KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,

KUMASI, GHANA

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF POPULATION, FAMILY AND REPRODUCTIVE HEALTH

EFFECTS OF A COMPUTERISED CLINICAL DECISION SUPPORT SYSTEM AND PERFORMANCE-BASED INCENTIVES ON MATERNAL HEALTHCARE PROVIDERS IN NORTHERN GHANA.

BY

GIFTY APIUNG ANINANYA

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A THESIS SUBMITTED TO THE DEPARTMENT OF POPULATION, FAMILY AND REPRODUCTIVE HEALTH, COLLEGE OF HEALTH SCIENCE, SCHOOL OF PUBLIC HEALTH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE

DOCTOR OF PHILOSOPHY IN PUBLIC HEALTH

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DECLARATION

I, declare that except for references to other people's work which have been duly acknowledged, this piece of work is my own composition and neither in whole nor in part has this work been presented for the award of degree in this university or elsewhere.

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DEDICATION

This PhD thesis is dedicated to my parents: Mr. John Arthur Apiung and Mrs. Marian Apiung as well as my husband, Mr. Oswald Gariba Aninanya for their immense support throughout the research period.

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ABSTRACT

Computerized clinical decision support system (CDSS) and performance-based incentive (PBI) have a potential to contribute to improving motivation and performance of healthcare providers in developing countries. However, there is currently a dearth of rigorous evidence on the effectiveness of these strategies in improving maternal health care in developing countries including Ghana. This study sought to evaluate the impact of CDSS and PBI on motivation and performance of healthcare providers in northern Ghana. The study employed a quasi-experimental design with an explanatory mixedmethods model to assess the effects of the social and technological interventions on motivation and performance of providers. The quantitative research component consisted of a controlled pre- and post-test design, which allowed the quantitative measure of motivation and performance of healthcare providers. To obtain explanatory descriptions of the effects of the interventions on motivation and performance of providers, 66 in-depth interviews (IDIs) with midwives, nurses and their supervisors were conducted in twelve health facilities in the Kassena-Nankana and Builsa districts at intervention endline. A difference-in-difference logistic regression analysis controlling for potential covariates compared variables across intervention and comparison facilities at baseline and endline. Nvivo version 10 was used to analyse qualitative data. CDSS and PBIs were associated with improvements in maternal healthcare providers' motivation and performance in the intervention facilities compared with the comparison arm. At endline, constructs of motivation that improved were: job satisfaction, intrinsic motivation, organizational commitment, timeliness and attendance. Furthermore, CDSS and PBIs strategies improved providers' management of antenatal and delivery clients.

There was statistically significant increase in the proportion of anti-tetanus vaccinations, Human Imuno Deficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) testing compliance and hemoglobin examined during antenatal care consultations in the intervention sites. Additionally, perceptions of antenatal clients on providers' technical performance, client-provider interaction and provider availability in the intervention arm at endline improved significantly. Furthermore, delivery clients' perception of providers' performance in terms of technical performance, healthcare provider availability and general satisfaction with delivery services significantly improved. Endline qualitative findings revealed that CDSS and PBIs interventions have enhanced providers' knowledge and adherence to World Health Organisation (WHO) reproductive health treatment guidelines. CDSS prompted them on actions such as diagnosis, prescriptions, checking blood pressures of clients and use of partograph to monitor progress of labour.

While the introduction of CDSS and PBIs interventions show positive improvement in healthcare delivery within these selected institutions, there is the need to provide evidence on sustainance mechanisms for large-scale implementation of this intervention. Therefore, future studies on the long-term effects of these interventions are required employing larger samples of different healthcare worker populations, including those of midwives, nurses as well as Medical Doctors.

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ABBREVIATIONS

ANC:	Antenatal Care
BDHMT:	Builsa District Health Management Team
CDSS:	Computerised Decision Support System
CHPS:	Community-based Health Planning and Services Centres
DSS:	Decision Support System
EHR:	Electronic Health Record
GSS:	Ghana Statistical Service
GHS:	Ghana Health Service
JLI:	Joint Learning Initiative
IDI:	In-depth Interviews
KNDHMT:	Kassena Nankana District Health Management Team
KND:	Kassena-Nankana District
MMR:	Maternal Mortality Ratio
MMR:	Maternal Mortality Rate
MDGs:	Millennium Development Goals

MOH:	Ministry of Health
MNH:	Maternal and Neonatal Health
MH :	Maternal Healthcare
PBI:	Performance-Based Incentives
P4P:	Pay for performance
PBF:	Performance-Based Financing
QUALMAT:	Quality of Maternal and Neonatal Health Care
RBF:	Results-Based Financing
SBA:	Skilled Birth Attendant
SDG:	Sustainable Development Goal
UN:	United Nations
UNFPA:	United Nations Population Fund
UNICEF:	United Nations Children's Fund
USAID:	United States Agency for International Development WHO: World Health Organization

DEFINITION OF CONCEPTS

Antenatal care refers to care during pregnancy aiming at facilitating early diagnosis of complications.

Labour and delivery care is care provided to a woman during delivery, ensures that woman is assisted by skilled practitioner.

J**ob satisfaction** is defined as '*the attitude towards one's work and the related emotions, beliefs, and behaviors, results from complex interactions between on-the-job experience, organizational environment and motivation*'(Franco *et al*., 2002).

Motivation is defined as an '*individual's degree of willingness to exert and maintain an effort towards attaining organizational goals'*(Franco *et al*., 2002).

Performance refers to the "*efficiency and effectiveness of workers to attain organizational objectives"* (Koontz & *Weihrich*, 1990).

Computerized decision support systems are computer programs designed to assist healthcare professionals in decision-making (Haynes and Wilczynski, 2010, Cresswell *et al*., 2012).

Performance-based incentive is the "*transfer of money or material goods from a funder or other supporter to a recipient, conditional on the recipient taking a measurable action or achieving a predetermined performance target"*(Eichler and Levine, 2009).

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

This chapter presents an overview of the global and national maternal health statistics, interventions used to improve them as well as computerized clinical decision support system (CDSS) and performance-based incentive (PBI) strategies to improve motivation and performance of healthcare providers. The problem statement outlines the problem the study seeks to address and the study rationale explains reasons for conducting the study. Theoretical aspects of the study are discussed to lay a foundation. Objectives, research questions and hypothesis are also highlighted. The scope and organization of the study are also discussed.

1.1.1 MATERNAL MORTALITY TRENDS AND DIFFERENTIALS

Reduction of maternal mortality has been a global health priority for decades, explaining why it was one of the targets in the United Nations (UN) Millennium Development Goals (MDGs) framework (Say *et al.*, 2014). Despite modest progress towards attaining the MDGs in general, maternal mortality continues to be a major challenge to health care systems in developing countries (Patton *et al.*, 2010, Hogan *et al*., 2010, WHO, 2012, UN, 2014). Improvements in maternal health and reductions in maternal mortality have been slower than anticipated in many countries across the developing world (Hill *et al*., 2012,

Lozano *et al.*, 2011). Since 1990, maternal mortality has declined globally. However, the statistics remain unacceptably high. Worldwide, maternal mortality declined from 376,034 deaths in 1990 to 292,982 deaths in 2013 (Kassebaum *et al*., 2014).

Majority of maternal deaths (99%) take place in developing countries (WHO, 2014). In 2013, maternal mortality ratio in these countries was 230 for every 100,000 live births as against 16 for every 100,000 live births in the developed world (WHO, 2014). In developed countries, a woman's risk of maternal death is 1 in 3,700 as against 1 in 160 in developing countries (WHO, 2014). Sub-Saharan Africa (SSA) is still the most risky region in the world for women dying from complications in pregnancy. Most countries in SSA will take many years past 2015 to achieve the MDG 5 (WHO/UNFPA/DFID *et al*, 2014, Kassebaum *et al*., 2014). The sub-region remains highly burdened in terms of maternal mortality with about 49% (143,380) of the global maternal mortality (Kassebaum *et al.*, 2014, Wang *et al*., 2014).

For every pregnant mother who dies, there are many other women who are either disabled or chronically ill due to pregnancy and child-birth related complications (WHO, 2005). The situation in Ghana and in the Upper East Region where this study was conducted is not too different from what has been reported elsewhere. In Ghana, the maternal mortality rate declined by 49% between 1990 and 2013 (WHO & UNICEF 2014). Although Ghana's maternal mortality ratio (MMR) reduced from 760/100,000 live births in 1990 to 380 in 2013, there remains a substantial amount of effort to attain the unfinished business of MDG 5 and the new business of Sustainable Development Goal (SDG) 3. In 2013, 3,100 women died in Ghana from pregnancy related complications (WHO & UNICEF 2014). The fact remains that Ghana's progress is less than optimal in reducing maternal deaths. The

institutional MMR in the Upper East Region was 352 per 100,000 live births, while in the Kassena Nankana and Builsa districts, MMR was estimated at 367 and 259 maternal deaths per 100,000 live births respectively in 2010 (GHS, 2010, KNDHMT, 2010, BDHMT, 2010).

1.1.2 Causes of maternal mortality

For effective policy and health systems decision making towards further advances in maternal mortality reduction, it is important to understand the causes of these deaths. Since the causes of maternal deaths are well known and extensively documented, it suffices to briefly highlight them. The causes of maternal deaths have been grouped into two; direct and indirect causes. A recent comprehensive systematic analysis of the causes of maternal mortality commissioned by the World Health Organisation (WHO) suggests that indirect causes including the effects of pre-existing disorders such as diabetes and malaria that are aggravated by the physiologic effects of pregnancy, and haemorrhage combined are the largest causes of maternal deaths worldwide (Say *et al*., 2014). The direct causes that account for nearly 75% of all maternal deaths include: severe bleeding, infections, preeclampsia and eclampsia, complications from delivery, unsafe abortion, birth injury, asphyxia and prematurity (Say *et al*., 2014, Welaga *et al*., 2013, Khan *et al*., 2009).

Access to and optimal use of maternal health care services - antenatal care, delivery in health facilities and having a skilled health worker at delivery - can reduce maternal deaths from most of these causes (Adam *et al*., 2005), as it is the case in most developed countries. This is because the major causes of maternal deaths are essentially the same around the world. However, use of these interventions is limited in developing countries, and consequently plays a

major role for poor progress made at improving maternal mortality (Mpembeni *et al.*, 2007, Stanton *et al.,* 2013).

Several factors account for the underutilization of maternal health services in Ghana and elsewhere in the developing world. Key among them is the acute shortage and misdistribution of healthcare professionals such as doctors and midwives, and the resultant inadequate performance of the few overstressed care providers (Rowe *et al.,* 2005, Gerein *et al.,* 2006). Even in situations where providers have been sufficiently trained and provided with the minimum standard of physical infrastructure, they often perform below expectation simply because of insufficient time to provide services of the required quality, inadequate motivation, 'the know-do-gap' and in some instances laziness (Maestad *et al.*, 2010, Ottar and Gaute, 2008). This suggests that well trained providers in least developed countries like Ghana frequently do not perform to the best of their abilities; pointing to a gap between what providers know and how they actually perform on the job (Eriksen *et al.*, 2007, Kenneth *et al.,* 2007, Pembe *et al.,* 2009), referred to as the "know-do gap"(Ottar and Gaute, 2008). The existence of this "know-do gap" ought to be explained by looking at other constraints in the health systems of developing countries rather than the greater emphasis often placed on more training for, and or increase in numbers of health professionals (Ottar and Gaute, 2008).

The know-do gap is particularly critical in maternal health care settings, where providers need to be proactive, observe warning signs closely, and take appropriate actions rapidly in anticipation of adverse outcomes. Failure to do in practice what a provider knows to do in

principle contributes to low quality of service delivery (Das *et al*., 2012). Incorrect decisions may lead to the demise of the mother (Blank *et al.*, 2013).

Low motivation of health workers significantly explains the know-do gap (Leonard and Masatu, 2010, Inke and Imhoff, 2006). Poor motivation also plays a role in explaining the low performance levels of health personnel in many places including Ghana (Jishnu and Jeffrey, 2007, Kenneth *et al*., 2007). Motivational problems can partly be ascribed to lack of incentives or the lack of extrinsic sources of motivation (Manongi *et al*., 2006). Motivated providers can improve maternal health (ten Hoope-Bender *et al.*, 2006, Gerein *et al.*, 2006, Dogba and Fournier, 2009). Motivation is defined as: *"an individual's degree of willingness to exert and maintain an effort towards organizational goals"* (Franco *et al*., 2002). Ryan and Deci (2000) explained that: "*to be motivated means to be moved to do something*." Motivation could be categorised into two: intrinsic and extrinsic. Intrinsic motivation means "*doing something because it is inherently enjoyable*"(Ryan and Deci, 2000a). Intrinsic motivation exists without regard for external rewards and aligns with personal motives and values such as empathy and pride. Extrinsic motivation means *"doing something because it results in an outcome"*(Ryan and Deci, 2000a). It is mainly driven from external rewards such as verbal recognition and non-monetary incentives. Low motivation has been associated with poor health worker practices such as negative attitudes towards clients, lateness to work and absenteeism (Agyepong *et al.*, 2004, Dieleman *et al*., 2009, Aberese-Ako *et al.*, 2014), health worker retention and turnover (Bonfrer *et al.*,
2014b) and health worker migration (Blaauw *et al*., 2013).

