preventive, curative and quality of MCH services	Monthly	Primary care providers in control arms got flat rate salary supplements	Quality of ANC, child care services and family planning care	Process quality of ANC, family planning and child care	7(41)

[28] (Table 2). Among the five CBA studies, only one [27] was of high quality, scoring 88 %. Two studies were of medium quality with a score of 53 and 59 % [25, 26]. Two CBA studies were of low quality with a score of 41 % [24, 31].

Five studies did not report baseline participant characteristics, representativeness of the participants or facilities, estimates of random variability and actual probability values [24–26, 30, 31]. Three CBAs did not mention the matching criteria for control and intervention sites [24, 27, 32]. Studies with selection bias did not consider the use of instrumental variable techniques to identifying treatment effects. Seasonality might have confounded the outcomes in the DRC study as the surveys were conducted at two different seasons [24].

Effects of interventions

Structural quality

Studies gathered results on structural quality from direct observation and review of records. Four studies described the effect of P4P on elements of structural quality (Table 3). The availability of qualified staff increased by 15 % points and patient perceived availability of drugs improved by 37 % points in DRC [24] compared to pre-intervention period. In the Philippines, P4P improved physicians' knowledge to manage under-five diarrhea and pneumonia (coefficient 1.6; $p < 0.001$) [29]. However, another study showed some negative effects of P4P on structural quality in DRC [30]. These negative effects were observed on overall structural quality index and availability of drugs and vaccines in the facility [30]. Patient perceived availability of drugs decreased (coefficient -308.33; $p < 0.001$). There was a decline in structural quality index based on interviewers' observation (coefficient -0.525; $p = 0.014$), equipment index (coefficient -0.639; $p = 0.026$) and vaccine availability (coefficient -0.744; $p = 0.034$). In this study, P4P did not show any effect on patient perceived equipment quality, infrastructure index and the number of types of drug currently available. Patient perceived availability of drugs in Burundi (coefficient 0.04; $p = 0.492$) and equipment quality in DRC (coefficient 0; $p = 0.997$) did not change under the P4P program [26, 30].

Table 3 Effect on structural quality

Variable	Net treatment effect	*P* value
Qualified staff in facilities[a]	15	<0.05
Sufficient drug availability (patient perceived)[b]	0.04	0.492
Provider clinical knowledge on child health (Mean Vignette score)[c]	1.6	<0.001
Patient perceived availability of drugs (%)[a]	37	<0.001
Patient perceived equipment quality[d]	0	0.997
Structural quality index based on interviewers' observation[d]	−0.525	0.014
Infrastructure index[d]	0.184	0.372
Equipment index[d]	−0.639	0.026
Number of types of vaccine currently available[d]	−0.744	0.034
Number of types of drug currently available[d]	0.236	0.646

[a]Soeters et al. [24]; [b]Bonfrer et al. [25]; [c]Peabody et al. [28]; [d]Huillery and Seban [30]

Process quality

Studies reported process quality results from direct observation and review of records. Four studies presented P4P's impact on various elements of process quality (Table 4). One study reported P4P's effect on history taking and examination of pregnant women during ANC [31]. Two studies reported the effect on prescription and treatment of pregnant women and under-five children [30, 31]. Three studies mentioned about patient reported process quality on MCH services [29, 32, 33]. The study in Egypt showed the P4P increased the chances of a provider asking about parity (coefficient 11.4; $p < 0.05$) and past illness (coefficient 16.4; $p < 0.01$) during ANC visits [31]. But, the P4P did not significantly influence the chance of a provider enquiring about a pregnant women's name, age and last menstrual cycle. In this study, P4P increased likelihood of measuring blood pressure (coefficient 8.4; $p < 0.01$), testing blood (coefficient 12; $p < 0.01$) and urine (coefficient 20; $p < 0.01$) during ANC visits. However, P4P program did not influence the chances of being weighed or fetal heart rate checked. The P4P increased provider's adherence to explaining medicine intake for children under five years (coefficient 11.1; $p < 0.05$), follow-up treatment (coefficient 24.2; $p < 0.05$) and medicines (coefficient 10.5; $p < 0.05$). Yet, the program could not improve provider practices on treatment, prescribing iron, injections, vitamins, and tetanus toxoid for ANC visits. In Rwanda, P4P increased the ANC quality index in primary health centers (coefficient 0.157; $p = 0.02$) [27]. In DRC, P4P improved patient's perceived quality of care index (coefficient 15; $p < 0.05$) and professional quality score of facilities on MCH services (coefficient 26; $P < 0.001$) [24]. Patient perceived overall quality of care index is the aggregate score given by the patient for various dimensions of provider behavior and competence (e.g. how provider explores the case scenario, how provider explains the health condition, how much respect a provider gives for the patient etc.) Professional quality score of the facility is a composite score consisting of structural and process elements as shown by both studies in DRC and Burundi. However, P4P program did not influence provider's adherence to standardized medical procedure for any MCH service (coefficient -0.015; $p = 0.695$) [30].

Table 4 Effect on process quality

Variable	Net treatment effect	P value
History taking		
Asked name during ANC visit[a]	4.3	NS
Asked age during ANC visit[a]	4.5	NS
Asked parity during ANC visit[a]	11.4	<0.01
Asked date of last menses during ANC visit[a]	2.9	NS
Asked past illnesses during ANC visit[a]	16.4	<0.01
Examination		
Examined weight during ANC visit[a]	5.8	NS
Examined blood pressure during ANC visit[a]	8.4	<0.01
Examined fetal heart rate during ANC visit[a]	10.9	NS
Prescription and Treatment		
Asked for blood test during ANC visit[a]	12	<0.01
Asked for urine analysis during ANC visit[a]	20	<0.01
Explained intake of tetanus toxoid during ANC visit[a]	−8.4	NS
Explained intake of Vitamins during ANC visit[a]	5	NS
Explained medicine intake for under-five (%)[a]	11.1	$p < 0.05$
Overall treatment procedures (patient perceived) during ANC visit[a]	−5.5	NS
Drugs prescribed to pregnant women without examination[b]	0.02	0.66
Children received injection (%)[a]	−6	$p < 0.05$
Children received follow up (%)[a]	2.4	$p < 0.05$
Children given medicine (%)[a]	24.2	$p < 0.05$
Overall process quality		
Compliance rate with medical procedure, any service[b]	−0.015	0.695
ANC process quality score[c]	0.157	<0.001

NS Not significant
[a]Huntington et al. [31]; [b]Huillery and Seban [30]; [c]Basinga et al., [27]

Quality outcomes

Studies obtained results on quality outcomes from review of records, exit interviews, household interviews and vignettes. Five studies demonstrated the effect of P4P on patient knowledge on managing health conditions, morbidity, mortality, out-of-pocket expense and client satisfaction (Table 5) [24, 29–32].

Patient knowledge

Number of pregnant women knowing the usage of prenatal drugs increased in Egypt (coefficient 12; $p < 0.05$), while patient's knowledge on drug intake decreased in DRC (coefficient -0.072; $p = 0.039$) [30, 31].

Table 5 Effect on quality outcomes

Variable	Net treatment effect	P value
Patient knowledge		
Women knew medicine-use in prenatal period[a]	12	<0.05
Women knew medicine-use in prenatal period[b]	−0.072	0.039
Health outcomes		
CRP negative for under-five[c]	0.84	0.497
Not anemic under-five[c]	−4.87	0.253
Good GSRH for under-five[c]	7.37	0.001
Weight-for-height z-score of under-five[b]	−0.347	0.306
Number of under-five deaths last year in households[b]	12	0.55
Out-of-pocket expenses		
Fee paid for the delivery[b]	301.24	0.762
Fee paid for the last postnatal visit[b]	−71.637	0.35
Fee paid for the last prenatal visit[b]	−112.969	0.125
Fee paid for the last immunization shot[b]	−22.096	0.237
Cost of drugs purchased by the patient at facilities[b]	−1106.16	0.005
Client Satisfaction		
Felt cured (pp)[d]	11	NS
Acceptable waiting time (pp)[d]	7	NS
Respect by staff (pp)[d]	12	<0.10
Felt cured (coefficient)[e]	0.09	0.012
Waiting time reasonable (coefficient)[e]	−0.12	0.318
Personnel respectful (coefficient)[e]	−0.02	0.718
Adequate consultation time (minutes)[b]	1.028	0.422
Pregnant women satisfied on user fees[b]	0.012	0.48
Pregnant women satisfied on welcome quality[b]	−0.027	0.442
Pregnant women dissatisfied on user fees[b]	0	0
Pregnant women dissatisfied on welcome quality[b]	0	0.946
Pregnant women satisfied on total care quality[b]	−0.005	0.671
Patient overall satisfied[b]	0.013	0.359
Overall quality of care		
Overall patient perceived quality score on ANC (pp)[d]	25	<0.05
Overall professional quality score of health centers (pp)[d]	26	<0.001
Total facility quality score (coefficient)[e]	17.24	0.062
Patient perceived quality of care (coefficient)[e]	0	0.924

NS Not significant
[a]Huntington et al. [31]; [b]Huillery and Seban [30]; [c]Peabody et al., [29]; [d]Soeters et al [24]; [e]Bonfrer et al. [25]

Health outcomes

In the Philippines, there was a small improvement in patient reported health measure for under-five (coefficient 7.37; $p = 0.001$) [29]. However, P4P had no effect on the prognosis of acute infections or on the incidence of anemia among sick children after 6 to 10 weeks of discharge from hospital. Under-five children did not experience any improvements in their weight-for-height z-score (coefficient -0.347; $p = 0.306$), longevity (coefficient -0.012; $p = 0.55$) or infants' survival (coefficient -0.01; $p = 0.093$) in the DRC program [30].

Out-of-pocket expenses

In DRC [30], P4P reduced patient out-off-pocket expenses on purchase of drugs at facilities (coefficient -1106.16, $p = 0.005$). On the contrary, there was no significant effect on fee paid for immunization, delivery and ANC and PNC visits.

Client satisfaction

Three studies reported how P4P could influence patient satisfaction on consultation time, provider behavior, waiting time, user fee, welcome quality, overall quality of care and cure. In the DRC program, no improvement on provider attitude towards patients (coefficient 12; $p < 0.10$) [24] was observed. Patients' chance of feeling cured was higher under P4P program in Burundi (coefficient 0.09; $p = 0.012$) [26]. The DRC P4P program did not affect level of client satisfaction on adequacy of consultation time, overall quality of care, user fee and welcome quality [30].

Overall quality of care

Two studies demonstrated the effect of P4P on overall quality of care of MCH services considering structure, process and outcome measures (Table 5). The P4P program in DRC could enhance the total professional quality score of health centers (coefficient 26; $p < 0.001$) and patient perceived overall quality index (coefficient 25; $p < 0.05$) [24]. However, the facility quality score in Burundi though improved, it was not statistically significant (coefficient 17.24; $p = 0.062$) [26].

Discussion

Summary of evidence

This systematic review makes a unique attempt to examine the effect of P4P on multiple quality of care elements by using a defined framework. This review found that the current evidence indicating P4P's effect on quality of MCH in LMICs is skewed towards process quality and antenatal care. Feeble evidence showing P4P's impact on quality of MCH care was mainly due to three reasons; 1) program evaluations did not adequately explore quality of care; 2) evaluations were mostly not powered enough to examine quality elements; and 3) P4P could not affect quality of care to a large extent.

The positive effect of P4P was observed only on limited aspects of MCH quality elements. Studies focused predominantly on antenatal care than delivery, EmONC, post natal care and under-five child care. Strength of evidence on maternal and neonatal health outcomes and out-of-pocket expenses was also limited. P4P program fetched a few negative outcomes on structural quality such as a reduction in the level of availability of drugs and equipment.

Despite targeting to improve structural quality of facilities, P4P programs could only improve availability of skilled staff, drugs and provider's clinical knowledge. On the contrary, P4P negatively affected availability of equipment and vaccines [30]. The evidence was considerably positive on provider adherence to treatment protocols on ANC and child care. Patient out-of-pocket expenses on MCH did not reduce considerably under P4P programs, though out-of-pocket costs on drugs were reduced. However, client satisfaction did not substantially improve under P4P.

Implications for policy and research

As P4P programs intend to reduce maternal and child deaths in LMICs, it is essential to demonstrate their potential to improve quality of MCH care comprehensively than process quality alone. Improving provider adherence to treatment guidelines on ANC alone cannot guarantee an improved maternal and child health. Clinical evidence suggests that quality of skilled birth attendance, EmONC and post natal care are necessary to reduce maternal and neonatal deaths [11]. There could be a possibility of insufficient provider skills affecting the process quality on delivery, EmONC and post natal care [11]. Thus, adequate attention should be given to evaluate the evidence on other aspects of MCH care.

Ensuring structural quality such as facility infrastructure, equipment, drugs and supplies is equally pertinent to offer quality care on MCH [11]. Absence of these minimum standards can affect patient satisfaction and in turn reduce demand for services in the long term [11]. Inadequate structural quality could be a reason for the poor client satisfaction in the studies [11]. Several P4P programs provided autonomy and funds to facilities to enhance structural quality. P4P programs in Egypt, Burundi, Rwanda and DRC also had routinely monitored structural quality. However, the prevailing positive evidence on structural quality is minimal. The DRC program faced negative effects on structural quality index, as facilities could not spend on infrastructure and equipment due to their reduced revenue under P4P. The adequacy of funds for infrastructural innovations under P4P programs needs to be investigated. Evaluations of

P4P programs in high-income settings reflect that proportion of facility revenue is significant to improve quality of care [6].

There could be also a possibility of limited motivation and capacity among health workers and managers restricting innovations on strengthening structural quality, as evident in many LMICs [30]. Currently, it is unknown if the prevailing complex procurement system and managerial bottlenecks in the service delivery system to improve structural quality are better under P4P programs. Otherwise, these inefficiencies could retard structural quality improvement under P4P [30]. In addition, if there was no incentive for structural quality improvement, it could have been neglected with a preference for other incentivized indicators (known as cherry picking) [30].

Studies reflect that providers are motivated to improve process quality of care by adhering to treatment guidelines. There could be numerous reasons for their elevated motivation such as financial incentives, regular supervision, patient feedback and improved facility functioning [33]. Several demand-side financing programs proved that increased patient load negatively affects provider efficiency to handle high volume of patients and this could potentially reduce process quality of care in due course of time [33]. Thus, specific attention to retain process quality under P4P programs through optimum provider-patient ratio is needed.

Some P4P programs did not intend to charge user fee, but patient out-of-pocket expense was not reported to be lesser under P4P. Additional research is needed to explore specific cost drivers for out-of-pocket expenses under P4P. In DRC, facilities could not offset the revenue loss from reduced user fee as there was not sufficient demand generation, negatively affecting quality of care [30]. Design of P4P programs need to approach the issue of utilization and quality of services comprehensively by addressing both demand- and supply-side challenges.

Partial positive effect of P4P on quality of MCH care asks for a deeper investigation into role of design, implementation and evaluation of P4P programs. According to a review of P4P in high income countries, quality of care is the final outcome of the changes brought in by incentives at provider level, provider group level and health system level [6]. However, P4P programs in LMICs do not provide any similar evidence. Further, there could also be a possibility of preferential attention to P4P services at the cost of non-incentivized services or positive spillover from incentivized to non-incentivized services [8, 34]. None of the studies reported effects on non-P4P services.

Morbidity and mortality are difficult to attribute to the quality of care delivered because various factors such as severity and pre-existing illnesses, delayed care seeking, and non-adherence to treatment would affect these outcomes [15]. Since most of the P4P programs were less than two years, their evaluations did not potentially have adequate statistical power to explore the impact on mortality. Also, results need to be interpreted considering contextual factors e.g. duration and design of interventions, size of incentives, frequency of payment, timing of evaluation, representativeness of intervention areas and presence of private providers. Study sites were small and in some, were not representative of the country. Effectiveness can be different if intervention is exclusively on quality than many performance targets as shown in the studies.

A few studies with CBAs utilized matching of administrative areas such as provinces or districts [24, 30]. However, within these administrative areas there were gross heterogeneity among facilities in terms of infrastructure, staffing, catchment population and service volume. These differences can be minimized during the analysis if further matching of facilities could be performed. Matching technique such as propensity score matching which allows for comparison of effects between similar units can be tried to strengthen the rigor of evidence [35]. Studies in Rwanda, Egypt and DRC have tried to balance the financial resource effect across intervention arms by providing equivalent financing [27, 30, 31]. However, none had attempted to balance the effects of additional supportive interventions such as supportive supervision, continuous quality measurement, consistent use of checklists and operational plans that might have led to overestimation of P4P's effects.

Limitations

Most studies focused on other performance indicators such as service usage along with quality of care, restricting an in-depth exploration on the latter. This review may suffer from publication bias, as the existing literature may predominantly include studies reporting positive results. Despite these limitations, this review has attempted to include various quality of care elements comprehensively and explored in-depth.

Conclusions

This systematic review showed that P4P is effective to improve process quality of ante natal care but not so effective on improving structural quality, customer satisfaction, out-of-pocket expenses and maternal and child health status. Several studies neither explored the effect of P4P on quality of MCH in-depth, nor were powered enough statistically. Further research is needed to understand P4P's impact on EmONC, delivery and post natal care and their causal pathways in LMICs.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions
All authors drafted the systematic review protocol. AD and SG conducted the search, selection of records and quality appraisal. All authors have read and approved the final manuscript.

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RBF Midline Health Facility Survey

ZIMBABWE

2014

IDENTIFIER	
SURVEY AREA NUMBER	QUESTIONNAIRE NUMBER
	1

HEALTH FACILITY CHECKLIST

GEOGRAPHICAL LOCATION

Province: ____________ District: ____________

HEALTH FACILITY NAME: ____________________ HEALTH FACILITY CODE:

LOCATION

URBAN	1
RURAL	2
PERI-URBAN	3

HEALTH FACILITY VISITS

INTERVIEWER'S NAME: ____________________ CODE:

	DAY	MONTH	YEAR
VISIT # 1:			
VISIT # 2:			
VISIT # 3:			

RESULT OF THE INTERVIEW: ____________

INTERVIEW DONE	01
PARTIALLY COMPLETED	02
PERSON IN CHARGE REFUSED INTERVIEW	03
PERSON IN CHARGE IS OUT (STAFF THAT IS PRESENT IS NOT AUTHORIZED)	04
FACILITY IS EMPTY (NO STAFF MEMBERS)	05
HEALTH FACILITY NOT FOUND	06
OTHER, SPECIFY: ____________________	96

LANGUAGE USED

...BY THE INTERVIEWER?

TRANSLATOR USED?

			NEVER 1
... BY THE RESPONDENT?		ENGLISH 01	SOMETIMES 2
		OTHER (SPECIFY:__________) 96	ALWAYS 3

VERIFICATION OF QUESTIONNAIRE BY SUPERVISOR

		DAY	MONTH	YEAR
NAME:	CODE:			

DATA ENTRY OPERATOR

		DAY	MONTH	YEAR
NAME:	CODE:			

(1) General Information

(A) General

RECORD RESPONSE

RESPONDENT: HEAD OF THE HEALTH FACILITY OR HIS/HER DEPUTY IF ABSENT OR UNAVAILABLE.

(1.01)	Are you in charge of this facility today?	YES	1	
		NO	2	
(1.02)	Are you authorized to represent this facility?	YES	1	
		NO	2	
(1.03)	What is your job title at this facility?	Medical officer	01	
		Clinical officer	02	
		State Registered Nurse (SRN)	03	
		State Certified Nurse (SCN)	04	
		Primary Care Nurse (PCN)	05	
		Nurse Midwife	06	
		Nurse Aid (N.A)	07	
		Environmental Health Technician (EHT)	08	
		General Hand (G.H)	09	
		Rehabilitation technician	10	
		Other, specify: ______________	96	
(1.04)	Is this facility a district hospital, mission or a health center	District hospital	01	
		Clinic	02	
		Rural Hospital	03	
		Mission Hospital	04	
		Other, specify	96	
(1.05)	Who owns this health facility?	Government	01	
		Private	02	
		Non Governmental Organization	03	
		Mission/Faith-based organization	04	