Both intrinsic and extrinsic motivators could enhance motivation and performance of nurses and midwives if they are well implemented. Motivation and performance of healthcare workers may also depend on quality of feedback received from superiors, supportive supervision, economic situation, mobility, family and other opportunities (Bajwa e*t al.,* 2010). If healthcare providers are motivated, it will eventually boost their output in service delivery and may improve maternal health. In Ghana, incentives such as a vehicle hire purchase scheme and deprived area incentive schemes are important sources of motivation for workers but they are seen as inadequate. As a result, this has led to staff engagement in part-time income-generating jobs with a negative influence on quality of service delivery (Alhassan *et al.*, 2013, Johnson *et al.,* 2011, Snow *et al.*, 2011).

It has been established that limited access to health facilities (staffed with appropriately skilled providers and equipped with life-saving obstetric interventions) contribute significantly to the incidence of maternal mortality in the Kassena-Nankana and Builsa districts of the Upper East Region of Ghana. In some cases healthcare providers failed to properly treat clients and rarely used decision support systems for clinical care (Gething *et al*., 2012, Dalaba *et al.*, 2014). Laboratory tests are not done and partographs are scarcely used to monitor the progress of labour (Baker *et al.,* 2012, Duysburg *et al.,* 2013).

1.1.3 Interventions to improve health-worker motivation and performance

Interventions to improve clinical performance promise better chances of success if they improve both health worker competence and motivation (Blank *et al*., 2013). CDSS and PBI interventions are known to improve practitioner motivation, performance and quality of

health services (Hillestad *et al*., 2005, Kawamoto *et al*., 2005, Witter *et al.*, 2011, Witter *et al.*, 2012, Eichler *et al*., 2013). Computerised clinical decision support systems (computer programs that offer patient specific, actionable recommendations or management options to improve clinical decisions) seek to improve performance of care providers and patient outcomes. Performance-based incentives on the other hand are designed to encourage behaviours that both increase demand for and use of services, and to improve the quality and availability of those services (Rena and Levine, 2009). These two interventions are strategies to tackle low healthcare providers' motivation and performance.

CDSS motivates providers to apply knowledge, improves clinical practice, patients outcomes and general performance of health personnel (Haggstrom *et al.*, 2008, Bryan and Boren, 2008, Blaya *et al*., 2010). In developed countries, the implementation of clinical guidelines and protocols has been notably enhanced by the use of CDSS (Bertsche *et al.*, 2008, Toth-Pal *et al.*, 2008). Learning from these lessons, developing country practitioners who embraced CDSS have also begun to experience the benefits through improved clinical decision-making. Some projects have shown promising results (Fraser *et al.*, 2005, Basinga *et al*., 2011b, Lester *et al.*, 2010). Despite the promise of CDSSs for improving care, rigorous evaluations are rare in developing countries including Ghana; hence the need for more evaluations of CDSSs to produce valid and generalizable findings on its usefulness.

Due to its potential in improving maternal health, CDSS technique was designed to support routine antenatal and delivery care in three (3) African countries: Ghana, Burkina Faso and Tanzania (Blank *et al.*, 2013). The CDSS was developed based on the WHO guidelines on

"Pregnancy, Childbirth, Postpartum and Newborn Care; A Guide for Essential Practice." The software was designed to support maternal healthcare provider decision-making in health centres. In Ghana, six (6) primary health care centres in the Kassena-Nankana district of northern Ghana received this intervention. The CDSS supports the execution of complete actions necessary for antenatal and delivery care and helps to identify situations of concern, where timely actions like referral may reduce the likelihood of adverse consequences.

Performance-based incentive (PBI) or pay for performance (P4P) is another intervention for improving healthcare providers' motivation and performance. PBI aims at surmounting *"suboptimal performance in the health systems by providing rewards that are directly linked to maternal health outcomes"* (Eichler *et al*., 2013). They could address the low motivation among providers and eventually improve productivity and quality of services (Maestad *et al*., 2010, Hongoro and Normand, 2006). In Rwanda, both provider motivation and performance have improved due to the implementation of a PBI (Paul, 2009b). P4P interventions could also provide motivation for the use of clinical reminders (Haggstrom *et al.*, 2008). Financial rewards, career development, continuing education, hospital infrastructure, resource availability, hospital management and recognition are core contributing factors to motivation of health personnel (Willis-Shattuck *et al.*, 2008). Gilson and others point out that several contextual factors affect the health care delivery system, including health workers' motivation which "*reflects a range of personal, organizational, and societal factors, including relationships with others, and itself influences many aspects of the provision of health care"* (Gilson *et al*., 2011). In Tanzania, health workers also find

financial aspects of their working conditions as motivators (Songstad *et al.*, 2011, Songstad *et al.*, 2012).

Some incentives given to motivate health workers in Ghana include accommodation, staff vehicle hire purchase, paid annual leave and capacity building programs but their efficacy towards health worker motivation and quality health services delivery has been minimal (Johnson *et al.*, 2011, Kwansah *et al.*, 2012). Although, PBI programmes are a promising intervention to improve motivation and performance of maternal healthcare providers, there is limited evidence on its effectiveness on maternal health outcomes in developing countries including Ghana (Doran *et al.*, 2008, Witter *et al.*, 2012, Hammouche *et al.*, 2011, Witter *et al.*, 2011, Brenner *et al.*, 2014, Oxman and Fretheim, 2008, Scott *et al.*, 2011). Available studies only report on the single effects of CDSS or PBI interventions on either motivation or performance of health professionals. Therefore, a rigorous evaluation on the combined effects of these interventions on motivation and performance of maternal and neonatal healthcare providers is needed to inform policy. The current study sought to unearth the combined effects of CDSS and PBI interventions on motivation and performance of healthcare providers in primary healthcare centres in the Kassena-Nankana and Builsa districts of northern Ghana using a mixed-methods approach. The study was nested in a European Union-funded project named QUALMAT (Quality of maternal and neonatal care project), piloting CDSS and PBI interventions from 2010 to 2014 in the two districts to improve the quality of maternal and neonatal care.

1.2 PROBLEM STATEMENT

A well performing health workforce has been identified as one of the six building blocks (service delivery, health information systems, access to essential medicines, health systems financing and leadership and governance) for an efficient and effective health system anywhere in the world (WHO, 2010). Perhaps this explains why human resource development for health appears to be receiving some attention on the Ghanaian policy agenda as a critical resource for enhancing performance of the health system in recent years (JLI, 2004). This notwithstanding, the number of health workers is still inadequate with motivation to improve performance still sub-optimal (Rowe *et al.*, 2005, Das *et al.*, 2008). Ghana is one of the few countries in Sub-Saharan Africa that has introduced various innovative interventions to help reduce maternal mortality. Notable among them is the feefree delivery service (Ganle *et al*., 2014b, Ganle *et al*., 2014a). Despite the fact that the interventions resulted in some progress made in reducing the maternal mortality ratio (MMR) from 549 in 1990 to 380 in 2013, Ghana could not achieve MDG 5 (Hogan *et al.*, 2010, WHO *et al*., 2014). Furthermore, if appropriate interventions are not implemented in Ghana, it will be extremely difficult to attain Sustainable Development Goal (SDG) 3 by 2030.However, Ghana could not achieve MDG annual rate of decline of maternal mortality (2.8%) at the end of 2013 is far less than the (5.5%) required to reduce the MMR by threequarters from the 1990 level by December 2015. It is clear that the country will not be able to achieve the MDG target of 185 deaths per 100,000 live births by December, 2015 (Kassebaum *et al.*, 2014). There are also significant inter-regional and rural-urban differences in maternal mortality. The three poorest regions of the northern part of the country (Northern,

Upper East and Upper West regions) have higher ratios, with the Upper East Region having a maternal mortality ratio as high as 802 per 100,000 live births (GSS, 2012). In the Kassena-Nankana district, 373 maternal deaths per 100,000 live births were recorded in 2002-2004 (Mills *et al.,* 2008). Recent statistics from the Kassena-Nankana and Builsa districts show that maternal mortality is still a problem. These data presented are only estimates of the true situation as these districts continue to use traditional birth attendants who continue to conduct home deliveries that are largely unaccounted for in the health care reporting system.

In Ghana and elsewhere in the developing world, the uninspiring improvements in maternal health delivery can be attributed to low productivity and morale of health providers, despite huge investments in the sector over the years (Basinga *et al.*, 2010, Aberese-Ako *et al.,* 2014). Maternal healthcare providers are confronted with several challenges that impede their effectiveness. Prominent among these are dissatisfaction with salaries, inadequate incentives, inadequate training, inadequate equipment and tools, deplorable working conditions, excessive workload and poor access/adherence to clinical guidelines. These problems have the tendency to influence staff motivation negatively, and sometimes could lead to poor response to client needs resulting in poor quality of service delivery (Alhassan *et al.,* 2013, Baker *et al*., 2012, Banchani and Tenkorang, 2014, Yé *et al.,* 2014, AbereseAko *et al.*, 2015). Underutilization of maternity services that facilitate healthy childbirth, safe maternal and newborn lives, and ensure a healthy start for babies is a problem in the entire health system in Ghana (Mpembeni *et al.,* 2007, Dalaba *et al.,* 2014). Although, there has been an increase in accessibility to and utilisation of skilled maternal health services following a free delivery

policy implementation in Ghana, the Upper East Region is worst off in terms of access to maternal health services (Ganle *et al*., 2014b, Campbell *et al.*,

2006) rendering the increase insignificant. For instance, 53% of respondents in the Kassena-Nankana district of Ghana reported lower utilisation of skilled delivery services in Ghana (Ganle, 2015). In the Kassena-Nankana and Builsa districts, low productivity has been reported among maternal healthcare (MH) providers as in some cases they failed to treat clients properly and rarely use treatment guidelines. Partograph and health education practices are poorly done (Prytherch *et al.,* 2013a, Baker *et al.,* 2012, Duysburgh *et al.,* 2013). These poor health worker practices partly contribute to the low utilisation of maternal health services and the low quality of care often provided, which could lead to preventable losses of lives (Gething *et al.,* 2012, Stanton *et al.,* 2013). Prominent factors for underutilization of maternal health services include limited and unequal distribution of skilled maternity care services, inadequate numbers of community health officersmidwives, women's experiences of intimidation in healthcare facilities, unfriendly healthcare providers, long waiting time before care is received, poor care quality and lack of privacy at healthcare facilities, inadequate in-service training and increased workload (Sakeah *et al.,* 2014a, Sakeah *et al.,* 2014b). Poorly motivated and ineffective providers providing sub-optimal maternal health services have compounded the problem. If there is no radical transformation in health worker motivation and performance, maternal health outcomes will remain poor and there wouldn't be an improvement in Sustainable

Development Goal (SDG) 3.

To achieve SDG 3 in Ghana, there is the need for all-inclusive motivational strategies that would improve motivation and performance of healthcare providers (Alhassan *et al.*, 2013,

WHO, 2006). Available evidence suggests that improving prenatal, obstetrical care, motivation and competence of providers would most certainly reduce maternal mortality when compared with other interventions (Deschamps, 2000, WHO, 2006). CDSS and PBI interventions are currently seen as comprehensive strategies to improve motivation, quality of care and performance of healthcare providers (Sukums *et al.*, 2015, Witter *et al.*, 2012). Although CDSS and PBI have been known to improve performance and motivation of practitioners elsewhere, evidence is rare on the combined effects of these interventions on motivation and performance of MH providers in the Kassena-Nankana district and in Ghana as a whole. In Ghana, a study that focused on the impact of CDSS on providers workflow showed that CDSS streamlined workflow of MH providers in primary care facilities (Mensah *et al.*, 2015b). Another study carried out in primary facilities in Ghana on the cost effectiveness of the CDSS showed that there was a decrease in the proportion of complications during delivery (baseline about 11% versus end line 10%) and a reduction in the number of maternal deaths (baseline 4 deaths versus end line 1 death) (Dalaba *et al.*, 2014). A recent study on cost-effectiveness of CDSS to enhance maternal health care in the Kassena-Nankana and Builsa districts in northern Ghana showed that, CDSS increased the detection of pregnancy complications during antenatal care in the intervention health centres. There was also a reduction in the number of complications during labour by 1.1% in the intervention arm (Dalaba *et al.*, 2015a).

Nonetheless, none of these studies examined the combined effects of CDSS and PBI on maternal and neonatal healthcare providers' motivation (intrinsic motivation, job satisfaction, pride, organizational commitment, timeliness and attendance) and performance in terms of client satisfaction with maternal health services. In view of this research gap, the current

study evaluated the combined effects of these interventions on motivation and performance of MH providers in the two districts to generate relevant evidence to inform Ghana Health Service (GHS), Ministry of Health (MOH) and other stakeholders on the desirability or otherwise of a scale up of these interventions to cover other primary care facilities in Ghana to improve motivation and performance of providers.

1.3 RATIONALE OF THE STUDY

Improving motivation and performance of MH providers has gained attention in developing countries including Ghana because of the need to attain the unfinished business of MDG 5 and the new business of SGD 3. If mechanisms for stimulating higher levels of MH providers' motivation and performance are not given the necessary attention, Ghana will not attain SDG 3. Despite the introduction of a free maternal health policy 13 years ago to reduce maternal mortality, high maternal mortality still exists in Ghana (Ganle *et al.*, 2014b). To enhance motivation and performance of MH providers, there is the need for more comprehensive interventions including a health sector human resource approach (Alhassan *et al.*, 2013, Aberese-Ako *et al.*, 2014). CDSS and PBIs strategies could improve maternal health in Ghana. Nevertheless, evidence on the combined effects of these interventions on motivation and performance of healthcare providers is rare. This study will contribute to the evidence on the effects of CDSS and PBIs on motivation and performance of maternal healthcare providers in the Kassena-Nankana and Builsa districts as well as Ghana as a whole.

Additionally, deep insights gained on the effects of CDSS and PBI interventions on motivation and performance of MH providers in primary health facilities in KassenaNankana

and Builsa districts would be used to promote and advocate for these interventions to be scaled-up in other health facilities in Ghana to boost nurses and midwives morale to provide maternal health services.

Furthermore, the study would generate relevant recommendations to serve as a precursor for further research on other areas of CDSS and PBI. Other researchers who intend conducting further studies on the impact of these interventions on motivation and performance could rely on findings of the study.

Currently, there is a dearth of specific operational solutions and recommendations that Ghana Health Service could adapt to improve motivation and performance of MH providers. The findings and recommendations of this study would provide a way forward for policy makers at the district, regional and national levels in making pragmatic policies as far as improving motivation and performance of providers are concerned.

The study will also contribute in shaping existing maternal health policies in Ghana. Presently, in Ghana's health sector, there are no standard policies on PBIs and the use of electronic tools for clinical decisions for maternal healthcare providers. The findings will therefore facilitate the development of a policy on the use of electronic tools to improve the quality of maternal health and PBI policy in health facilities in Ghana. This will go a long way to reduce the maternal mortality burden in Ghana.

As part of efforts to disseminate findings of this study to stakeholders, preliminary data were shared at three (3) international conferences: The first (1st) African Medical and Research Foundation (AMREF) international conference held in Nairobi, Kenya from 24th26th

November, 2014; the second (2nd) Scientists Network for Outcomes from Water and Sanitation (SNOWS) Conference held in Kumasi, Ghana from 18th to 20th May, 2015 and the third (3rd) Asian Population Conference held in Kuala Lumpur, Malaysia from the 27th to 30th July, 2015.

1.4 HYPOTHESES

a. Computerised decision support system and performance-based incentives together improve motivation of maternal healthcare providers.

b. Computerised decision support system and performance-based incentives together improve performance of maternal healthcare providers.

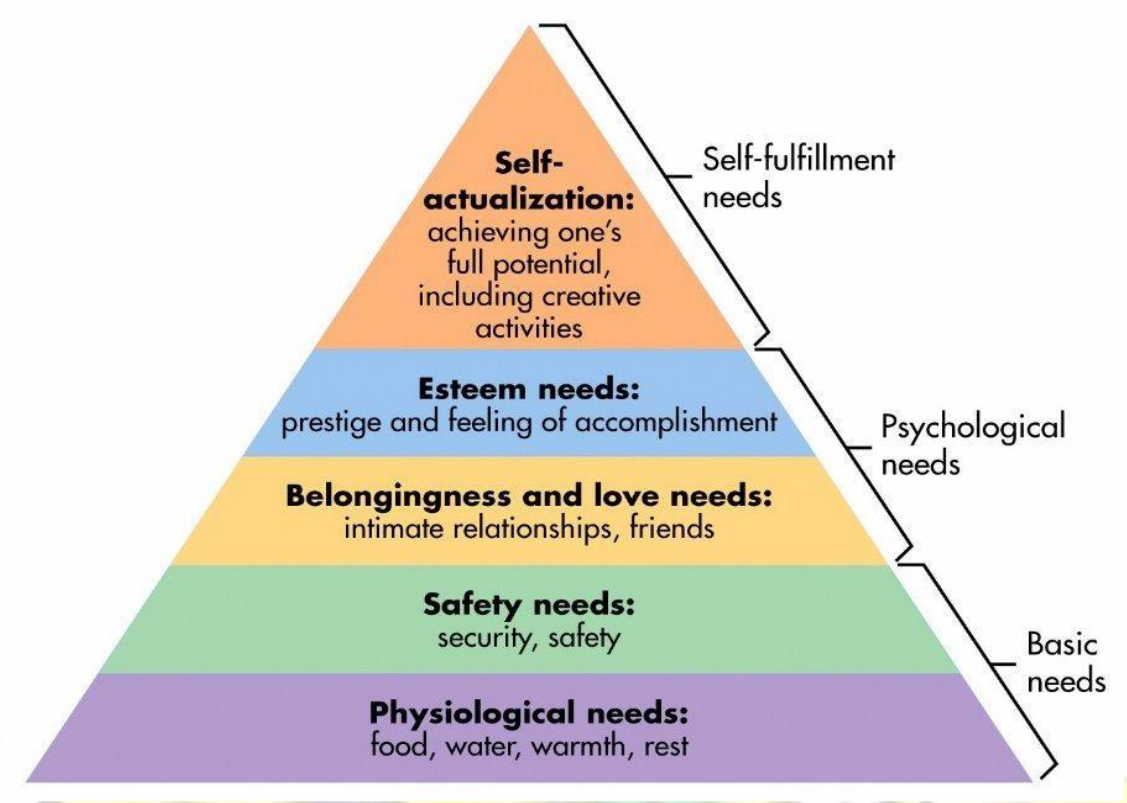
1.5 THEORETICAL FRAMEWORK

Three theories of motivation and performance that serve as a solid foundation for this study have been explained below:

Abraham Maslow's motivational theory conceives that employees have five distinct types of needs, some more pressing than others and once the more imminent needs are addressed, employees continue up the hierarchy. He perceived that employees are motivated by needs such as physiological, safety, social, esteem and self-actualization (Learning, 2015). The pyramid (Figure 1.1) shows the five need types and descriptions, which Maslow posits to be the main motivational factors. Nevertheless, some limitations of Maslow's theory include needs may not be hierarchically ranked because human needs are generally insatiable and so a satisfied need may not be a motivator. Also, human beings are sometimes motivated by

wants rather than needs and this is what greed, which breeds corruption, is often about. Moreover, the theory is not backed by empirical evidence - the sample size was small and Maslow still drew conclusions from his study (Armstrong, 2001). Despite these limitations, the theory is still useful to understand healthcare workers behavior and to select appropriate interventions in motivating them to perform (Halepota, 2005).

Figure 1. 1 Maslow's Hierarchy of Needs

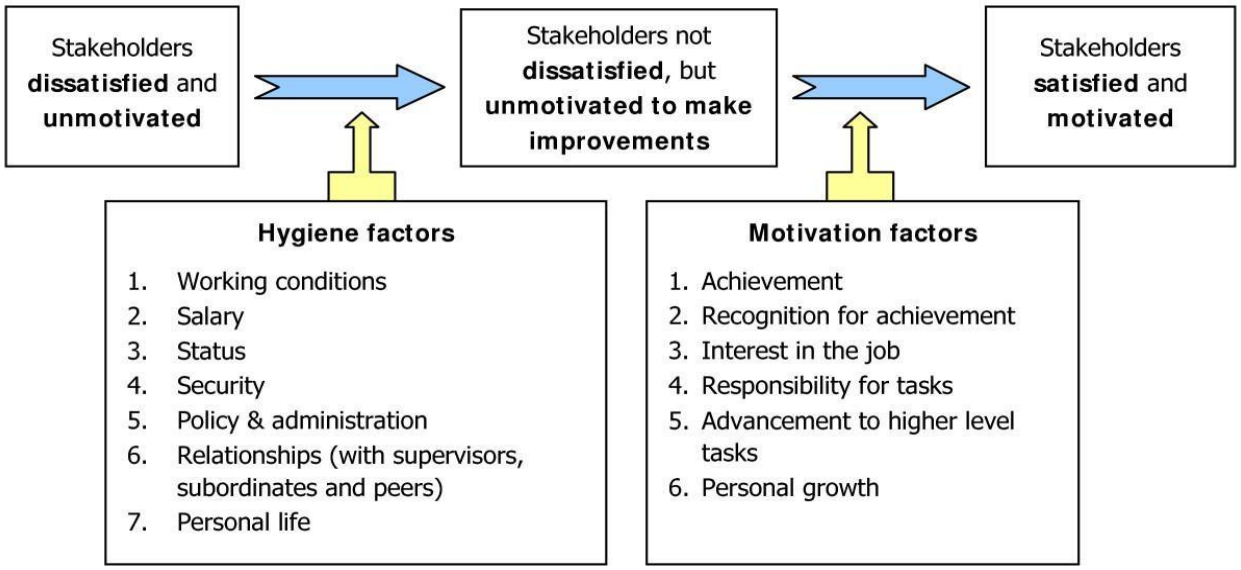


Source: (Puller, 2014)

Frederick Herzberg developed a motivational theory made up of two factors of motivation; hygiene and motivational factors (Learning, 2015). Hygiene factors such as company policies, supervision, pay and working conditions do not necessarily motivate employees. Also, if these factors are undermined in an organization, it may lead to dissatisfaction and low motivation among employees and there would not be a platform to improve motivation and performance of workers. When hygiene factors are improved they will not positively motivate workers but they will reduce dissatisfaction among employees. Motivation factors are positive factors that give employees job satisfaction (for instance, receiving recognition for high performance), increasing performance as motivation increases (Misra, 2013, Nobilis,

2009). These factors that motivate employees and make them more productive include recognition, achievement, the work itself and self-actualization (Figure 1.2). Herzberg explained that motivators should be built into the hygiene factors. If hygiene factors are properly met in an organization, motivational factors can begin to operate positively among employees (Misra, 2013). Some motivational factors used in this current study to build strong levels of motivation and performance of healthcare providers are performance-based incentives and computerized decision support system. These factors contribute greatly to staff satisfaction and motivation (Franco *et al.*, 2002, Dieleman *et al.*, 2006).

Figure 1. 2 Herzberg's Two-Factor Motivation Theory



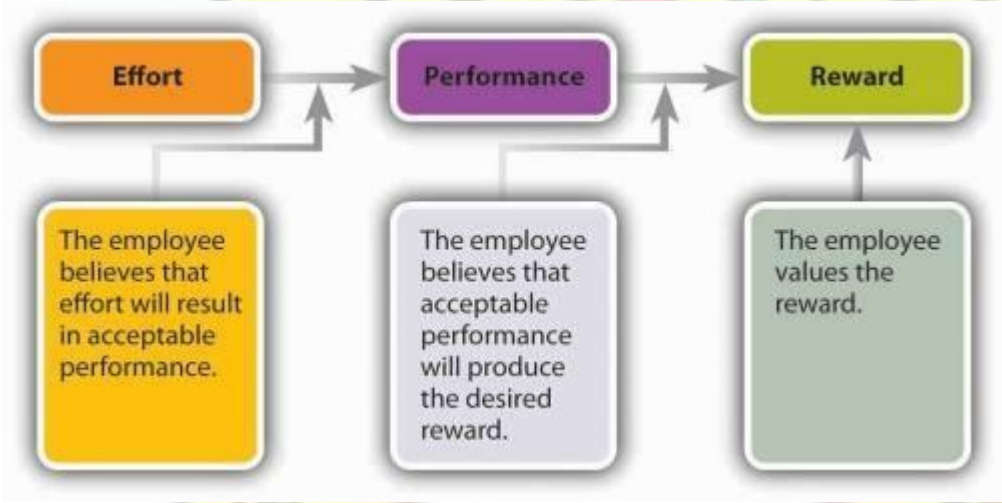
Source: Author's Construct, 2016

Herzberg's motivation factors and Maslow's esteem and self-actualization needs are similar. The esteem level depicts employees' needs for achievement, competence and recognition. The self-actualization level depicts employee need to live up to his or her fullest potential.