		Local government	05	
		Other, specify	96	
(1.06)				
(1.07)	When was the last major investment in the infrastructure? INTERVIEWER: RECORD MONTH <u>AND</u> YEAR. INCLUDE MAJOR PAINTING, PLUMBING, EXTENSIONS TO THE BUILDING, ETC.	a. MONTH MM		
		b. YEAR YYYY IF INVESTMENT WAS OVER MORE THAN ONE YEAR, ONLY RECORD THE MOST RECENT YEAR OF INVESTMENT		
(1.08)	Does this facility provide care round-the-clock (i.e. 24 hours)?	YES, FORMALLY/ OFFICIALLY	01	► **(1.11)**
		YES, INFORMALLY/ IN PRACTICE	02	► **(1.11)**
		NO	03	
(1.09)	At what time of the day does outpatient care start? INTERVIEWER: RECORD IN 24 HOUR FORMAT THROUGHOUT. E.G. IF IT STARTS AT 0700 or IF IT STARTS 1900.	a. Weekdays		
		b. Saturday		
		c. Sunday		
		d. Holidays		
(1.10)	At what time does outpatient care end? INTERVIEWER: RECORD IN 24 HOUR FORMAT THROUGHOUT. E.G. ENDS 0700.or ENDS 1900.	a. Weekdays		
		b. Saturday		
		c. Sunday		
		d. Holidays		
(1.11)	On what days does the facility offer antenatal care clinics, and for how many hours on those days?	a. Monday		
		b. Tuesday		
		c. Wednesday		
	INTERVIEWER: FOR EACH DAY, RECORD THE NUMBER OF HOURS THE SERVICE IF OFFERED. IF SERVICE IS NOT OFFERED THAT DAY, RECORD "00".	d. Thursday		
		e. Friday		
		f. Saturday		
		g. Sunday		
(1.12)	On what days does the facility offer under 5 clinics, and for how many hours on those days?	a. Monday		
		b. Tuesday		
		c. Wednesday		
	INTERVIEWER: FOR EACH DAY, RECORD THE NUMBER OF HOURS THE SERVICE IF OFFERED. IF SERVICE IS NOT OFFERED THAT DAY, RECORD "00".	d. Thursday		
		e. Friday		
		f. Saturday		
		g. Sunday		
(1.13)	What is the distance from the health facility to the nearest higher level health facility <u>one way in kilometers</u>?	KILOMETERS		
(1.22)	What is the primary source of electricity?	Electrical mains/grid	01	
		Generator	02	

		Solar	03	
		No source of electricity	04	► **(1.25)**
		Other (Specify: ______________ __________________________)	96	
(1.23)	Were there any electric power outages in the last 7 days?	YES	1	
		NO	2	► **(1.25)**
(1.24)	How many hours was electric power missing in the last 7 days?	MAXIMUM 168 HOURS		
(1.25)	What is the primary source of water?	Piped into Facility	01	
		Piped into Yard/Plot	02	
		Public tap/Standpipe	03	
		Protected well	04	
		Unprotected well	05	
		Protected spring	06	
		Unprotected spring	07	
		Rainwater	08	
		Tanker Truck/Vendor	09	
		Surface water (lake, river or stream)	10	► **(1.29)**
		Bottled water	11	► **(1.27)**
		Other (Specify: ______________ __________________________)	96	
(1.26)	Is this primary source of water used only by the facility, or is it shared with other users?	ONLY FACILITY	01	
		SHARED	02	
(1.27)	In the last 7 days, was there any time when there was no water available in the facility?	YES	1	
		NO	2	► **(1.29)**
(1.28)	In the last 7 days, for how many hours was there no water available at the facility?	MAXIMUM 168 HOURS		
(1.29)	How long does it take to fetch water from the primary source for the health facility, <u>one way on foot in minutes</u>? IF WATER IN FACILITY, RECORD "0".	MINUTES		
(1.30)	Does the facility have a functioning two-way radio?	YES	1	
		NO	2	
(1.31)	Does the health facility have phone line, whether a landline or a mobile line?	YES, LANDLINE	01	► **(1.34)**
		YES, MOBILE	02	► **(1.34)**
		YES, BOTH	03	► **(1.34)**
		NO	04	
(1.32)	INTERVIEWER: ONLY IF ANSWER TO (1.31) WAS NO: Are there any phone services available in the community apart from the staffs' personal phone that the health facility staff can use if needed?	YES	1	
		NO	2	► **(1.36)**
(1.33)	How long does it take to reach those phone services?	MINUTES		► **(1.36)**
(1.34)	In the last 7 days, was there any time when the facility did not have any telephone service whether landline or mobile?	YES	1	
		NO	2	► **(1.36)**
(1.35)	How many hours was telephone out in the last 7 days?	MAXIMUM 168 HOURS		
(1.36)	Do any of the health facility staff have a mobile phone line?	YES	1	
		NO	2	
(1.37)	Does this facility refer patients to other facilities?	YES	1	

		NO	2	► (1.40)
(1.38)	Where does the facility refer for the following: INTERVIEWER: READ ALL OPTIONS ALOUD. FOR EACH OPTION, RECORD THE FOLLOWING CODES: Hospital…………1 Clinic…………… 2 Mission Hospital……. 3 Does not refer.... 4	a. Lab tests		
		b. Radiology		
		c. In-patient		
		d. Specialized care		
		e. Surgery		
		f. Uncomplicated delivery		
		g. Complicated delivery		
		h. Other, specify:________________________		
(1.39)	How far is the main referral facility from this facility <u>one way in kilometers</u>?	KILOMETERS		
(1.40)	Does the facility have access to any kind of transportation (to pick up patients or take them to referral facility)?	YES	1	
		NO	2	► (1.44)
(1.41)	How many working [VEHICLES] does the facility have access to? **INTERVIEWER: READ OPTIONS ALOUD. FOR EACH OPTION, RECORD NUMBER OF <u>WORKING</u> VEHICLES AVAILABLE. IF ZERO, RECORD 00.** **OWN REFERS TO OWNED BY THE FACILITY OR THE INDIVIDUAL.**	**a.** Ambulance owned by facility		
		b. Ambulance owned by District Health Executive		
		c. Private vehicle rented full time		
		d. Private vehicle rented part time		
		e. Other vehicle owned by facility		
		f. Private vehicles on call		
		g. Motorbike owned by facility		
		h. Rented motorbike		
		i. Bicycle owned by facility		
		j. Other, specify:________________________		
(1.42)	In the last 7 days, was there any time when there was no transportation available for patients?	YES	1	
		NO	2	► (1.44)
(1.43)	How many days was transportation unavailable in the last 7 days?	MAXIMUM 7 DAYS		
(1.44)	Does the facility own a functioning computer?	YES	1	
		NO	2	
(1.45)		YES	1	
		NO	2	
(B)	**Universal Precautions**			RECORD RESPONSE
	RESPONDENT: HEAD OF THE HEALTH FACILITY OR HIS/HER DEPUTY IF ABSENT OR UNAVAILABLE.			
(1.45)	Does the facility have a general outpatient consultation room?	YES, SEEN	01	
		YES, NOT SEEN	02	
		NO	03	► (1.49)
(1.46)	Is this room equipped with a safety box or closed container present for disposal of used sharps?	YES, SEEN	01	
		YES, NOT SEEN	02	
		NO	03	

(1.47)	Does the room have posted procedures for decontamination procedure steps?	YES, SEEN	01		
		YES, NOT SEEN	02		
		NO	03		
(1.48)	Does the room have a basin with a water source and soap?	YES SEEN,	01		
		YES, NOT SEEN	02		
		NO	03		
(1.49)	What disinfectant(s) are being used in the facility? **CODE 01 IF MENTIONED AND CODE 02 IF NOT MENTIONED.**	Chlorhexidine (gluconate)	01		
		Sodium Hypochlorite/Chlorine solution/JIK solution	03		
		Methylated spirit		#	
		Other: _____________	96		
(1.50)	In the last 30 days, was there any time when there was a stock-out of disinfectant(s) in the facility?	YES	1		
		NO	2	► **(1.52)**	
(1.51)	In the last 30 days, for how many days was there a stock-out of disinfectant(s) in the facility?	DAYS			
(1.52)	Is there a functional incinerator for disposing of medical waste?	YES, SEEN	01		
		YES, NOT SEEN	02		
		NO	03		
(1.53)	What procedure is used for **INITIAL** decontaminating medical equipment after use?	SOAKED IN DISINFECTANT SOLUTION AND THEN BRUSH SCRUBBED WITH SOAP+WATER	01		
		BRUSH SCRUBBED WITH SOAP AND WATER AND THEN SOAKED IN DISINFECTANT SOLUTION	02		
		BRUSH SCRUBBED WITH SOAP AND WATER ONLY	03		
		SOAKED IN DISINFECTANT SOLUTION ONLY	04		
	INTERVIEWER: DO NOT READ OPTIONS ALOUD. RECORD SINGLE RESPONSE. IF SEVERAL DECONTAMINATION TECHNIQUES, **RECORD MOST USED ONE.**	CLEANED WITH SOAP & WATER	05		
		EQUIPMENT NEVER DECONTAMINATED	06		
		EQUIPMENT NEVER REUSED	07	► **(1.55)**	
		OTHER (SPECIFY: ________ ________________________)	96		
(1.54)	What procedure is used for sterilizing medical equipment before reuse?	DRY-HEAT STERILIZATION	01		
		AUTOCLAVING	02		
		BOILING	03		
	INTERVIEWER: DO NOT READ OPTIONS ALOUD. RECORD SINGLE RESPONSE. IF SEVERAL STERILIZATION TECHNIQUES, **RECORD MOST USED ONE.**	STEAM STERILIZATION	04		
		CHEMICAL METHOD	05		
		PROCESSED OUTSIDE FACILITY	06		
		NONE	07		
		OTHER, SPECIFY: ________	96		
(1.55)	Is the protocol for sterilizing equipment displayed?	DISPLAYED	01		
		NOT DISPLAYED	02		
(1.56)	Is there a provision for the disposal of bio medical waste?	YES	1		
		NO	2	► **(2.01)**	
(1.57)	How is biomedical waste disposed of?	BURIED IN PIT	01		
		BURNED	02		
		INCINARATOR	03		

	INTERVIEWER: DO NOT READ OPTIONS ALOUD. RECORD SINGLE RESPONSE. IF SEVERAL WASTE DISPOSAL METHODS, **RECORD MOST USED ONE.**	OTOWAY PIT	04	
		THROWN OUTSIDE	05	
		OUTSOURCED	06	
		OTHER, SPECIFY: ________	96	