Both are consistent with the motivation factors such as recognition, achievement, level of responsibility and need for personal growth. Maternal healthcare providers in the study districts would desire that their self-esteem and self-actualization needs be met through performance-based incentives and computerized decision support system for them to be motivated to provide maternal health services and for an improvement in their performance.

Expectancy theory portrays that a worker who perceives that his performance would result in a secondary outcome like a reward would put in more effort at work (Figure 1.3). Staff will be motivated to exert a high level of effort to obtain rewards under some terms: the worker believes that his or her efforts will result in acceptable performance that will lead to a valuable reward (Learning, 2015).

Figure 1. 3 Vroom's Expectancy Theory (Learning, 2015)

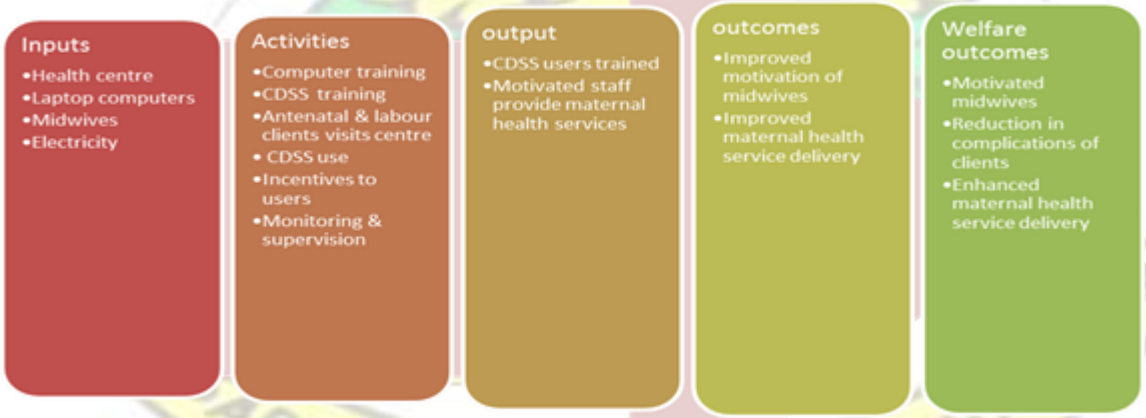


These three theories provide useful insights to understanding healthcare provider motivation and performance in this study. This study relied on key concepts of these theories to develop data collection tools for measuring motivation of providers. Herzberg and Maslow's theories

are linked to the questions related to recognition, organisational commitment, job satisfaction and timeliness.

Both CDSS and PBI interventions are seen as an attempt to align health workers goals to the goals of the employer, PBI offers incentives/rewards to achieve increased effort to reach organisational goals as illustrated in this program theory (Figure 1.4 Program Theory). The program theory describes the sequence of events leading to outcomes such as improved motivation and performance. In particular, it shows the kinds of resources, activities and assumptions that are required for improvement. In effect, it makes explicit the causal logic behind a program and map the interventions along logical pathways (Gertler *et al.*, 2011, Rogers, 2008).

Figure 1. 4 Program Theory.



Source: Author's Construct 2014

The theories assume that employee attitudes and behaviours could be changed and so recognition is given to financial and non-financial motivators of workers. CDSS and PBI interventions aim at increasing healthcare providers' motivation and performance and so it is vital to apply these theoretical approaches in parallel with a focus on the local context. The study applied the expectancy theory by interviewing health workers on what will motivate them to perform. The outcome was that managers in the health system should offer rewards that they value, set performance levels that they can reach, and ensure a strong link between performance and reward (Learning, 2015).

1.6 CONCEPTUAL FRAMEWORK

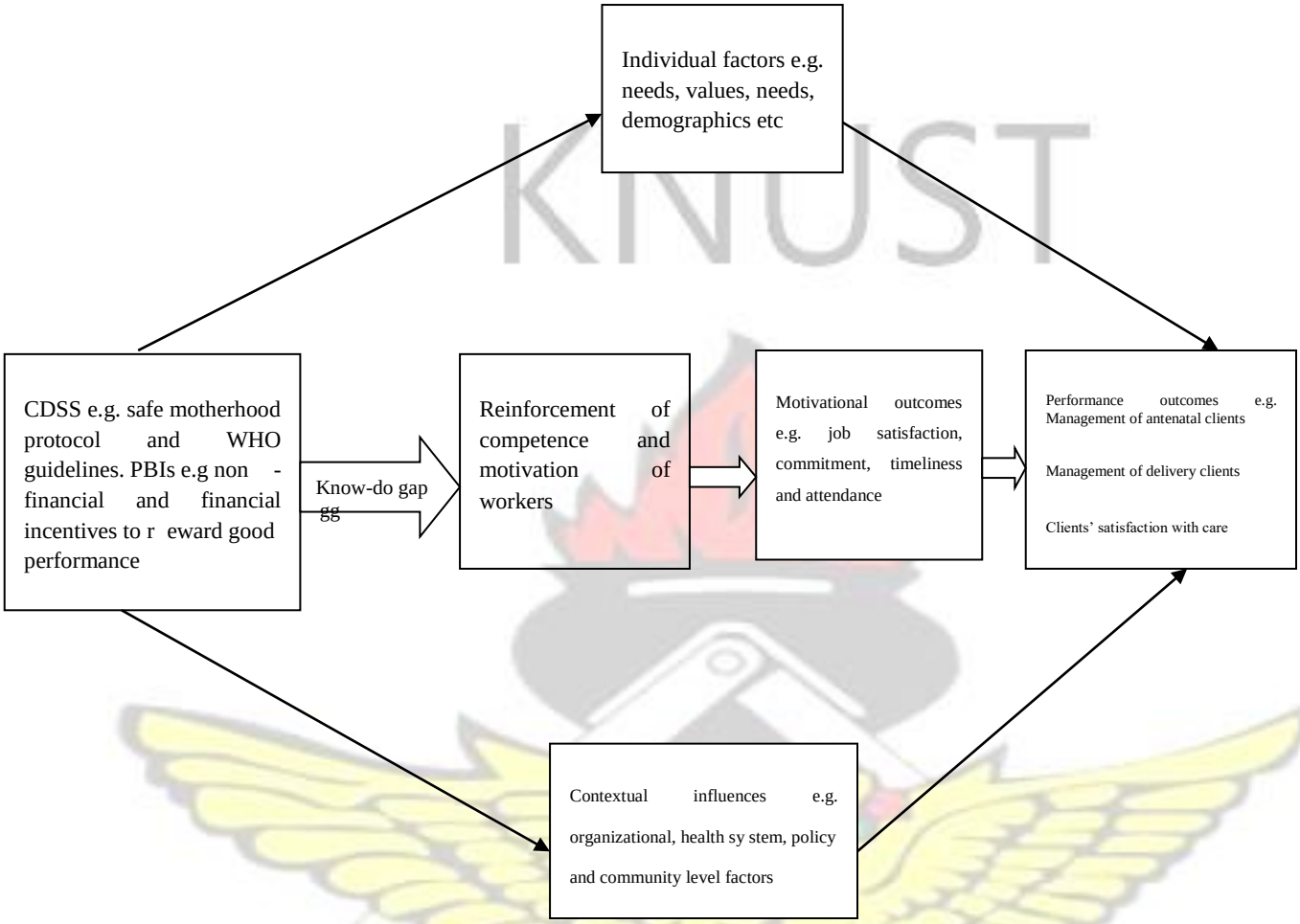
This conceptual framework shows how a web of interrelated factors including CDSS and PBI strategies addresses know-do gap of providers and results in improvement in motivation and performance (Bennett *et al.*, 2001, Bennett and Franco, 1999). Figure 1.5 shows a complex web of links and interaction between CDSS and PBI, motivation and performance of providers. Determinants of motivation may include perception of competence, autonomy, and good social and interpersonal context among others. Extrinsic motivation factors may also be related to specific rewards. Kanfer proposed some determinants of motivation that include societal values, organizational values, personal values, personality tendencies, workplace conditions, human resource management practices and self-efficacy of work (Kanfer, 1999). Beyond theoretical considerations, determinants of health workers motivation and performance originate from individual, the immediate organization, the larger

health sector and the socio-cultural contexts (Franco *et al.*, 2002, Bennett and Franco, 1999). Influencing any of these factors may also result in influencing motivation and performance of maternal healthcare providers. Some detailed information on these influences are illustrated in Figure 1.5. Individual factors such as the capacities of individuals such as needs, knowledge, lack of appropriate skills and expectations have an effect on providers' motivation and performance (Carmen and Orvill, 2005, Bennett and Franco, 1999). Others are health workers' goals, values, and how far he or she believes in his or her ability to succeed in certain situations and conscientiousness (Bandura, 1982). Healthcare workers have some psychological needs that must be addressed for them to attain better motivation and performance. Maslow developed a hierarchical model of these psychological needs that was stated above: physiological, safety, social, self-esteem, and self-realization. Although empirical evidence does not support the specific hierarchical nature of these needs, the notion of a range of needs is useful for understanding health workers' motivation and performance. If health workers' needs are not met, there may be tension among them and they will try to look elsewhere for redress. Also, differences among individuals imply that health workers will not all have the same balance of needs, nor will it be necessary to meet each need in the work context. Furthermore, the relative importance of various needs will change over time. This calls for the need to critically assess what the workers truly need and address them.

Contextual influences of health worker motivation include organizational factors that encompass the health system, policy environment, the community and cultural influences (Carmen and Orvill, 2005, Bennett and Franco, 1999). At the level of the organization, processes involve service delivery that entails the use of paper-based and computer-based treatment guidelines. Supportive supervision, provision of logistics such as drugs, supplies

and training will affect motivation and performance. The health system and health policy are also vital source of factors influencing workers motivation (Franco *et al.*, 2004). If these are well structured, it can reinforce good motivation and performance. Incentives in place will further boost health workers morale. At the policy level factors such as salaries, leave and so on are vital influences. Lastly, broader social and cultural factors will also contribute to healthcare workers' motivation and performance outcomes. At the foundation of health service delivery is the interaction between healthcare worker and the clients, expectations from the community on how maternal health services should be delivered may affect motivation and performance outcomes.

Figure 1.5 Conceptual framework on the effects of CDSS and PBIs on motivation and performance of maternal healthcare providers.



The conceptual framework was developed with reference to works on motivation and performance by earlier researchers (Carmen and Orvill, 2005, Bennett and Franco, 1999, Prytherch *et al.*, 2012). In sum, CDSS and PBI strategies if implemented in the health system will lead to some changes on motivation and performance of healthcare providers.

Motivation constructs and variables that are likely to improve in this study include job satisfaction, organizational commitment, intrinsic motivation, timeliness and attendance while performance constructs such as antenatal attendance, skilled delivery, HIV/AIDS

testing, referrals, anti-tetanus vaccinations and clients' satisfaction with care are likely to also improve.

1.7 RESEARCH QUESTIONS

1. What are the combined effects of CDSS and PBIs on the motivation (job satisfaction, organizational commitment, intrinsic motivation, timeliness and attendance) of maternal healthcare providers?
2. What are the combined effects of the CDSS and PBIs on the performance (antenatal attendance, skilled delivery, HIV/AIDS testing, referrals, anti-tetanus vaccinations and clients' satisfaction with care) of maternal healthcare providers?

1.8 STUDY/RESEARCH OBJECTIVES

1.8.1 GENERAL OBJECTIVE

1. To determine combined effects of CDSS and PBIs on the motivation and performance of maternal healthcare providers in the Kassena-Nankana and Builsa districts of Northern Ghana.

1.8.2 SPECIFIC OBJECTIVES

1. To determine whether CDSS together with PBI interventions increases job satisfaction of maternal healthcare providers in primary healthcare facilities in the KassenaNankana and Builsa districts of northern Ghana.

2. To determine whether CDSS together with PBI interventions increases organisational commitment of maternal healthcare providers in primary healthcare facilities in the Kassena-Nankana and Builsa districts of northern Ghana.

3. To determine whether CDSS together with PBI interventions increases intrinsic motivation of maternal healthcare providers in primary healthcare facilities in the KassenaNankana and Builsa districts of northern Ghana.

4. To determine whether CDSS together with PBI interventions increases timeliness and attendance of maternal healthcare providers in primary healthcare facilities in the Kassena-Nankana and Builsa districts of northern Ghana.

5. To determine whether CDSS and PBI interventions increase performance in terms of management of antenatal and delivery clients by maternal healthcare providers in primary healthcare facilities in the Kassena-Nankana and Builsa districts of northern Ghana **6.** To determine whether CDSS and PBI interventions increases performance of

maternal healthcare providers in terms of antenatal and delivery clients' satisfaction with care in primary healthcare facilities in the Kassena-Nankana and Builsa districts of northern Ghana.

1.9 ORGANIZATION OF THE THESIS

Chapter 1 describes maternal and neonatal mortality statistics; it states the problem, describes the rationale of the study, states the specific objectives of the study, research questions, hypotheses and presents the theoretical framework. The study profile that includes the study

site, location, health service organization is also explained in chapter one. Chapter two provides a review of related literature of the study. The chapter defines concepts/terms that are key to this topic that are motivation and performance, elaborates on motivation and performance theories and examines the effects of CDSS and PBI strategies on health professionals' motivation and performance. The chapter ends with a conceptual framework showing how a web of complex factors including CDSS and PBIs influence motivation and performance of healthcare providers. Chapter three describes the study design, data collection methods and techniques, study variables, data handling, data analysis, ethical considerations, assumptions and limitations of the study. Chapter four presents the results of the study in line with the stated study objectives. Finally, chapter five discusses the main results of the study citing evidence to support the findings of the present study. Chapter six highlights conclusions and recommendations for stakeholders based on the study results.

1.10 CONCLUSION

In summary, this chapter described the following elements in detail; background of the study, the problem statement, rationale of the study, theoretical aspects of the study, objectives, research questions and hypotheses. The organization of the study was also described. The next chapter focuses on review of related literature.

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

Chapter two focuses on reviewing known literature on the effects of CDSS and PBIs on motivation and performance of healthcare professionals that would provide theoretical foundation for the current study. The chapter consists of: the definitions of motivation and performance, theories of motivation and performance, decision support systems (DSS), computerized decision support system, CDSS in health and PBIs in health. The chapter also elaborates on some knowledge gaps and how the current study will surmount some of them. A critical search of databases such as PubMed, Popline, Google and Google Scholar provided a lot of literature on empirical evidence for this study. Reference lists of studies relevant to the project were reviewed and vital articles were searched for additional information. Also, unpublished reports were used.

The literature search was done in a systematic and thorough manner. Key search terms used extensively to obtain literature from the databases included; Health-worker, nurses, midwives, computerized decision support system, performance-based incentives/resultsbased financing, motivation, performance, developing countries, sub Saharan Africa and Ghana. Also, references of articles related to the study were examined and articles deemed relevant to the study included. Classic articles and journals relevant to the study were also included.

2.1 DEFINITION AND CONCEPTS

2.1.1 Motivation

Motivation represents a hypothetical construct that explains behavior of employees. It also signifies the reasons for employees' actions, desires, and needs (Wikipedia, 2015). A motive makes a worker act in a certain way or develop a tendency for a specific action (Akram and Sultan, 2014). With reference to organizational management, motivation is defined as "*willingness of workers to exert and maintain an effort toward organizational goals"* (Franco *et al.,* 2002). The current study explains worker motivation as the inner drive that pushes workers to attain organizational goal, in this context, diligent provision of maternal health services to enhance uptake and satisfaction of clients. Thus, highly motivated healthcare providers will exhibit better performance in provision of maternal health services. Constructs of motivation measured in this study include recognition, organizational commitment, timeliness, attendance, job satisfaction and intrinsic motivation.

Motivation can be divided into two different categories known as intrinsic (internal) motivation and extrinsic (external) motivation. Intrinsic motivation is the self-desire to seek out new things and new challenges, to analyze one's capacity, to observe and to gain knowledge (Ryan and Deci, 2000b). Intrinsic motivation results from an individual's need to be competent and self-determined irrespective of possible external rewards (James, 2011). Intrinsic motivation is also personal satisfaction workers derive from carrying out an activity. Compliments, public recognition, and professional opportunities are motivators and are effective as extrinsic rewards in the form of monetary reward and gifts (Mallaiah and

Yadapadithaya, 2009). For example, midwives became CDSS users in this study because they wanted to learn about how computers could facilitate the use of treatment protocols. The midwives had the intrinsic motivation to gain more knowledge of maternal health guidelines and to enhance their diagnosis of antenatal and delivery clients. Extrinsic motivation is the performance of an activity so as to get a desired outcome. It tries to answer the question, where do workers get the motivation to carry out and continue to push with persistence at work? For instance, rewards were given to midwives to promote the use of CDSS in primary health facilities in Ghana. More insight into these features of motivation is presented in theories of motivation.

2.1.2 Performance

Performance refers to the "*efficiency and effectiveness of workers to attain organizational objectives"* (Koontz & Weihrich,1990). Performing health staff "*work in ways that are responsive, reasonable and proficient to achieve paramount health outcomes"*(WHO, 2006). Dimensions of performance include availability, productivity, competence, responsiveness and patient satisfaction (WHO, 2006, Kruk and Freedman, 2008). Availability includes waiting time and attendance of health workers to the needs of their clients. Productivity is the ability of providers to deliver effective services and reduce clients' waiting time. Competencies include clinical diagnosis and protocol adherence. Responsiveness deals with client satisfaction and proactive quality service (WHO, 2006). These dimensions may be influenced by external and internal factors such as individual, organizational, health system and environmental factors. These dimensions could be evaluated among healthcare providers

to establish their performance. The present study relied on the four main dimensions of performance to assess maternal healthcare providers'

performance. Competence focused on nurses and midwives adherence to WHO reproductive health guidelines. Responsiveness focused on antenatal and delivery clients' satisfaction care. Availability and productivity looked at timeliness of care and quality of maternal health services provided.

There are numerous theories of motivation and performance but in this study, three most relevant theories would be discussed in view of their significance on workers' motivation and performance: (1) Maslow's theory (2) Herzberg two-factor theory and (3) expectancy theory.

2.3 THEORIES OF WORKERS' MOTIVATION AND PERFORMANCE

Three main theories of motivation and performance that serve as building blocks for this study are discussed in this section. These theories are useful because they provide a guide on how to motivate health providers to produce a motivational atmosphere in the health system which ultimately leads to higher performance (Halepota, 2005).

2.3.1 Maslow's Need Hierarchy Theory

Maslow's Need Hierarchy theory posits that at any point in time people are motivated to satisfy at least one of five most important needs: physiological, safety, belongingness, esteem and self-actualization (Mullins, 2007). According to Maslow the importance of higher needs increases when lower needs become satisfied and that a satisfied need was not a motivator.

If a set of needs were met, they would not serve as motivators (Armstrong, 2006). Thus, a satisfied need raises a desire to fulfill another one at a higher level (Maslow, 1943). This means that unsatisfied needs provide sources of motivation.

Physiological needs include the need for food, air and water. When these needs are met, workers become concerned about safety needs. Safety needs include protection from diverse forms of risks. Social needs include belongingness and acceptance by workmates (Mullins, 2007). Esteem factors include recognition, self-respect, achievements and status (Maslow, 1943). "*Self-actualization is the inner drive of workers to become what they are capable of becoming"*(Maslow, 1943).

To apply this theory, healthcare managers have the responsibility to create a conducive work environment for their staff to develop to their full potential, which ultimately will improve their motivation and ultimately delivery of maternal health services.

However, a few limitations of Maslow's theory may be noted. First and foremost, needs may not be hierarchically ranked because human needs are generally insatiable and so a satisfied need may not be a motivator. Also, human beings are sometimes motivated by wants rather than needs and this is what greed, which breeds corruption, is often about.
Moreover, the theory is not backed by empirical evidence - the sample size was small and Maslow still drew conclusions from his study (Armstrong, 2001). Despite these limitations, the theory is still useful to understand healthcare workers behavior and to select appropriate interventions in motivating them to perform (Halepota, 2005). It can be said that in the health system in Ghana, social, safety and physiological needs to some extent have been provided

to healthcare workers. What they seek now is acknowledgement, self-esteem and self-actualization (Prytherch *et al.,* 2013 & Ye *et al* 2014). PBI and CDSS strategies could address these needs. Managers should, however, continue to ensure that the needs of health workers are addressed for them to self-actualize.

2.3.2 The Motivator-Hygiene Theory

Herzberg tried to refine Maslow's theory by dividing the hierarchy of needs into lowerlevel and higher-level needs according to hygiene factors and motivation factors correspondingly (Bassett-Jones and Lloyd, 2005). His theory is more inclined to the working environment because; it discusses sources of motivation that are vital to the completion of work. The theory concludes that certain factors in the workplace result in job satisfaction, but if absent, they do not lead to dissatisfaction but to no satisfaction. Motivators such as challenging work, recognition, responsibility give positive satisfaction while hygiene factors such as status, job security, salary and fringe benefits do not motivate if present, but if absent, result in demotivation (Bassett-Jones and Lloyd, 2005). A hygiene factor can do away with hazards from the environment. Like hygiene, their presence will not improve health, but absence can cause health deterioration. It does not motivate workers and when used to achieve this goal it can actually produce negative effects over the long term. A "hygienic" environment prevents discontent with a job. A positive

"happiness" seems to require some attainment of psychological growth (Herzberg *et al.,* 1959). The hygiene factor is easier to measure, control, and manipulate than the motivators. Motivators are complex and subjective, and often too elusive to measure. But to the extent that management concentrates on hygiene, while at the same time neglecting motivators,

workers are probably going to seek more of the hygiene. This has a negative effect on developing a motivated workforce. If the treatment of employees is reasonably good but they express few positive attitudes toward their work and are unwilling to extend any extra effort for the company, then the organization has a motivation problem. Measures have to be taken to address these problems. True satisfaction in one's job is mainly a product of internalized motivation factors such as praise or recognition for efforts and opportunities for advancement (Herzberg, 2003). This suggests that managers in the health system have a role to play to fulfill providers' need for self-esteem and self-actualization, which influence motivation.

Herzberg's conception of motivation of work presented many years ago remains relevant for healthcare managers in manipulating motivation and performance of healthcare providers (Smith and Shields, 2013). A differentiation between hygiene and motivational factors is helpful in grasping health workers motivation and performance in the health system. Healthcare managers should provide basic conditions in which health workers can work satisfactorily without dragging on their performance. Drawing on Herzberg's concept of motivation to work, characteristics related to motivation among workers are highlighted in this study. In the health system in Ghana, most hygiene factors are present for healthcare professionals but motivation factors such as recognition and opportunities for advancement are inadequate and have resulted in poor motivation of health professionals. PBIs and CDSS were implemented to boost morale of providers for better performance. CDSS in particular was introduced to create an opportunity for self-advancement. CDSS contains WHO reproductive health guidelines that aimed at reminding workers about the best treatment to offer antenatal and delivery clients. As users use this software, they become proud as modern

midwives. Also, a questionnaire was used to assess workers' motivation based on some constructs of this theory including work intrinsic motivation, job satisfaction, recognition, organizational commitment, timeliness and attendance. Despite the usefulness of this theory, it is unable to determine a connection between satisfaction and performance and evidence is rare in terms of satisfiers enhancing performance of workers (Armstrong, 2001). It is also ambitious because it assumes that all hygiene factors should first be addressed for motivators to work properly but in practice, things do not work this way (Armstrong, 2001).

2.3.3 Victor Vroom's Expectancy Theory of Motivation

The Expectancy Theory states that motivation is a combined function of the individual's perception that effort will lead to performance and of the perceived desirability of outcomes that may result from the performance (Learning, 2015). If a worker possess an ability to put up his or her best and believes that successful job performance requires that ability, he/she will perform higher than if he/she believes that effective performance is irrelevant to the ability he/she possesses (Vroom, 1964, Rainlall, 2004). The source of motivation in this theory is a *"multiplicative function of valence, instrumentality and expectancy"*(Stecher and Rosse, 2007). Valence is the perceived amount of the reward or punishment that will result from the performance (Vroom, 1964). Instrumentality is the person's perception that performance will be rewarded or punished. Expectancy is the person's perception that effort will result in performance (Vroom, 1964, Rainlall, 2004).

Performance as an outcome as defined by Vroom is the degree to which the individual believes that performing at a particular level will lead to the attainment of a desired outcome.

Work effort results in a variety of outcomes, some of them directly and others indirectly and can include pay and promotion.

Vroom suggested linking instrumentality as a probability belief linking one outcome to other outcomes. According to Vroom, an outcome is positively valent if the person believes that it holds high instrumentality for the acquisition of positively valent consequences and the avoidance of negatively valent outcomes (Rainlall, 2004).

The implication of this theory is that for outcomes to be motivating to healthcare workers, they must yearn for them. In this light, healthcare managers should identify outcomes for which workers would like to be rewarded and implement them in the health system. PBIs and CDSS were designed because they are seen as strategies that could enhance motivation and performance of nurses and midwives in primary facilities in Ghana. The positive impact of these strategies will provide a foundation for managers to better understand ways to motivate healthcare workers to enhance performance in the delivery of maternal health services in primary healthcare facilities in the Kassena-Nankana districts of northern Ghana.