(2)	Administration and Management			RECORD RESPONSE
RESPONDENT: HEAD OF THE HEALTH FACILITY OR HIS/HER DEPUTY IF ABSENT OR UNAVAILABLE.				
(2.01)	Is there a Hospital/Health Center Committee/Ward Health Team for this health facility?	YES	1	
		NO	2 ► **(2.08)**	
(2.02)	How many members are on this Committee?			
(2.03)	Is there a representation of any of the following on this Committee? INTERVIEWER: READ ALL OPTIONS ALOUD. FOR EACH OPTION, RECORD "1" IF YES, "2" IF NO.	**a.**	Health facility director/head	
		b.	Health facility staff	
		c.	Neighborhood health committees	
		d.	Community Health Workers	
		e.	Ministry of Health / District Health Executive Team	
		f.	Non Governmental Organization staff	
		g.	Other, specify: ___________________________	
(2.04)	<u>In the last 12 months</u>, how many Hospital/Health Center Committee meetings were held?			
(2.05)	Does the facility have written records of the Hospital/Health Center Committee meetings (minutes, decisions, etc.)?	YES, SEEN	1	
		YES, NOT SEEN	2	
		NO	3	
(2.06)	What initiatives were taken by the Hospital/Health Center Committee and implemented <u>in the last 12 months</u>? DO NOT READ OPTIONS ALOUD. FOR EACH OPTION, RECORD "1" IF MENTIONED, "2" IF NOT MENTIONED.	**a.**	ADMINISTRATIVE SUPPORT TO FACILITY, E.G. APPROVING PAYMENTS	
		b.	PROVIDED NEW SUPPLIES OR EQUIPMENT	
		c.	PROVIDED NEW INFRASTRUCTURE	
		d.	PROVIDED REPAIRS TO FACILITY	
		e.	PROVIDED DRUGS	
		f.	SENSITIZATION / MOBILIZED COMMUNITY TO USE THE HEALTH FACILITY	
		g.	PROVIDED TRANSPORT TO STAFF FOR HOME VISITS	
		h.	GAVE IN-KIND CONTRIBUTIONS	
		i.	IMPROVED SECURITY AT THE FACILITY	
		j.	IMPROVED WATER QUALITY	
		k.	IMPROVED WATER SUPPLY (QUANTITY)	
		l.	SUPPORTED TRAINING FOR COMMUNITY HEALTH WORKERS	
		m.	SUPPORTED OUTREACH TEAMS	
		n.	VERIFIED HEALTH FACILITY MATERNAL AND CHILD HEALTH-RELATED RESULTS	
		o.	ENVIRONMENTAL SANITATION (E.G. DESTRUCTION OF MOSQUITO BREEDING SITES)	
		p.	INDOOR RESIDUAL SPRAY	
		q.	SCREENING OF DISEASES	
		r.	REPORTED AND COLLECTED DATA FOR RESULTS-BASED FINANCING ACTIVITIES	

		s. DESIGNED THE RESULTS-BASED FINANCING SCHEME	
		t. PARTICIPATED IN TRAINING AND AWARENESS RAISING OF THE RESULTS-BASED FINANCING SCHEME	
		u. OTHER, SPECIFY: ______________________	
(2.08)	Has a facility workplan been developed for the current financial year? ASK TO SEE THE WORKPLAN.	YES, SEEN 01 YES, NOT SEEN 02 NO 03 ► **(2.11)**	
(2.09)	Who was involved in setting this operational plan? READ ALL OPTIONS ALOUD. FOR EACH OPTION, RECORD "1" IF YES, "2" IF NO.	**a.** Health facility head/in-charge	
		b. Health facility staff	
		c. Non governmental Organization staff	
		d. Ministry of Health / District Health Executive Team	
		e. Wardhealth committees	
		f. Hospital/Health center committee	
		g. Hospital management	
		h. Community Health Worker Cooperative president / leader	
		i Community Health Workers	
		j. Community members	
		k. Health Center Committee	
		l. Other, specify: _____________________	
(2.10)	Are priority health-related activities identified in this workplan for the current financial year?	YES 1 NO 2 ► **(2.12)**	
(2.11)	Now I will read you a list of services. For each service, please tell me whether this service is a priority or not a priority for this fiscal year. READ ALL OPTIONS ALOUD. FOR EACH OPTION, RECORD "1" IF YES/priority, "2" IF NO/NOT A PRIORITY.	**a.** Prenatal care	
		b. Institutional delivery	
		c. Postnatal care	
		d. Immunization	
		e. Curative consultations	
		f. Family planning/Reproductive health	
		g. Nutrition	
		h. Integrated management of childhood illness	
		i. Malaria	
		j. Tuberculosis	
		k. HIV/AIDS	
		l. Health promotion and monitoring	
		m. Other, specify: ______________________	
(2.12)	How many health facility staff meetings were held in the last 3 months?		
(2.13)	Do all facility staff have written job descriptions?	All have work descriptions 01 Some have work descriptions 02 None have work descriptions 03	
(2.14)	In the last 3 months, how many visits were made by a district health executive team for supervision or technical assistance? IF ZERO, RECORD "0"	-	
(2.15)	In the last 3 months, how many meetings were made by this health facility with Community Health Workers for supervision or technical support? IF ZERO, RECORD "0".		

(3) Human Resources

RESPONDENT: HEAD OF HUMAN RESOURCES, HEAD OF THE FACILITY OR BEST INFORMED STAFF MEMBER

(A)	Human Resources Management			RECORD RESPONSE
(3.01)	Who has the authority to employ new staff?	a.	Health facility manager/in charge	
		b.	Health facility staff	
		c.	Ministry of Health / District Health Executive Teams	
	READ ALL OPTIONS ALOUD. FOR EACH OPTION, RECORD "1" IF YES, "2" IF NO.	d.	Public Service Commission	
		e.	Local government	
		f.	Non Governmental Organization	
		g.	Community Health Workers	
		h.	Community members	
		i.	Health Services Board	
		j.	Other, specify: ______________________	
(3.02)	Who has the authority to dismiss staff?	a.	Health facility manager/in charge	
		b.	Health facility staff	
		c.	Ministry of Health / District Health Executive	
	READ ALL OPTIONS ALOUD. FOR EACH OPTION, RECORD "1" IF YES, "2" IF NO.	d.	Public Service Management division at cabinet office	
		e.	Local government	
		f.	Non Governmental Organization	
		g.	Community Health Workers	
		h.	Community members	
		i.	Health Services Board	
		j.	Church	
		k.	Other, specify: ______________________	

FOR EACH TYPE OF POSITION LISTED BELOW, ASK QUESTIONS (3.04) TO (3.07). IF ZERO, RECORD 0.

			(3.04)	(3.05)	(3.06)	(3.07)
	POSITION TYPE		What is the establishment for each staff category for the facility [POSITION TYPE]s?	How many positions for [POSITION TYPE] are currently filled?	In the last 12 months, how many [POSITION TYPE] have left the facility permanently?	How many [POSITION TYPE] work regularly do locums and are not part of the staff complement

	Medical officer	a.				
	Clinical officer	b.				
	State Registered Nurse (SRN)	c.				
	State Certified Nurse (SCN)	d.				
	Primary Care Nurse (PCN)	e.				
	Nurse Midwife	f.				
	Nurse Aid (N.A)	g.				
	Environmental Health Technician (EHT)	h.				
	General Hand (G.H)	i.				
	Rehabilitation technician	j.				
	Other, specify:________________________	k.				

(B)	**Village Health Workers**		RECORD RESPONSE
(3.08)			
(3.10)	Does the health facility catchment area have active Village Health Workers (VHWs)?	YES 1 NO 2 ► **(3.14)**	
(3.11)	How many Village Health Workers are currently active in this catchment area?	a. FEMALE b. MALE	
(3.12)	Is there any Village Health Worker who has stopped working in the <u>last 12 months</u>?	YES 1 NO 2 ► **(3.14)**	
(3.13)	How many Village Health Workers have stopped working in the <u>last 12 months</u>?	a. FEMALE b. MALE	
(3.14)	Does the health facility catchment area have active Traditional Birth Attendants (TBA)?	YES 1 NO 2 ► **(5.01)**	
(3.15)	How many Traditional Birth Attendants are currently active in this catchment area?		
(3.16)	Is there any Traditional Birth Attendant who has stopped working in the <u>last 12 months</u>?	YES 1 NO 2 ► **(5.01)**	
(3.17)	How many Traditional Birth Attendants have stopped working in the <u>last 12 months</u>?		

(5) Laboratory

RESPONDENT: LAB TECHNICIAN OR BEST INFORMED STAFF MEMBER

(5.01)	Does the facility provide laboratory services?	YES 1 NO 2 ► **(6.01)**		

(A) Lab Tests

		(5.02)	**(5.03)**	**(5.04)**
		For the following tests, please tell me if you are able to perform them today, if you were able to perform them 3 months ago but not today, or if you simply cannot do this test (today or 3 months ago). INTERVIEWER: RECORD ONE RESPONSE FOR EACH TEST. Able to do this test today 01 Able to do in past 3 months but not today 02 Cannot do this test, today or in past 3 months 03	How many of the […] tests were conducted in the <u>last 3 months</u>? INTERVIEWER: IF NONE, RECORD "0". RECORD ONE RESPONSE FOR EACH TEST.	INTERVIEWER: RECORD SOURCE OF THE INFORMATION. RECORD ONE RESPONSE FOR EACH TEST. RECORDS 01 NO RECORDS AVAILABLE, ORAL REPORT 02
a.	White cell and red cell counts			
b.	Hemoglobin estimation			
c.	Blood type and cross match			
d.	Malaria smears (thick and thin)/ Rapid diagnostic test			
e.	Tuberculosis smears			
f.	Gram stains			
g.	HIV testing			
h.	Hepatitis B testing			
i.	Hepatitis C testing			
j.	Syphilis testing (RPR Test)			
k.	Urine dipstick tests			
l.	Pregnancy testing			
m.	Blood sugar			
n.	Stool tests for parasites			
o.	Stool tests for occult blood			

p .	Liver function testing		

(B)	Lab Equipment		RECORD RESPONSE
(5.05)	Where is the lab equipment located?	Separate laboratory 01	
		Room that is also used for other activities 02	
		Other, specify: ________________ 96	
(5.06)	INTERVIEWER: RECORD QUANTITY OF EACH EQUIPMENT FUNCTIONING. RECORD ONE RESPONSE FOR EACH EQUIPMENT. RECORD 98 IF NOT FUNCTIONING OR NOT AVAILABLE.	a. Microscope	
		b. Centrifuge	
		c. Hemoglobinometer	
		d. Refrigerator for storing reagents	
(5.07)	Is there a Tuberculosis Laboratory Register? INTERVIEWER: IF YES, ASK TO SEE IT.	YES, SEEN 01	
		YES, NOT SEEN 02	
		NO 03	
(5.08)	How many laboratory technicians are trained in Acid-Fast Bacilli (AFB) microscopy? INTERVIEWER: CHECK THE NUMBER DOES NOT EXCEED THE TOTAL NUMBER OF LABORATORY TECHNICIANS		

(6) Services

RESPONDENT: HEAD OF THE FACILITY OR BEST INFORMED STAFF MEMBER

(A)	Vaccination Services				RECORD RESPONSE
(6.01)	Does this facility provide immunization services?	YES	1		
		NO	2	▶ (6.13)	
(6.02)	Is there a separate room or area for immunizations?	YES	1		
		NO	2		
(6.03)	Are immunizations regularly given to children at the facility or in outreach activities?	Facility only	01		
		Outreach only	02		
		Facility and outreach	03		
(6.04)	Is there a vaccination outreach work plan for the current year?	YES	1		
		NO	2		
(6.05)	In the last 30 days, on how many days did the facility staff do vaccination outreach in the community?				