2.4 Decision Support Systems

Decision support systems (DSS) technology has evolved significantly (Shim *et al.*, 2002) over the years. The concept of a DSS is broad, and its definition varies depending on who is defining it. A decision support system *"couples the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions"* (Keen and Morton, 1978). DSS prompts maternal healthcare providers to provide maternal care and then gives recommendations or alerts to health workers when there are potential danger signs among

their clients. A full description of the CDSS is found elsewhere (Baker *et al.,* 2012, Blank *et al.*, 2013). For the purposes of this study, DSS facilitate decision-making processes of midwives in maternal health through the use of WHO reproductive health guidelines. CDSS are computer programs designed to assist healthcare professionals in decision-making (Haynes and Wilczynski, 2010, Cresswell *et al.,* 2012). Personal information of clients is matched to a computerized knowledge base and software algorithms generate patient specific information in the form of recommendations. CDSS enhances adherence to clinical guidelines, lessen paper work and access to affordable care and ultimately facilitates practitioners' performance (Hillestad *et al.,* 2005, Schoen *et al.,* 2006). Medical error rates, drug dosing, diagnosis and laboratory test usage could be enhanced due to regular use of CDSS (Sequist *et al.*, 2005, Bates *et al.*, 1998, Hunt *et al.*, 1998). CDSS could be used for blood pressure monitoring, prognostics, public health surveillance, capturing user responses to alert and supporting data collection (Cresswell *et al.,* 2012, Berner, 2009). In developed countries, electronic medical-record systems are used for nearly all primary care patients (DesRoches *et al.*, 2008, Jha *et al.,* 2009).

Electronic decision support systems can reduce the existing gap between evidence-based knowledge and health care practice (Car *et al.,* 2008, Bassi *et al.*, 2010). Dream, baobab health in Malawi and electronic perinatal record system in Zambia are forms of electronic medical records available in specialist hospitals in low- and middle-income countries but are rarely available in health centres (Nucita *et al.*, 2009, Seebregts *et al.*, 2010, Douglas *et al.*, 2010, Chi *et al*., 2011).

2.4.1 Effects of Computerised Clinical Decision Support Systems on Healthcare Providers' Motivation

In the health system, users of CDSS must be motivated to use CDSS for patient care. However, some characteristics within the health system may diminish or enhance practitioners' motivation to use CDSS (Berner, 2009). If the use of CDSS creates challenges for them, they may be demotivated when it comes to its usage. Interventions may be required to enhance their motivation to use it (Berner, 2009). Evidence outside of the clinical domain has used motivation theory to explore factors that influence technology acceptance. Much of the evidence has been concerned with extrinsic motivation, and explores what outcomes outside the activity itself influence performance of workers.

Important facets of intrinsic motivation outlined in Deci and Ryan's Cognitive Evaluation Theory include self-efficacy during the performance of an action (Igbaria *et al*., 1995). Motivation to use CDSS will be high if the system is considered to be very useful to the user. Motivation to use CDSS together with other aspects culminates in good performance (Chan *et al.,* 2014). Extrinsic motivation and intrinsic motivation accounts for 62% and 75% respectively of user intentions to use information systems in some studies (Davis, 1993). Both extrinsic and intrinsic motivation explains what determines user usage intentions. A study that assessed medical doctors' motivation using an intrinsic motivation tool revealed that physicians are motivated to use computer software at point-of-care and CDSS is perceived to be valuable for clinical care (O'Sullivan *et al.,* 2011). The current study seeks to measure workers' motivation based on a questionnaire. Constructs of motivation to be measured

include intrinsic motivation, timeliness and attendance, job satisfaction and organizational commitment.

A study to identify potential barriers and facilitators to implementing CDSS revealed that physicians had positive attitudes towards CDSS. Identified facilitators were self-control, frequency, contents of CDSS and the fact that it facilitates decision- making (Varonen *et al.*, 2008). Another study that sought to investigate reasons that motivate healthcare professionals to use CDSS in hospitals revealed perceived *"threats to professional autonomy, level of interactivity with CDSS, level of involvement in decision making, computer self efficacy and subjective norms in predicting healthcare professionals' intention to use CDSS in Malaysia*" (Esmaeilzadeh *et al.*, 2012). Another study of perceived needs and attitudes among healthcare workers accessing WHO guidelines using CDSS in maternal and neonatal care in rural Burkina Faso revealed an appreciable willingness among healthcare workers to use computers to advance in knowledge. Potential users also had a positive attitude and easy access of guidelines and implementation of decision-support using computers in the workplace. However, there were fears that the CDSS would be time-consuming and increase workload. The system was also seen to be complicated and demanded extensive computer training before full implementation. These studies provide some background information for the current study.

An assessment of healthcare providers' computer knowledge, experience, and attitudes prior to the implementation of an electronic CDSS in Tanzania and Ghana revealed that about 95% of participants had positive attitudes towards computers. Qualitative interviews also proved that despite the fact that participants were lacking computer knowledge and experience, they

were optimistic that they can surmount problems associated with computer usage. Although, this was a baseline cross-sectional study conducted with healthcare providers in 24 health facilities in Ghana and Tanzania, it serves as a foundation to build up the current study because views of participants in Ghana will be further explored. The current study will also evaluate CDSS as a tool for improving health care outcomes.

2.4.2 Effects of Computerised Clinical Decision Support Systems on Healthcare Providers' Performance

Several systematic reviews have demonstrated that CDSS enhance practitioners' performance. CDSS had positive effects in 76% of studies investigating reminders for cervical cancer screening, and mammography (Garg *et al.*, 2005b, Jamal *et al.*, 2009, Randell *et al.*, 2007, Sintchenko *et al.*, 2007, Cresswell *et al.*, 2012). Evidence further indicates that computerized provider order entry reduces the risk of both medication errors and adverse drug events (Ammenwerth *et al.*, 2008). However, there are diverse gaps associated with these studies. Most of them are systematic studies in developed countries and their target groups were not maternal healthcare providers. Implementation period for the CDSS were also brief and sometimes only as pilot interventions in selected areas. This may have led to erroneous estimations concerning long-term effects of electronic prescribing. More long-term studies seem to be needed and the current quasi experimental study involving mixed methods approaches that seeks to evaluate combined effects of CDSS and PBI interventions on motivation and performance of providers is therefore warranted.

Another study revealed that CDSS may lead to improvements in health outcomes (Bryan and Boren, 2008). Despite the fact that CDSS enhance health outcomes, there is much variability among the types and methods of CDSS implementation and resulting effectiveness. This therefore requires further work to determine effective implementation strategies for the use of CDSS across diverse healthcare settings (Bryan and Boren, 2008).

A study that addressed community hospital nurses' use of electronic health records and views of the impact of such records on job performance and patient outcomes revealed that use of these records enhanced nursing work through improved information access, efficiency and useful alert screens (Kossman and Scheidenhelm, 2008). Also, there were significant improvements in process of care after implementation of CDSS (Damiani *et al.*, 2010). One limitation of the study is the lack of quantitative estimate of specific outcomes linked to clinical conditions (Damiani *et al.*, 2010).

A study that investigated the perceptions of nurses on the usefulness of nursing information system for patient care revealed that the system was useful in aspects of patient care such as expediting care, early diagnosis and formulating diet plan (Kahouei *et al*., 2014). However, this was a self-administered questionnaire and so the findings should be interpreted with caution (Kahouei *et al.*, 2014). Another study that reviewed evidence from controlled trials of the effects of CDSSs on clinician performance and patient outcomes revealed that "*three out of 4 studies of computer-assisted dosing, 1 of 5 studies of computer-aided diagnosis, 4 of 6 studies of preventive care reminder systems, and 7 of 9 studies of computer-aided quality assurance for active medical care that assessed clinician performance showed improvements in clinician performance using a CDSS*" (Johnston *et al*., 1994). However, these studies

concentration was not on provider motivation and performance in terms of provision of antenatal and delivery care.

Furthermore, a study that systematically reviewed 65 controlled clinical trials assessing the effects of CDSSs on physician performance and patient outcomes revealed *that* 43 (66%) reported some benefits*: "Nine (9) of 15 studies on drug dosing systems, 1 of 5 studies on diagnostic aids, 14 of 19 preventive care systems, and 19 of 26 studies evaluating CDSSs for other medical care"*(Hunt *et al.*, 1998). Thus, CDSSs could enhance clinical performance for drug dosing, preventive care, and other aspects of medical care, but not convincingly for diagnosis. This current study will unearth effects of CDSS and PBIs on providers' motivation and performance in terms of provision of maternal health services.

Finally, an evaluation post-implementation impact of a nursing information system found that nurses gave the system a higher score at the second stage than at the early stage. However, overall ratings were slightly negative at both stages (Lee *et al.*, 2008). This means CDSS could have some negative effects on practitioners' performance. This study may prove otherwise.

A study on CDSS for mother and child health revealed that users were able to do early diagnosis, manage complicated and emergency deliveries, and access patient profiles to facilitate treatment (Hussain and Latif). Balaguer's study aimed to investigate the performance of both medical and nursing staff in a neonatal setting in calculating drug dosages and drug dilutions. With computer support, these workers made fewer errors.

Minor errors decreased from 16% to 2% and major errors from 2% to zero (Balaguer Santamaria *et al.*, 2001). Although this study provides some foundation for the current study, it failed to address performance indicators such as antenatal and delivery outcomes. The current study will address these indicators of maternal health service provision. It will also explore clients' satisfaction in maternal health services.

A Zambian electronic perinatal record system implemented to record demographic characteristics, past medical and obstetric history, antenatal and delivery care across 25 facilities in Lusaka's health sector revealed that *"from June, 2007, to January, 2010, 115,552 pregnant women had their antenatal and delivery information recorded in ZEPRS. Syphilis screening was documented in 83% of pregnancies: 3% of women tested positive, of which 60% were treated. Ninety six percent of women agreed to HIV testing, of whom 22% were diagnosed with HIV. In all, 98% of pregnancies culminated in a live birth, and 2% in a stillbirth"* (Chi *et al.*, 2011).

A study that evaluated the impact of the introduction of an in-patient electronic health record (EHR) on clinical workflow in a labour and delivery unit in a hospital in the United States revealed that after introduction of an EHR, direct patient care activities increased from a mean of 12.0 to 15.4; computer activities increased from 1.9 to 8.5; and idle time decreased from 3.1 to 1.4 (Henriksen *et al.*, 2008). However, the brief observational periods used for evaluations and small sample size nature of the study might have affected statistical significance.

A pre-and-post study to investigate the influence of CDSS on infection management of severe sepsis and septic shock intensive care units revealed that following CDSS implementation, adherence to standards increased by 35% (Tafelski *et al*., 2010). Data were collected for 180 days during two study periods in 2006 and 2007. Of the 186 patients with severe sepsis or septic shock, 62 were stratified into a low adherence to infection management standards group and 124 were stratified into a high adherence group. In conclusion, CDSS is a useful tool to aid adherence to treatment protocols. The current study will also try to find out whether CDSS enhances adherence to WHO reproductive health guidelines in northern Ghana.

Also, paper admission records were significantly more likely to *"miss key clinical information such as complaints (contractions, membrane status, bleeding, fetal movement, 10-64% versus 2-5% and prenatal laboratory results and history as compared to CDSS"* (Eden *et al.*, 2008). Management of patients and computer activities improved after electronic health records implementation (2 versus 12 and 12 versus 17 activities respectively) (Eden *et al.*, 2008).

Another study that analyzed cost effectiveness of the CDSS in health centres in Ghana revealed that midwives and their assistants managed 5,595 antenatal and 872 labor clients (Dalaba *et al.*, 2014). There was also an improvement in the proportion of complications during delivery; at baseline it was about 11% and end line it was about 10%. There was also an improvement in the number of maternal deaths; baseline 4 deaths and end line 1 death (Dalaba *et al.*, 2014). Although the study provides some background information to the current study in terms of antenatal and delivery clients managed by the CDSS for just a year, it has some limitations/gaps. The study evaluated the intervention only after a year of

implementation but the present study evaluated outcomes after two years of implementing the interventions. The current study will use clients' satisfaction data from the two arms at baseline and end line to assess performance of midwives and nurses. A qualitative study will also strengthen the findings of these quantitative data sets.

A before and after study that investigated the influence of CDSS on workflow of healthcare workers in primary health care facilities in Ghana and Tanzania revealed that the median time spent to provide antenatal care increased in Tanzania and Ghana after CDSS implementation as compared to baseline but this was not significant as compared to the comparison sites. The percentage of medical history taken in women who had subsequent examinations increased after CDSS implementation from 58% to 95% in Ghana (Mensah *et al.*, 2015b). Although the Hawthorne effect cannot be ruled out in this study, it is still useful for the current study as it outlines workflow of midwives providing antenatal and delivery services that the present study can tap to affirm its results.

2.5 PERFORMANCE-BASED INCENTIVES (PBI)

PBI is the "*transfer of money or material goods from a funder or other supporter to a recipient, conditional on the recipient taking a measurable action or achieving a predetermined performance target"*(Eichler and Levine, 2009). Matching payments to output will promote hard work and improve quantity and quality of care (Eichler *et al.*, 2009, Petersen *et al.*, 2006, Adams and Hicks, 2000). Diverse terminologies assigned to PBIs include pay for performance (P4P), results-based financing (RBF) and performancebased financing (PBF) (Eichler *et al.*, 2007).

Two components of PBIs are financial and non-financial incentives. In countries in which workers salaries are low, financial incentives could be used to boost their morale (Dieleman *et al.*, 2003, Gupta and Dal Poz, 2009). Financial incentives include salaries, housing and transportation allowances (Adams and Hicks, 2000). Non-financial incentives include career development, continuing education opportunities, personal recognition and verbal appreciation (Willis-Shattuck *et al*., 2008). Workers are also motivated by good working conditions and availability of logistics (Mathauer and Imhoff, 2006). Improving job satisfaction and career progression, enhancing working conditions, among others, enhance motivation, performance and could facilitate the attainment of the MDGs (McCoy *et al.*, 2008, Montagu and Yamey, 2011, Eichler *et al.*, 2013).

2.5.1 Effects of Performance-Based Incentives on Motivation and Performance of Healthcare Providers

Several studies have shown that PBIs improve motivation and performance of health workers. In a review of theories and empirical evidence of health workers motivation, Dolea and Adams stressed the importance of non-financial incentives on motivation and performance of workers (Dolea & Adams 2005). Another study has emphasized relevance of non-financial incentives for nurses' job satisfaction and self-esteem (Kingma, 2003).

A study in Mali showed that health workers motivation and performance would increase if they had more responsibilities and recognition for their work (Bradley and McAuliffe, 2009). A more recent study carried out in Mali showed that non-financial incentives improved intrinsic motivation and job satisfaction of health workers (Allison and Levey, 2012).

A one-year pilot of PBIs among health workers revealed that PBI intervention was acceptable and motivating (Miller *et al.,* 2014). The current study will also find out whether PBIs implemented for two years in primary facilities in northern Ghana is motivating for healthcare providers.

A longitudinal cohort study design on the effects of a rural allowance on motivation and retention of health workers in South Africa revealed that between 28 and 35 percent of nurses remained in rural hospitals due to the allowance. But there were no significant changes on motivation of workers and there was no comparison group (Reid, 2004).

Further evaluation will be needed to determine longer-term effects of these strategies (Reid, 2004). A study that analyzed perceived effectiveness of a rural allowance policy and its influence on motivation on 40 health workers in rural hospitals in the North West province of South Africa using qualitative interviews was effective in the recruitment of health professionals but it led to divisiveness and dissatisfaction among staff (Ditlopo *et al.*, 2011).

Financial incentives improve health workers effort for service provision and increases motivation in the Democratic Republic of Congo (Huillery and Seban, 2013). A twelve month pilot study in Zambia aimed at improving motivation and performance of staff through financial and non-financial performance awards improved staff motivation and job satisfaction substantially (Furth, 2006).

In Egypt, a PBI intervention was associated with improvements in quality of care and increased satisfaction levels among beneficiaries (El-Saharty *et al.*, 2010). Also, a qualitative study in Rwanda revealed that PBIs improved motivation and performance of healthcare

providers (Paul, 2009b). Another study showed that PBIs strongly influence healthcare workers' motivation and retention (Kok and Muula, 2013). This implies PBIs have a potential to enhance healthcare providers motivation and performance.

Pay-for-performance was used to increase the quantity and quality of health services in Haiti. Within six years, the intervention health centres showed remarkable improvements in a range of performance indicators such as percentage of pregnant women who attended antenatal visits at least three times and the percentage of skilled deliveries conducted (Eichler *et al.*, 2007).

Another study revealed that incentives given to providers resulted in an improvement in institutional deliveries and the content of antenatal care (Eichler *et al*., 2013). The present study will determine whether PBIs can enhance motivation and performance of healthcare providers in northern Ghana.

A study that assessed the effect of PBI on providers use and quality of maternal care services in healthcare facilities in Rwanda showed that facilities in the intervention group had a 23% increase in the number of institutional deliveries from 2001 to 2004. There was also an increase in performance of healthcare providers in general. No improvements were seen in the number of women completing four antenatal care visits (Basinga *et al.*, 2011a).

A more recent study in Rwanda has also affirmed that PBIs led to a 20% increase in productivity of maternal healthcare providers (Gertler and Vermeersch, 2013).

PBI evaluated in intervention health facilities in Cambodia improved immunization coverage, antenatal and other preventive services than in non-intervention facilities (Soeters and Grifiths, 2003). PBI pilots in Burundi revealed about 60 percent increase in the rate of assisted births, uptake of family planning services and improvement in motivation of staff (Toonen *et al*., 2009).

A few negative effects associated with PBI implementation have also been reported in Zimbabwe. The government implemented financial reforms, fortified health management and decentralization to promote higher levels of motivation and performance among health workers. Unfortunately, workers perceived reforms as a threat to their job security, salaries, career advancement opportunities and motivation. This demotivation made them to carry out strike actions and unethical behaviour (Mutizwa-Mangiza, 1998). The current study seeks to evaluate combined effects of CDSS and PBI interventions on motivation and performance and so it is unlikely that these interventions will culminate in negative effects.

In Ghana, additional duty allowance introduced for healthcare providers to boost their performance had minimal impact and ultimately the scheme was abrogated (Snow *et al.,* 2011). A systematic review to consolidate existing empirical evidence on the impact of incentives on motivation and retention of health workers in Ghana's district hospitals using quantitative design with a sample of 285 health workers revealed that financial incentives significantly influenced motivation and intention to stay and work in these hospitals (Adzei and Atinga, 2012). This study was however not a quasi-experimental study and the study participants were drawn from hospitals.

2.6 SUMMARY AND GAPS IDENTIFIED

Motivation and performance were defined in this chapter. Theories of motivation and performance of healthcare providers were also discussed. Generally, this chapter discussed related literature on the effects of CDSS and PBI strategies on motivation and performance of healthcare providers.

Taken together, the results of the review of related literature indicate that CDSS and PBI interventions play an important role in practitioners' motivation and performance. CDSS and PBI interventions improve motivation and performance of providers in developed and developing countries (Ammenwerth *et al.*, 2008, Garg *et al.*, 2005b, Furth, 2006, Kawamoto *et al.*, 2005). Although the evidence informs the current study, there are some limitations that are worth mentioning. Most of these studies were systematic reviews; others were either qualitative or quantitative studies. Moreover, most of the studies had no baseline and no comparison group; they used small sample sizes and focused on practitioners in general and not maternal healthcare providers. Most of these studies portrayed just single effects of either CDSS or PBIs on motivation and performance of practitioners.

Effects of CDSS on MH providers' performance have also been insufficiently studied.

Some studies have focused on CDSS users attitudes towards computers, effects of CDSS on workflow and cost effectiveness of CDSS in developing countries including Ghana (Mensah *et al.*, 2015b, Dalaba *et al.*, 2014, Blank *et al.*, 2013, Zakane *et al.*, 2014, Dalaba *et al.*, 2015a, Saronga *et al.*, 2014, Sukums *et al.*, 2015). Although these studies contribute some variables such as antenatal

and delivery clients managed, motivation and performance in terms of clients' satisfaction with care were not assessed using quasi experimental designs involving mixed methods approaches as the current study did.

PBIs enhance providers' motivation and performance in most developing countries. However, evidence is still weak and calls for rigorous studies like the current one (Witter *et al.*, 2012). Evidence on the combined effects of CDSS and PBI interventions on motivation and performance is non-existent worldwide. A study that focused on cardiovascular care assessed the effects of PBIs on quality in electronic health record (EHR)-enabled small practices in the perspective of an established quality improvement project, a clusterrandomized trial of less than 10 clinicians in primary care clinics in New York City from April 2009 to March 2010. Among small EHR-enabled clinics, the incentive program compared with normal care resulted in slight improvements in cardiovascular care procedures and outcomes (Bardach *et al.*, 2013). However, further research is needed to determine whether this effect increases or decreases over time. This study did not assess
MH provider motivation and performance in terms of provision of maternal health services. This current study extensively used quasi-experimental design involving mixed methods strategy to unearth combined effects of CDSS and PBIs on motivation and performance of MH providers in primary facilities in northern Ghana. The next chapter would describe research methods used for the study.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the profile of the study area. It also elaborates how the study was conducted to meet the objectives and test the hypotheses of the study. The chapter highlights study design, setting and participants, data collection methods and techniques, data analysis as well as ethical considerations.

3.2 PROFILE OF THE STUDY AREA

3.2.1 Study site

The study was conducted in the Kassena-Nankana districts (East and West) and Builsa district (North and South districts) in Northern Ghana. In this study, the former names of these districts were used; Kassena-Nankana and Builsa districts.

3.2.2 Location and Size of the Study Districts

The Kassena-Nankana district lies within the Guinea Savannah woodlands and falls approximately between latitude 11°10’ and 10°3’ North and longitude 10°1’ West. It is located in the Upper East Region of Ghana with an estimated land area of 1,675 square kilometers (Oduro et al., 2012). Builsa district (Now Builsa North and South districts) lies between longitudes 10 05’West and 10 35’ West and latitudes 100 20’ North and 100 50’

North. The district covers an area of 2,220 kilometers and constitutes 25.1% of the total land area of the Upper East region (Builsa-DHMT, 2010).

3.2.3 Basic Population Statistics

In 2012, the population of KND was 150,000 and more than 80% of this population lives in rural areas and the economy is based on subsistence agriculture, which accounts for about 68% of the employable population (Oduro et al., 2012). The entire population of the Kassena-Nankana district is monitored by the Navrongo Health and Demographic Surveillance System (Oduro et al., 2012). The settlement patterns are mostly dispersed as regards the local housing structure. Such structures are thus interspersed with households' farmlands. Most of the urban settlements are located along the major road networks especially the Trans-National-ECOWAS route and nearer the district capital–Navrongo. The district is characterized by a high poverty and mortality burden and has a poverty incidence of about 88% (Dinye and Ayitio, 2013, NDPC, 2012). Builsa district has a population of 95,800 (Builsa-DHMT, 2010). The district's economic structure is dominated by subsistence economy. The district has a single maximum rainfall regime expanding over a period of five months. The dry period extends for 7 months with a mean temperature of 25-30 degrees celsius (Builsa-DHMT, 2010).

3.2.4 Health Service Organisation

Both Kassena–Nankana and Builsa districts have a hospital and six health centres each. Kassena-Nankana district has three private clinics whilst Builsa district has two private clinics.

In the Kassena-Nankana district, there are 30 Community-based Health Planning and Services (CHPS) centres while in the Builsa district there are thirteen (13) CHPS centres. The CHPS strategy begun in 1999 with the objective of improving access to primary health care in Ghana through midwives and community health nurses (Nyonator *et al.,* 2005).

Inadequate health personnel is a problem in both the Kassena-Nankana and Builsa districts with a Doctor/Patient ratio of 1:75,488 and Nurse/Patient ratio of 1:5,245 in the KassenaNankana district. However, there are a number of staffs from the Health Administration that support the other health personnel to tackle health problems. There are also about 87 nurses, medical assistants and clinicians in the district hospital and about 120 other health workers in health centres and community health compounds. Two Cuban doctors support

Ghanaian doctors at the district hospital (Builsa-DHMT, 2010, Kolan, 2011, KNDHMT, 2010).

In the Builsa district, there is one medical doctor stationed at the hospital in Sandema; 15 practicing midwives, 32 community health nurses, 11 community health officers and 4 public health nurses (Builsa-DHMT, 2010). This trend depicts the precarious inadequate staffing situation nationwide, which creates a lot of workload for health workers that eventually affects their motivation, efficiency and performance.

Motivation of healthcare providers is low in these districts and incentives could serve as strategies for improving it but they are rarely implemented (Kolan, 2011, *Yé et al.,* 2014). Currently incentives that are applied are vehicle-hire purchase, study leave with pay, workshops and rural incentives allowances.

In the Kassena-Nankana districts, maternal mortality ratio for the period 1995–1996 was about 637 per 100,000 live births but this reduced to 373 per 100,000 live births in 2002–2004 (Mills *et al.*, 2008).