(6.06)	How many of the following storage methods does this site have for storing vaccines? INTERVIEWER: IF ZERO, RECORD '0'.	a. Ice Lined Refrigerator (ILR)				
		b. Cold Box				
		c. Refrigerator				
		d. Vaccine Carriers				
(6.07)	Is a temperature log kept? INTERVIEWER: IF YES, ASK TO SEE IT.	YES, SEEN	01			
		YES, NOT SEEN	02			
		NO	03	▶	**(6.11)**	
(6.08)	In the past 7 days, on how many days was the temperature logged?					
(6.09)	In the past 7 days, how many times was the temperature logged in total?					
(6.10)	In the past 7 days, how many days had a measurement of over 8^0C or under 2^0C?					
(6.11)	Are immunization cards issued to every child starting his/her immunization schedule?	YES	1			
		NO	2	►	**(6.13)**	
(6.12)	After a child starts its immunization schedule, where are the immunization cards kept?	Given to caregiver to bring for next visit	01	►	**(6.13)**	
		Kept at facility	02			
		One copy given to caregiver and one kept at facility	03			
		Other, specify: ___________	96	►	**(6.13)**	
(B)	**Antenatal Care Services**					RECORD RESPONSE
(6.13)	Are antenatal services provided at this facility?	YES	1			
		NO	2	▶	**6.24**	
(6.14)	Are pregnant women seen at specific times separate from times for other patients?	YES	1			
		NO	2			
(6.15)	In the last 30 days, how many days has antenatal care been available to women?	MAXIMUM 30 DAYS				
(6.17)	In the last 6 months, on how many days did the facility staff do outreach in the community for antenatal care?					
(6.18)	In the last 6 months, were iron and folate routinely prescribed? **INTERVIEWER: CHECK RECORDS. IF NO RECORDS, ASK IN-CHARGE. RECORD ANSWER BASED ON WHETHER RECORDS WERE SEEN OR NOT.**	RECORDS SEEN: All the time	01			
		RECORDS SEEN: Sometimes	02			
		RECORDS SEEN: Seldom or never	03			
		RECORDS NOT SEEN, ORAL REPORT: All the time	04			

		RECORDS NOT SEEN, ORAL REPORT: Sometimes	05		
		RECORDS NOT SEEN, ORAL REPORT: Seldom or never	06		
(6.19)	Do women who come to the facility for antenatal care get an antenatal or maternal health card?	YES	1		
		NO	2	► **6.24**	

(12) Direct Observation

INTERVIEWER: THERE IS NO RESPONDENT FOR THIS SECTION OF THE QUESTIONNAIRE. AFTER SEEKING PERMISSION, YOU SHOULD WALK AROUND THE FACILITY AND OBSERVE THE ITEMS OUTLINED IN THIS SECTION.

(A)	**General**				RECORD RESPONSE
(12.01)	Is there a reception/registration room in this facility? INTERVIEWER: CONFIRM WITH DIRECT OBSERVATION.	YES	1		
		NO	2		
(12.02)	Is there a waiting room in this facility? INTERVIEWER: CONFIRM WITH DIRECT OBSERVATION.	YES	1		
		NO	2		
12.03	Is there privacy in the consultation room?	YES	1		
		NO	2		
12.04	Is there privacy in the delivery room?	YES	1		
		NO	2		
(12.05)	Are there observation beds in this facility? INTERVIEWER: CONFIRM WITH DIRECT OBSERVATION.	YES	1		
		NO	2	► **(12.10)**	
(12.06)	INTERVIEWER: RECORD HOW MANY OBSERVATION BEDS ARE PRESENT. IF ZERO, RECORD "0".				
(12.07)	Are there separate wards for men and women in this facility? INTERVIEWER: CONFIRM WITH DIRECT OBSERVATION.	YES	1		
		NO	2	► **(12.10)**	
(12.08)	Number of beds for Men. INTERVIEWER: CONFIRM WITH DIRECT OBSERVATION.				
(12.09)	Number of beds for Women. INTERVIEWER: CONFIRM WITH DIRECT OBSERVATION.				
(12.10)	Is a functional toilet facility available? INTERVIEWER: CONFIRM WITH DIRECT OBSERVATION.	YES	1		
		NO	2		

(12.11)	Are there separate toilet facilities for men and women? INTERVIEWER: CONFIRM WITH DIRECT OBSERVATION.	YES	1	
		NO	2	
(12.12)	Does the facility have accommodation for health workers who are on-call during non-routine hours, e.g. night shift? INTERVIEWER: CONFIRM WITH DIRECT OBSERVATION.	YES	1	
		NO	2	
(C)	**National Protocols**			RECORD RESPONSE
INTERVIEWER: ASK THE FACILITY HEAD OR BEST INFORMED STAFF MEMBER TO SEE THE CLINICAL CARE PROTOCOLS. FOR EACH OF THE FOLLOWING, RECORD IF YOU HAVE SEEN OR NOT SEEN THE PROTOCOL / GUIDELINES / MATERIALS.				
(12.18)	Patient education materials (Information and Education Campaign materials)	SEEN	01	
		NOT SEEN	02	
(12.19)	Integrated Management of Childhood Illness (IMCI) chart booklet or wall chart	SEEN	01	
		NOT SEEN	02	
(12.20)	Mastercard for growth monitoring	SEEN	01	
		NOT SEEN	02	
(12.21)	National protocol for tuberculosis diagnosis and treatment	SEEN	01	
		NOT SEEN	02	
(12.22)	Health Management Information System (HMIS) guidelines	SEEN	01	
		NOT SEEN	02	
(12.23)	Health Management Information System (HMIS) Data	SEEN	01	
		NOT SEEN	02	
(12.24)	National Protocol for malaria diagnosis and treatment	SEEN	01	
		NOT SEEN	02	
(12.25)	National protocol for child vaccination	SEEN	01	
		NOT SEEN	02	
(12.26)	National protocol for reproductive health/family planning	SEEN	01	
		NOT SEEN	02	
(12.27)	National protocol for reducing unsafe abortion morbidity/mortality	SEEN	01	
		NOT SEEN	02	
(12.28)	Antenatal Care National Standards	SEEN	01	
		NOT SEEN	02	
(12.29)	Newborn Care National Standards	SEEN	01	
		NOT SEEN	02	
(12.30)	Post-Partum Care National Standards	SEEN	01	
		NOT SEEN	02	
(12.31)	Procedures Manual for Infection Prevention and Control	SEEN	01	
		NOT SEEN	02	
(12.32)	Management of Sexually Transmitted Infections (STI) guidelines	SEEN	01	
		NOT SEEN	02	
(12.33)	National HIV testing and counseling guidelines	SEEN	01	
		NOT SEEN	02	
(12.34)	Prevention of mother to child transmission of HIV (PMTCT)	SEEN	01	

	guidelines	NOT SEEN	02	
(12.35)	HIV treatment (Antiretroviral therapy, ART) guidelines	SEEN	01	
		NOT SEEN	02	
(12.36)	HIV treatment (Antiretroviral therapy, ART) for children/infants guidelines	SEEN	01	
		NOT SEEN	02	
(12.37)	Essential drugs list (EDLIZ)	SEEN	01	
		NOT SEEN	02	
(12.38)	National protocol for drug procurement	SEEN	01	
		NOT SEEN	02	
(12.39)	Detecting and reporting adverse drug or vaccine reaction	SEEN	01	
		NOT SEEN	02	

(13) Equipment (Direct Observation)

	INTERVIEWER: THERE IS NO RESPONDENT FOR THIS SECTION OF THE QUESTIONNAIRE. AFTER SEEKING PERMISSION, YOU SHOULD WALK AROUND THE FACILITY AND OBSERVE THE ITEMS OUTLINED IN THIS SECTION.			
	General equipment			RECORD RESPONSE
(13.01)	Where is the outpatient equipment located?	Separate outpatient room	01	
		Room that is also used for other activities	02	
		Other, specify: ___________________	96	
(13.02)	PLEASE RECORD THE QUANTITY FOR EACH TYPE OF EQUIPMENT. RECORD 98 IF NOT FUNCTIONING OR NOT AVAILABLE			QUANTITY AVAILABLE AND FUNCTIONING
a.	Timer or clock with seconds hand			
b.	Children’s weighing scale			
c.	Height measure			
d.	Tape measure			
e.	Adult weighing scale			
f.	Blood pressure instrument			
g.	Thermometer			
h.	Stethoscope			
i.	Fetoscope			
j.	Otoscope			
k.	Suction/aspirating device (Penguin Sucker)			
l.	Vision chart			
m.	Oxygen tank			
n.	Ambubag			
o.	Incubator			
p.	Drip Stand			
q.	Flashlight			
r.	Stretcher			
s.	Wheel chair			
t.	Minor surgical instruments for procedures like incision & drainage and suturing (forceps, scalpel)			
u.	Oral Rehydration Therapy (ORT) corner with equipment *(I liter container, cups and spoons and rehydration guidelines)*			
v	Resuscitare			

Sterilizing Equipment				RECORD RESPONSE
(13.03)	Where is the sterilization equipment located?	Separate sterilization room	01	
		Room that is also used for other activities	02	
		Other, specify: ___________________	96	
(13.04)	PLEASE RECORD THE QUANTITY FOR EACH TYPE OF EQUIPMENT. RECORD 98 IF NOT FUNCTIONING OR NOT AVAILABLE			QUANTITY AVAILABLE AND FUNCTIONING
a.	Electric autoclave (pressure and wet heat)			
b.	Non-electric autoclave (pressure and wet heat)			
c.	Electric dry heat sterilizer			
d.	Electric boiler or steamer (no pressure)			
e.	Non-electric pot with cover (steam boil)			
f.	Heat source for non-electric equipment			
g.	Automatic timer (MAY BE ON EQUIPMENT)			
h.	Time, Steam and Temperature (TST) Indicator strips or other sterilization indicators			
Vaccination Equipment				RECORD RESPONSE
(13.05)	Where is the vaccination equipment located? (VACCINATION EQUIPMENT: VACCINE FRIDGE PARRAFIN OR ELECTRIC, COLD BOX, VACCINE CARRIERS)	Separate vaccination room	01	
		Room that is also used for other activities	02	
		Other, specify: ___________________	96	
(13.06)	PLEASE RECORD THE QUANTITY FOR EACH TYPE OF EQUIPMENT. RECORD 98 IF NOT FUNCTIONING OR NOT AVAILABLE			QUANTITY AVAILABLE AND FUNCTIONING
a.	Main vaccine thermometer			
b.	Cold box / Vaccine carrier			
c.	Ice packs			
d.	Refrigerator			
Antenatal Care Equipment				RECORD RESPONSE
(13.07)	Where is the antenatal care equipment located? (ANTENATAL CARE EQUIPMENT: FETOSCOPE, BLOOD PRESSURE INSTRUMENT, TAPE MEASURE, ADULT WEIGHING SCALE)	Separate antenatal care room	01	
		Room that is also used for other activities	02	
		Other, specify: ___________________	96	

(14) Drug and Vaccine Storage and Availability

RESPONDENT: PHARMACIST, HEAD OF THE FACILITY OR BEST INFORMED STAFF MEMBER.

	(14.11)	**(14.12)**	**(14.13)**	**(14.14)**
	What is the strength of [DRUGS] that is stocked? **IF NONE, RECORD 00**	What quantity of [DRUGS] are available at this time?	In the past 30 days, has the item been out of stock at any time?	In the past 30 days, how many days has the item been out of stock?

			IF NONE, RECORD 00 and ► (14.14)	YES 1 NO 2 ►NEXT DRUG	
a.	Tetracycline ophthalmic ointment	_____ %			
b.	Amoxicillin (tabs or capsule)	_____ mg			
c.	Amoxicillin (syrup)	_____ mg			
d.	Doxycycline capsules	_____ mg			
e.	Cotrimoxazole tabs	_____ mg			
f.	Cotrimoxazole syrup	_____ mg/ml			
g.	Procaine Pen inj	_____ IU			
h.	Penicillin benzathine injection	_____ IU			
i.	Gentamycin	_____ mg/ml			
j.	Metronidazole	_____ mg			
k.	Norfloxacin	_____ mg			
l.	Kanamycin	_____ mg			
m.	Analgesics/Narcotics	_____ mg			
n.	Cloxacillin syrup	_____ mg/ml			
p.	Paracetamol (Panadol) tabs	_____ mg			
q.	Paracetamol syrup	_____ mg/ml			
u.	Morphine inj	_____ mg/ml			
v.	Morphine tabs	_____ mg			
w.	Pethedine im	_____ mg/ml			
x.	Diazepam injection	_____ mg/ml			
y.	Iron tabs (with or without folic acid)	1 tab			
z.	Folic acid tabs	1 tab			
aa.	Vitamin A	1 capsule			
ak.	Chloroquine	1 tab			
al.	Quinine	1 tab			
am.	Fansidar / Sulphadoxine-Pyrimethamine (SP)	1 tab			
an	Artemisinin-Based Combination Therapy ACT (fansidar + artesunate) / Coartem	1 tab			
be.	Oral Rehydration Solution (ORS) packets	1 packet			
bf.	Ringers Lactate	_____ ml			
bg.	Normal Saline	_____ ml			
bh.	5% Dextrose	_____ ml			
bn.	Bacille Calmette-Guérin (BCG)	1 dose			
bo.	Oral Polio Vaccine (OPV)	1 dose			
bp.	Tetanus Toxoid (TT)	1 dose			
bq.	Diphtheria Pertussis Tetanus (DPT)	1 dose			
br.	Hepatitis B Vaccine (HBV) Tetravalent	1 dose			
bs.	Measles vaccine	1 dose			

bt.	HiB vaccine	1 dose			
bu.	Pentavalent (DPT, Hepatitis B, Hemophilus influenzae B)	1 dose			
bv.	Pneumococcol Vaccine				
bw.	Malaria rapid diagnostic kits	1 unit			
bx.	HIV test kit	1 unit			
by.	Pregnancy testing kit	1 unit			
bz.	Rapid plasma reagin (RPR) test for syphilis	1 unit			
ca.	Urine Dip stick	1 unit			

RBF HEALTH FACILITY MIDLINE SURVEY
ZIMBABWE
2014
Exit Interview for Antenatal Care Visit

PROVINCE NAME	PROVINCE CODE	DISTRICT NAME	DISTRICT CODE	HEALTH FACILITY NAME	HEALTH FACILITY CODE

RESULT OF THE INTERVIEW		
	INTERVIEW DONE	01
	PARTIALLY COMPLETED	02
	REGISTERED PERSON REFUSED INTERVIEW	03
	OTHER, SPECIFY:	96

INTERVIEWER	CODE

	DAY	MONTH	YEAR
VISIT 1			
VISIT 2			
VISIT 3			

LANGUAGE

SHONA	01	OTHER, SPECIFY:	04
NDEBELE	02		
ENGLISH	03		

INTERVIEW	RESPONDENT	Translator Used?		
			NEVER	01
			SOMETIMES	02
			ALWAYS	03

SUPERVISOR	CODE	DAY	MONTH	YEAR	DATA ENTRY OPERATOR	CODE	DAY	MONTH	YEAR

CONTROL INFORMATION

Section 1: Identification			***RECORD RESPONSE***
(1.00)	Health Worker Tracking No. **[FROM THE ROSTER IN HEALTH FACILITY INSTRUMENT**]		
(1.01)	Health worker sex	Male 1	
		Female 2	

(1.02)	Type of Worker	Doctor	1	
		Nurse Midwife	2	
		Nurse	3	
		Nurse aid	4	
		Traditional Birth Attendant	5	
		Village Health Worker	6	
		Other	96	
		Specify		
(1.03)	Type of Facility	Central Hospital	1	
		Provincial Hospital	2	
		District Hospital	3	
		Rural Hospital	4	
		Urban/Municipal Clinic	5	
		Rural Health Center	6	
		Mission Hospital	7	
		Mission Clinic	8	
		Private Hospital	9	
		Specify		
		Other	96	
		Specify		
(1.04)	Patient age (years)	Years		
(1.05)	Can you (the respondent) read and write?	Yes	1	
		No	2	
(1.06)	What is the highest level of education obtained by you (RESPONDENT)?	Preschool	1	
		Primary	2	
		Secondary	3	
		Tertiary	4	
		None	5	
		Other	96	
		Specify		
(1.07)	What is the highest (grade/form/year) completed at that level? IF COMPLETED LESS THAN ONE YEAR AT THAT LEVEL, RECORD '00'.			

2 Treatment and counseling	**RECORD RESPONSE**

(2.01)	Do you have an antenatal-care card/book? IF YES: ASK TO SEE THE CARD/BOOK.	Yes	1		
		No, card kept with facility	2	► **(2.06)**	
		No, card/book used	3	► **(2.06)**	
(2.02)	CHECK ANTENATAL-CARE CARD/BOOK, INDICATE WHETHER THERE IS ANY NOTE OR RECORD OF THE CLIENT HAVING RECEIVED TETANUS TOXOID.	Yes, 1 time	1		
		Yes, 2 or more times	2		
		No	3		
(2.03)	HOW MANY WEEKS PREGNANT IS THE CLIENT, ACCORDING TO THE ANC CARD? In WEEKS	Information not available	99		
(2.04)	DOES THE CARD INDICATE THE CLIENT HAS RECEIVED IPT? (IF NON MALARIOUS AREA, CHOOSE "NOT APPLICABLE")	Yes, 1 dose	1		
		Yes, 2 doses	2		
		No	3		
		Not applicable	98		
(2.05)	DOES THE CARD/BOOK MENTION THE CLIENT'S BLOOD GROUP?	YES	1		
		NO	2		
(2.06)	How long have you been pregnant? (Record Months OR Weeks) RECORD 99, IF NOT KNOWN	a. Weeks			
		b. Months			
(2.07)	Is this your first pregnancy?	Yes	1		
		No	2		
(2.08)	Is this your first	Yes	1	► **(2.10)**	

	antenatal visit at this facility for this pregnancy?	No 2	
(2.09)	Including this visit, how many antenatal care visits have you had for this pregnancy to this health facility?		
(2.10)	How many antenatal care visits have you had for this pregnancy to other health facilities?		
(2.11)	Was your medical history taken during the first visit of your ANC booking?	YES 1 NO 2	
(2.12)	Was your obstestric history taken during the first visit of your ANC booking	YES 1 NO 2	
(2.13)	During this visit, were you weighed?	YES 1 NO 2	
(2.14)	During this visit or earlier visit, was your height measured?	YES 1 NO 2	
(2.15)	During this visit, did someone measure your blood pressure?	YES 1 NO 2	
(2.16)	During this visit, did you give a urine sample?	YES 1 NO 2	
(2.17)	During this visit, did you give a blood sample?	YES 1 NO 2	
(2.18)	During this visit were you checked for anaemia?	YES 1 NO 2	
(2.19)	During this visit were you checked for oedema of face, hands and legs?	YES 1 NO 2	
(2.20)	During this visit	YES 1	

	was the fetal heart checked?	NO	2	
(2.21)	During this visit, did you schedule your delivery in the facility?	YES	1	
		NO	2	
(2.22)	During this visit, was your abdomen measured with a tape?	YES	1	
		NO	2	
(2.23)	During this visit, did the provider palpate your abdomen?	YES	1	
		NO	2	
(2.24)	During this visit or earlier visit, did the health worker estimate your delivery or due date?	YES	1	
		NO	2	
(2.25)	During this visit, did a health worker ask for your blood type/group?	YES	1	
		NO	2	
(2.26)	During this visit, did a health worker give you advice on your diet (this is, what to eat and drink) during pregnancy?	YES	1	
		NO	2 ► **(2.28)**	
(2.27)	What types of food did the health worker advise you to eat during pregnancy?	a. GREEN LEAFY VEGETABLES		
		b. MILK		
	DO NOT CITE ANSWERS, BUT FOR EACH OPTION RECORD "1" IF MENTIONED, "2" IF NOT MENTIONED. YOU MAY PROBE WITHOUT USING SPECIFIC ANSWERS (E.G., "ANYTHING	c. MEAT AND POULTRY		
		d. FRUITS AND NUTS		
		e. SADZA/RICE/POTATOES/KASAVA		
		f. OTHER (SPECIFY: ______________________)		

	ELSE?")			
(2.28)	During this visit, or previous visits, did the provider give you iron pills, folic acid or iron with folic acid, or give you a prescription for them?	Yes, this visit	1	
		Yes, previous visit	2 ► (2.30)	
		No	3 ► (2.33)	
		Don't know	99 ► (2.33)	
(2.29)	ASK TO SEE THE CLIENT'S IRON/FOLIC ACID/IRON WITH FOLIC ACID PILLS.	Saw pills	1	
		Saw prescription	2	
		No pills or prescription	3	
(2.30)	During this visit or previous visits, has a provider explained to you how to take the iron pills?	Yes, this visit	1	
		Yes, previous visit	2	
		No	3	
(2.31)	During this or previous visits, has a provider discussed with you the side effects of the iron pill?	Yes, this visit	1	
		Yes, previous visit	2	
		No	3	
(2.32)	Please tell me any side effects of the iron pill that you know of. RECORD "1" IF Mentioned, "2" IF Not mentioned. FOR EACH OPTION. DO NOT READ THE LIST.	a. Nausea		
		b. Black stools		
		c. Constipation		
		d. Other		
		Specify		
(2.33)	During this or previous visits, has a provider given or prescribed any anti-malarial pills for you? SHOW THE CLIENT CAPSULES OF FANSIDAR.	Yes, this visit	1	
		Yes, previous visit	2	
		No	3 ► (2.36)	
(2.34)	ASK TO SEE	Yes I have seen the Capsules	1	

	THE CLIENT'S ANTI-MALARIA CAPSULES or PRESCRIPTION	Yes I have seen the prescription	2	
		I have neither seen the capsules or prescription	3	
(2.35)	Did a provider explain to you how to take the anti-malarial pills?	Yes, this visit	1	
		Yes, previous visit	2	
		No	3	
(2.36)	Do you own an ITN, that is a net that has been treated with an insecticide to protect you from mosquito bites?	Yes	1	
		No	2	
(2.37)	During this visit or a previous visit, did a provider offer you an ITN free of charge or offer to sell you one? IF THE CLIENT WILL PICK UP OR BUY THE ITN WITHIN THE FACILITY, THAT COUNTS AS PROVIDER OFFERING THE ITN.	Yes, offered free now	1	
		Yes, offered free in previous visit	2	
		Yes, offered for sale now	3	
		Yes, offered for sale in previous visit	4	
		No, not offered	5	
(2.38)	During this visit or a previous visit, did a provider discuss the importance of sleeping under an insecticide treated net?	Yes, this visit	1	
		Yes, previous visit	2	
		No	3	
(2.39)	Last night, did you sleep under an insecticide treated net?	Yes	1	
		No	2	
(2.40)	During this visit or previous visits, has a provider asked you whether you had ever received a tetanus toxoid (TT) injection?	Yes, this visit	1	
		Yes, previous visit	2	
		No	3	

(2.41)	Have you ever received a tetanus toxoid (TT) injection, including one you may have received today? IF YES: Including any TT injection you received today, how many times in total during your lifetime have received a tetanus toxoid injection? (INJECTION MAY HAVE BEEN RECEIVED EITHER AT THIS FACILITY OR ELSEWHERE.)	Yes 1 Never 2 ► **(2.43)**	
(2.42)	NUMBER OF TETANUS INJECTIONS RECEIVED		
(2.43)	During this visit or previous visits, has a provider discussed things you should have in preparation for your delivery? This may include planning in case of emergency, things you should bring to a facility, or things you should prepare at home for home delivery.	Yes 1 No 2	
(2.44)	Please tell me any things you know of that you should have in preparation for your delivery. RECORD "1" IF Mentioned, "2"	a. Emergency transport	
		b. Money	
		c. Methylated spirit	

	IF Not mentioned. DO NOT READ THE LIST.		
		d. Sterile blade/ scissors to cut cord	
		e. Layette	
		f. Sanitary pads/cotton wool	
		g. Other Specify	
(2.45)	Do you have money set aside for the delivery? IF YES, PROBE	Yes, enough 1	
		Yes, but not enough 2	
		Yes, not sure 3	
		No 4 ► **(2.48)**	
(2.46)	How much do you currently have set aside for delivery?	a. US Dollar	
		b. ZA Rand	
		c. Others (Specify)	
(2.47)	How much do you need to have set aside for delivery?	a. US Dollar	
		b. ZA Rand	
		c. Others (Specify)	
(2.48)	During this visit or previous visits, has a provider talked with you about any signs of complications (danger signs) that should warn you of problems with the pregnancy?	Yes, this visit 1	
		Yes, previous visit 2	
		No 3 ► **(2.51)**	
(2.49)	Please tell me any signs of complications (danger signs) during pregnancy that you know of. DO NOT CITE ANSWERS, BUT FOR EACH OPTION RECORD "1" IF MENTIONED, "2" IF NOT MENTIONED. YOU MAY PROBE WITHOUT USING	a. ANY VAGINAL BLEEDING	
		b. FEVER	
		c. SWOLLEN FACE, HANDS OR LEGS	
		d. TIREDNESS OR BREATHLESSNESS	
		e. SEVERE HEADACHE	
		F. BLURRED VISION	
		g. CONVULSIONS/FITS	
		h. LIGHTHEADEDNESS/DIZZINESS/BLACKOUT	
		i. SEVERE PAIN IN LOWER BELLY	

	SPECIFIC ANSWERS (E.G., "ANYTHING ELSE?")		
		j. BABY STOPS MOVING OR REDUCED FETAL MOVEMENT	
		k. BAG OF WATER BREAKS OR LEAKS	
		l. DIFFICULTY BREATHING	
		m. OTHER (SPECIFY: ______________________)	
(2.50)	What did the provider advise you to do if you experienced any of the warning signs? RECORD "1" IF Mentioned, "2" IF Not mentioned FOR ALL RESPONSES THE CLIENT MENTIONS. PROBE WITHOUT USING SPECIFIC ANSWERS.	a. SEEK CARE AT FACILITY	
		b. DECREASE ACTIVITY	
		c. CHANGE DIET	
		d. OTHER (SPECIFY: ____________________)	
(2.51)	Do you know any danger signs during/after delivery?	Yes 1	
		No 2 ► **(2.53)**	
(2.52)	What danger signs do you know? RECORD "1" IF Mentioned, "2" IF Not mentioned FOR ALL RESPONSES THE CLIENT MENTIONS. PROBE WITHOUT USING SPECIFIC ANSWERS.	a. Bleeding	
		b. Fever	
		c. Genital injuries	
		d. Other	
(2.53)	During this visit or previous visits, has a provider spoken to you about	Yes, this visit 1	
		Yes, previous visit 2	
		No 3 ► **(2.57)**	

	breastfeeding?				
(2.54)	During the discussion, did the provider discuss exclusive breastfeeding (giving the baby nothing apart from breast milk)?	Yes	1		
		No	2	► **(2.57)**	
(2.55)	When did the provider explain you should start exclusive breastfeeding?	FIRST HOUR	01		
		FIRST DAY	02		
		FIRST WEEK	03		
		FIRST MONTH	04		
(2.56)	For how many months did the provider recommend that you exclusively breastfeed, that is, that you do not give your baby liquid or food in addition to your breast milk?				
(2.57)	During this visit or previous visits, did the provider talk to you about where you plan to deliver your baby?	Yes, this visit	1		
		Yes, previous visit	2		
		No	3		
(2.58)	Have you decided where you will go for the delivery of your baby? IF YES: PROBE FOR WHETHER THE PLAN IS TO DELIVER IN A FACILITY OR AT HOME	At this health facility	1		
		At other health facility	2		
		In a private home	3		
		Other Specify	96		
(2.59)	During this or previous visits, did a provider talk with you about using family planning after the birth of your baby?	Yes, this visit	1		
		Yes, previous visit	2		
		No	3	► **(2.61)**	
		Don't know	99		

(2.60)	Which methods did the provider discuss? RECORD "1" IF Mentioned, "2" IF Not mentioned FOR ALL RESPONSES THE CLIENT MENTIONS. PROBE WITHOUT USING SPECIFIC ANSWERS.	a. FEMALE STERILIZATION	
		b. MALE STERILIZATION	
		c. CONTRACEPTIVE PILL	
		d. INTRAUTERINE DEVICE (IUD)	
		e. INJECTABLE CONTRACEPTIVES	
		f. IMPLANTS	
		g. MALE CONDOMS	
		h. FEMALE CONDOMS	
		i. DIAPHRAGM	
		j. FOAM / JELLY	
		k. LACTATIONAL AMENORRHEA	
		l. RHYTHM METHOD	
		m. WITHDRAWAL	
(2.61)	During this or previous visits, did a provider talk with you about HIV testing?	Yes, this visit 1 Yes, previous visit 2 No 3 Don't know 99	
(2.62)	During this or previous visits, did a provider talk with you about counseling?	Yes, this visit 1 Yes, previous visit 2 No 3 Don't know 99	

Section 3: Travel and expenditure					***RECORD RESPONSE***
(3.01)	How far is your household from this health facility? **(Use landmarks to estimate distance)**	Kilometers			
(3.02)	How long did it take you/the patient to reach this health facility from home today? (**One way**)	a. Minutes			
		b. Hours			
(3.03)	What was your primary mode of transportation today? (**One way**)	By foot	1	► **(3.05)**	
		Bicycle	2	► **(3.05)**	
		Animal drawn cart	3	► **(3.05)**	
		Private car	4		

		Public car/bus 5	
		Wheelbarrow 6 ► (3.05)	
		Other 96	
		Specify	
(3.04)	How much did it cost for you/the patient to travel to the health facility today? **(One way)**	a. US Dollar	
		b. ZA Rand	
		c. Other (Specify)	
(3.05)	How long did you/the patient wait in the health facility before being seen in consultation by the health worker?	a. Minutes	
		b. Hours	
(3.06)	Do you think this was too long?	Yes 1	
		No 2	
(3.07)	Was a registration/administration/ consultation/ doctor fee charged?	Yes 1	
		No 2 ► **(3.09)**	
(3.08)	How much was paid for this?	a. US Dollar	
		b. ZA Rand	
		c. Other (Specify)	
(3.09)	Was a laboratory test done?	Yes 1	
		No 2 ► **(3.11)**	
(3.10)	How much was paid for this?	a. US Dollar	
		b. ZA Rand	
		c. Other (Specify)	
(3.11)	Was an ultrasound done?	Yes 1	
		No 2 ► **(3.13)**	
(3.12)	How much was paid for this?	a. US Dollar	
		b. ZA Rand	
		c. Other (Specify)	
(3.13)	Were medicines dispensed to you at the pharmacy in the health center?	Yes 1	
		No 2 ► **(3.15)**	
(3.14)	How much was paid for this?	a. US Dollar	
		b. ZA Rand	
		c. Other (Specify)	
(3.15)	How much was spent in total at the facility for this visit, not including transportation costs? CHECK TO SEE IF THE TOTAL	a. US Dollar	
		b. ZA Rand	

	MATCHES WITH THE AMOUNTS GIVEN ABOVE. IF NOT, RECONCILE THE AMOUNTS UNTIL BOTH ARE CORRECT.	c. Other (Specify)	
(3.16)	Where did the money come from that was used to pay for health care today? DO NOT READ OPTIONS ALOUD. FOR EACH OPTION, RECORD "1" IF MENTIONED OR "2" IF NOT MENTIONED	a. Savings or regular household budget	
		b. Medical aid	
		c. Selling household possessions	
		d. Selling crops/ selling livestock	
		e. From a friend or relative	
		f. Borrowed from someone other than friend or family	
		g. Other	
		Specify	
(3.17)	Is your family covered under a medical aid scheme?	Yes 1 No 2 ► **Section 4**	
(3.18)	What type of medical aid?	Private 2 Don't know 99	
(3.19)	How long (in months) has your family been enrolled in the medical aid scheme?	Months	
(3.20)	What services are covered under the medical aid scheme? FOR EACH OPTION, RECORD "1" IF MENTIONED OR "2" IF NOT MENTIONED	a. Routine well baby visits (Incl. vaccination)	
		b. Sick child care	
		c. Other outpatient care	
		d. Antenatal care for pregnant women	
		e. Delivery care for pregnant women	
		f. Postpartum care for women and newborns	
		g. Hospital admission and inpatient care	
		h. Other	
		Specify	
(3.21)	Does your family have to pay the following before using the insurance? For each option record '1' if 'Yes' or '2' if 'No'	Premium	
		Deductible	
		Co-insurance	

Section 4: Patient satisfaction							RECORD RESPONSE
I'm going to read you a series of statements. For instance, the first statement is, "It is convenient to travel from your house to the health unit." If you have to walk for 6 hours to get to the facility, you might strongly disagree with the statement and give it a score of only 1 out of 4. If, on the other hand, your house is right across the street from the facility, you should give 4. If you walk for 3 to 4 hours, you may want to give a score of 2 or 3, depending on how convenient you feel it is to get to the facility.							
	READ EACH STATEMENT TO THE RESPONSDENT AND RECORD THE RESPONSE CODE FOR EACH QUESTION.	**Strong disagreement**	**Slight Disagreement**	**Slight agreement**	**Strong agreement**	**Not applicable**	
(4.03)	It is convenient to travel from your house to the health facility.	1	2	3	4	5	
(4.04)	The health facility is clean.	1	2	3	4	5	
(4.05)	The health staff are courteous and respectful.	1	2	3	4	5	
(4.06)	You trust in the skills and abilities of the health workers.	1	2	3	4	5	
(4.07)	The health workers did a good job of explaining your illness.	1	2	3	4	5	
(4.08)	The health workers did a good job of explaining your treatment.	1	2	3	4	5	
(4.09)	It is easy to get medicine that health workers prescribe.	1	2	3	4	5	
(4.10)	The registration fees of this visit to the health facility were reasonable.	1	2	3	4	5	
(4.11)	The lab fees of this visit to the health facility were reasonable.	1	2	3	4	5	

(4.12)	The medication fees of this visit to the health facility were reasonable.	1	2	3	4	5	
(4.13)	The transport fees for this visit to the health facility were reasonable.	1	2	3	4	5	
(4.14)	The amount of time you spent waiting to be seen by a health provider was reasonable.	1	2	3	4	5	
(4.15)	You had enough privacy during your visit.	1	2	3	4	5	
(4.16)	The health worker spent a sufficient amount of time with the patient.	1	2	3	4	5	
(4.17)	The hours the facility is open is adequate to meet the needs of the community.	1	2	3	4	5	
(4.18)	The overall quality of services provided was satisfactory	1	2	3	4	5	
(4.19)	Your overall visit was satisfactory.	1	2	3	4	5	

Section 5: Questions about the household				***RECORD RESPONSE***
	"I would now like to ask you some questions about your household."	(i.e. People cooking and eating from the same pot		
(5.01)	What type of dwelling do you live in?	Traditional	1	
		Mixed	2	
		Detached	3	
		Semi-detached	4	
		Flat/townhome	5	
		Shack	6	
		Other	96	

		Specify		
(5.02)	What is the main material used for Wall DO NOT READ CHOICES RECORD THE RESPONSE FOR EACH SEPARATELY	NATURAL WALLS		
		Cane/trunks	11	
		Mud	12	
		RUDIMENTARY WALLS		
		Stone with mud	22	
		Plywood	23	
		Carton	24	
		Reused wood	25	
		FINISHED WALLS		
		Cement	31	
		Stone with lime/cement	32	
		Bricks	33	
		Cement blocks	34	
		Wood planks/shingles	35	
		Other	96	
		Specify		
(5.03)	What is the main material used for the Rooftop DO NOT READ CHOICES RECORD THE RESPONSE FOR EACH SEPARATELY	NATURAL ROOFING		
		No roof	11	
		Thatch	12	
		RUDIMENTARY ROOFING		
		Rustic mat	21	
		Wood planks	23	
		FINISHED ROOFING		
		Metal	31	
		Wood planks	32	
		Asbestos	33	
		Tiles	34	
		Cement	35	
		Other	96	
		Specify		
(5.04)	What is the main material used for the Floor? DO NOT READ	NATURAL FLOOR		
		Earth/sand/dung	11	
		RUDIMENTARY FLOOR		
		Wood planks	21	
		FINISHED FLOOR		

	CHOICES				
	RECORD THE RESPONSE FOR EACH SEPARATELY	Parquet or polished wood	31		
		Vinyl or asphalt strips	32		
		ceramic tiles	33		
		cement	34		
		carpet	35		
		Other	96		
		Specify			
(5.05)	What is the ownership status of your house? DO NOT READ CHOICES	Owner occupied dwelling - with mortgage	1	► (5.07)	
		Owner rural home	2	► (5.07)	
		Owner resettlement home	3	► (5.07)	
		Owner occupied dwelling - without mortgage	4	► (5.07)	
		Rented (not tied to the job)	5		
		Rented (tied to the job)	6		
		Rent free (not owner occupied)	7	► (5.09)	
		Municipality plot	8	► (5.09)	
		Provided by employer (government)	9	► (5.09)	
		Provider by employer (non govt)	10	► (5.09)	
		Temporary housing	11	► (5.09)	
		Other	96	► (5.09)	
		Specify			
(5.06)	How much money for rent are you charged per month?	a. US Dollars		► (5.09)	
		b. ZA Rand		► (5.09)	
		c. Other (Specify)		► (5.09)	
(5.07)	If you sold this dwelling today, how much rent would you receive for it?	a. US Dollars			
		b. ZA Rand			
		c. Other (Specify)			
(5.08)	If you rented this dwelling today, how much rent would you receive for it?	a. US Dollars			
		b. ZA Rand			
		c. Other (Specify)			
(5.09)	How many				

	rooms does your household have? (Including rooms outside the main dwelling, excluding kitchen and bathrooms)			
(5.10)	What is the **main** source of water for drinking and food preparation for the household? DO NOT READ CHOICES; Only one answer is allowed.	PIPED WATER		
		Piped into dwelling	1	a. Dry season
		Piped into Yard/Plot	2	
		Public tap	3	
		Tubewell/Borehole	4	
		DUG WELL		
		Protected dug well	5	b. Rainy season
		Unprotected dug well	6	
		WATER FROM SPRING		
		Protected spring	7	
		Unprotected spring	8	
		RAINWATER	9	
		TANKER TRUCK	10	
		CART WITH SMALL TANK	11	
		SURFACE WATER (river/dam/lake/pond/stream/canal/irrigation channel)	12	
		BOTTLED WATER	13	
		Other	96	
		Specify		
(5.11)	How far is this source from house? IF LESS THAN ONE KM, ENTER 00			a. Dry season b. Rainy season
(5.12)	Does your household have electricity?	Yes	1	
		No	2	
(5.13)	What is your household's main source of energy for lighting? "MAIN" IN TERMS OF	Electricity	1	
		Liquid propane gas	2	
		Natural gas	3	

	QUANTITY DO NOT READ CHOICES			
		biogas	4	
		Paraffin/kerosene	5	
		Jelly	6	
		Coal, Lignite	7	
		Charcoal	8	
		Wood	9	
		Straw/shrubs/grass	10	
		Maize/other crop waste	11	
		Animal dung	12	
		Do not cook	13	
		Other	96	
		Specify		
(5.14)	What is the main source of energy used for cooking? "MAIN" IN TERMS OF QUANTITY DO NOT READ CHOICES	Electricity	1	
		Liquid propane gas	2	
		Natural gas	3	
		biogas	4	
		Paraffin/kerosene	5	
		Coal, Lignite	6	
		Charcoal	7	
		Wood	8	
		Straw/shrubs/grass	9	
		Maize/agricultural crop waste	10	
		Animal dung	11	
		No food cooked in household	12	
		Other	96	
		Specify		
(5.15)	What kind of toilet facility do people in your household **mainly** use? *DO NOT READ CHOICES; Only one answer is allowed.*	FLUSH TOILET		
		Flush to piped sewer system	1	
		Flush to pit latrine	2	
		Flush to somewhere else	3	
		Flush, don't know where	4	
		PIT LATRINE		
		Ventilated Improved Pit Latrine (VIP)/blair toilet	5	
		Pit latrine with slab	6	
		Pit latrine without slab	7	
		BUCKET TOILET	8	
		NO FACILITY BUSH/FIELD	9	
		Other	96	

	Specify	

Section 6: Questions about the household

		(6.14)	(6.15)
	FOR EACH ITEM IN THE LIST BELOW, ASK Q6.14 THEN Q6.15	How many [ASSET]s does your household own? IF ZERO, GO TO NEXT ASSET	What is the condition of the asset?
a	Battery/generator		WORKING
			NOT WORKING
b	Solar panel		WORKING
			NOT WORKING
c	Radio		WORKING
			NOT WORKING
d	Television		WORKING
			NOT WORKING
e	Mobile telephone		WORKING
			NOT WORKING
f	Non-mobile telephone		WORKING
			NOT WORKING
g	Refrigerator		WORKING
			NOT WORKING
h	Computer		WORKING
			NOT WORKING
i	Watch		WORKING
			NOT WORKING
j	Bicycle		WORKING
			NOT WORKING
k	Motorcycle/scooter		WORKING
			NOT WORKING
l	Animal-drawn cart		WORKING
			NOT WORKING
m	Car/truck		WORKING
			NOT WORKING

n	Tractor		WORKING
			NOT WORKING
o	Boat with motor		WORKING
			NOT WORKING
p	Wheelbarrow		WORKING
			NOT WORKING