3.3 RESEARCH DESIGN

This study used a quasi-experimental design with a before and after measurement to test the following hypothesis: maternal healthcare (MH) providers who use a computerised decision support system (CDSS) and are beneficiaries of performance-based incentives (PBI) have higher levels of motivation and performance in terms of management of antenatal and delivery clients. A quasi-experimental design is a design with the ability to establish causal associations between an intervention and an outcome and is particularly useful for assessing public health interventions (Harris *et al*., 2006). The CDSS and PBIs interventions were implemented and MH providers' motivation and performance before and after the intervention were measured. Out of thirteen (13) districts in the Upper East region of Ghana, two (2) districts were purposively selected to be part of the study. The Quality Maternal and Neonatal Health (QUALMAT) Study was carried out in these districts. All six health centres in the original Kassena-Nankana district (now divided into KassenaNankana East Municipality and Kassena-Nankana West district) received the interventions (CDSS and PBI), while all six (6) Health Centres in Builsa district served as the comparison sites (Appendix 1). The original Kassena-Nankana district is used throughout in this research. Pre- and post-test measurements helped to identify changes over time and a comparison group helped establish possible effects of the intervention over time (Table 3.1).

Table 3. 1 Intervention and Comparison Health Centres

No.	Intervention (Kassena Nankana District)	Comparison (Builsa District)
1.	Kologo Health Centre	Chuchuliga Health Centre
2.	Kassena-Nankana East Health Centre	Wiaga Health Centre
3.	Sirigu Health Centre	Siniensa Health Centre
4.	Paga Health Centre	Fumbisi Health Centre
5.	Chiana Health Centre	Kanjarga Health Centre
6.	Navrongo Health Centre	Doninga Health Centre

Source: Author's Own Construct, 2014.

3.4 DATA COLLECTION TECHNIQUES AND TOOLS

In order to assess the impact of the interventions on motivation and performance of providers, a mixed-methods approach involving the use of quantitative data, routine data from the health facilities and qualitative data on motivational constructs and performance of providers before and after the intervention was used. While quantitative and routine data were essential in highlighting the magnitude of change, qualitative data were critical in clarifying and explaining the change process. A combination of quantitative and qualitative methods

provided a measure of change in motivational constructs and performance of providers as well as provided an explanation of the change process. "*Mixed-methods approach is a methodology for conducting research that involves collecting, analyzing, and integrating (or mixing) quantitative and qualitative data in a study.*" (Bulsara, 2014). By combining qualitative and quantitative data, the strengths of quantitative and qualitative data collection strategies were maintained while some of the weaknesses were drastically lessened (Creswell *et al*., 2011).

3.4.1 Quantitative Methods

To quantitatively measure the combined effect of the interventions on MH providers' motivation, a questionnaire was administered at baseline (April to May, 2011) and end line (May to June, 2014) to the intervention and comparison groups. The questionnaire was developed after a review of related literature on constructs of motivation (Mutale *et al.*, 2013 Mbindyo et al., 2009). Constructs of motivation measured included: job satisfaction, general motivation, timeliness and attendance. The questionnaire had two sections - a section on demographic characteristics of respondents and another on the motivation constructs with their response categories (Appendix 2). Two (2) main research assistants with previous experience in data collection were trained for three (3) days on the study objectives, techniques of interviewing, the content of the questionnaire, probing skills and building rapport during the interviews and research ethics. They also pretested the scale to check its validity and reliability and to familiarize themselves with these tools. Afterwards, the scale was administered among all maternal healthcare providers in the study health centres from May to August in 2011 and from May to August in 2014. Eligible participants were guided

to fill the questionnaire at their places of work after consenting. At baseline, 50 interviews were conducted and at end line the same cohort of health providers were reinterviewed. They were asked to rate their agreement or disagreement with each statement by ticking any of the four response categories provided in the scale. They ticked whether they strongly agree, agree, disagree or strongly disagree with statements provided. The interviews were done at the health centres and each interview lasted for about thirty minutes.

Using routinely collected data from the health facilities and a structured questionnaire the study assessed maternal healthcare providers' performance in terms of management of antenatal and delivery clients. The study reviewed service statistics from the twelve (12) facilities in the two (2) districts from April 2011 to March 2014, to assess the performance of healthcare providers at baseline.

The clients', satisfaction survey questionnaire was in two (2) parts: a part on antenatal clients' satisfaction with care and the other on delivery clients' satisfaction with care. Antenatal and delivery care clients care satisfaction questions were presented using a fivepoint Likert scale (Appendices 3 and 4). Data were collected using these structured questionnaires through face-to-face exit interviews with antenatal and delivery clients in both the intervention and comparison health centres. These surveys focused on key areas of provider performance such as technical performance comprising of reception of client, compassion, and respect shown to clients, adequacy of drugs prescribed and diagnosis, among others. Client-provider interaction and health worker availability were also assessed to establish the level of performance of maternal healthcare providers. These dimensions of performance are generally used to assess health workers' performance (WHO, 2006). Baseline data for the

satisfaction survey were collected in 2010, while end line data were collected in 2014. Field workers trained for four (4) days carried out these exit interviews.

The data collectors stayed in communities close to the study health centres and visited the facilities daily to interview antenatal and delivery clients. Most interviews with clients were conducted in the Kassena-Nankana district using the two major local languages (Kassem and Nankam), while interviews in the Builsa district were conducted in Builli. On average, interviews lasted not more than forty (40) minutes. Before starting the interviews, both verbal and written informed consent were obtained from participants.

3.4.3 Qualitative Research Methods

The qualitative component of the study sought to complement the survey and routinely collected data. In-depth interview (IDI) guides that explored participants' experiences on the combined effects of the CDSS and PBIs interventions on motivation and performance were developed. The IDI guides captured personal information of respondents and the perceived effects of the interventions on motivation and performance as reported by the respondents. The investigator and two research assistants conducted IDIs with 24 MH providers in the intervention (Appendices 5 and 6) and comparison facilities (Appendices 7 and 8). IDIs were also conducted with twelve (12) health facility managers and six (6) district level staff because of various roles they have played in implementing the CDSS and PBI. Both health facility and district level staff were part of the IDIs in this study to allow for triangulation of findings. IDIs with healthcare providers, health facility managers, and district public health nurses were done in English. Consent was sought from participants before audio taping interviews. IDIs took approximately thirty minutes and the two research assistants took

detailed notes during the interviews. The interviews were conducted at places the participants deemed convenient. The IDIs focused on participants' experiences and opinions about the effect of the interventions on motivation and performance. Table 3.2 shows the total number of participants interviewed.

Table 3. 2 Participants Interviewed

Type of participants	**Number of participants**	**Location**
Maternal healthcare providers-Users of the CDSS and beneficiaries of the incentive scheme	24	Intervention health centre
Maternal healthcare providers-Not users of the CDSS and beneficiaries of the incentive scheme	24	Comparison health centres
Health facility managers	6	Intervention health centres
Health facility managers	6	Comparison health centres
District level staff	2	Intervention districts
District level staff	4	Comparison districts
Total	**66 interviews**	

3.5 STUDY POPULATION

The study population includes all maternal healthcare workers in all twelve health centres in the Kassena-Nankana and Builsa districts in the Upper East region of Ghana. In particular, at baseline, all midwives and nurses providing maternal health services in the two districts

were part of the study population. Women who went for antenatal and delivery services also constituted the study population. At the intervention and endline phases, all maternal healthcare providers who were using CDSS and beneficiaries of the PBI were part of the study population. It also included women who went for antenatal and delivery care at end line.

3.6 STUDY VARIABLES AND CONSTRUCTS

Variables for this study were categorized into dependent and independent variables. Independent variables for the first survey (motivation survey) included: age, sex, years of schooling, years of working in maternal health and years of working at the facility. The dependent variables on health workers' motivation included: job satisfaction, intrinsic motivation, organizational commitment, attendance and timeliness. The independent variables for the second survey (satisfaction survey) were age, education, week of gestation, number of ANC visits, number of pregnancies, number of deliveries, type of delivery and knowledge about newborn. On the other hand, dependent variables on performance of providers were measured in terms of management of antenatal and delivery clients as well as clients' satisfaction with antenatal and delivery care. Table 3.3 contains the constructs/variables, constitutive definitions and their operational definitions of the study.

Table 3. 3 Table of Variables

Outcome	Constructs/Variables	Constitutive definition	Source of data/questions used

Motivation	Job satisfaction (Overall, I am very satisfied with my work in maternal and neonatal care)	The attitude the participant has toward all aspects of the job	34, 35 and 36
	Intrinsic motivation (These days I feel motivated to work as hard as I can)	The attitude the participant has toward the intrinsic motivational aspects of the job	32 and 33
	Timeliness and attendance (I am punctual about coming to work and works to make sure that no patient had to wait for long)	Participants punctuality to work and timely service provision	Responses to questions 37 and 38
	Organizational commitment (I don't intend to leave this facility)	The participant feels attached to their work place	Responses to questions 29, 30 and 31
Performance in terms of management of antenatal and delivery clients	Routinely collected data	Antenatal attendance Skilled delivery conducted HIV/AIDS testing compliance Antenatal and delivery referrals Anti-tetanus vaccinations	Routine Data
Performance in terms of antenatal and delivery clients satisfaction with care	Clients satisfaction with antenatal services	Technical performanceParticipants satisfaction with specific output of healthcare providers	Responses to question 1, 3, 5,7,8,9, 10, 11, 12, 14, 14, 15,16, 17,18, 19, 22
		Client-provider interaction-	Responses to question 20-21

		Participants satisfaction with healthcare providers' interaction with them when care was	
		Health worker availability- Participants satisfaction with presence of health personnel when service was rendered.	Responses to question 5 &6
		General satisfaction with ANC services	Responses to questions 25 & 27
	Clients satisfaction with delivery services	Technical performanceParticipants satisfaction with specific output of healthcare providers	Responses to questions1, 3,5, 13,14, 18, 20, 21, 22, 24, 25, 26 & 28
		Client-provider interactionParticipants satisfaction with healthcare providers' interaction with them when care was provided.	Responses to questions 27
		Health worker availability- Participants satisfaction with presence of health personnel when service was rendered.	Responses to 6,7, 8 & 9
		General satisfaction with delivery services	Response to question 34

3.7 SAMPLE SIZE AND SAMPLING

The study used a census of the health centres in the districts - all twelve (12) health centres from the intervention and comparison sites were involved in the study. Selection of participants was done using purposive sampling for the quantitative survey with healthcare providers (Ary et al., 2013, King and Horrocks, 2010). The number of maternal healthcare providers in the two study districts was small (50) at baseline and so all participants who consented to participate in the study were interviewed. Before the CDSS and PBI interventions were implemented, baseline surveys were conducted in all the twelve (12) health centres in the two districts. After the interventions were rolled out for two years, all maternal healthcare providers interviewed at baseline were re-interviewed at end line.

For the clients' satisfaction surveys, the main sampling unit was the antenatal and the delivery clients. A total sample of 2,681 antenatal and delivery clients at baseline and end line in the intervention, and comparison arms was sufficient to achieve 80% power to detect a difference of 10% in satisfaction, with a significance level of 5%.

Purposive sampling technique was applied to select 24 CDSS users, six (6) district level staff and six (6) health facility managers for the IDIs. It was also used to select equal numbers of respondents in the comparison arm for the IDIs. Purposive sampling technique allowed the study to choose participants believed to be most knowledgeable about the research area and able to provide insights into the phenomenon of interest (Green and Thorogood, 2013).

3.8 PRE-TESTING

The data collection tools were pre-tested by the investigator and two research assistants before data collection commenced among maternal healthcare providers in six (6) health centres in the Bongo district of the Upper East Region. This was done to determine whether the questions adequately addressed the study objectives and to test the capabilities of the interviewers. In the end, some modifications were made to the data collection guides. Some questions were revised and others were dropped.

3.9 DATA MANAGEMENT

On a daily basis, during the study period, the principal investigator supervised the research assistants in the field to ensure accuracy and completeness of the questionnaire and interviews. At the end of each day, all completed questionnaires were checked to ensure that there was no missing information. The completed questionnaires were de-identified and data entry commenced. The data were double-entered and verified using Epidata. Data entry screens were developed with inbuilt validation and consistency checks to control data input. Confidential storage of audio and written data was done. Qualitative interviews were transcribed and anonymised. Two transcription consultants transcribed the audio recordings verbatim for the purposes of coding and analysis. Each of the transcripts was edited before they were imported into QSR Nvivo 10 for analysis.

3.10 DATA ANALYSIS

Data was triangulated to develop a more complete understanding of the effects of CDSS and PBI on motivation and performance of healthcare providers. The surveys allowed for quantification of the effects of the interventions on motivation and performance of healthcare providers while the qualitative approach allowed for an explanatory analysis of health workers own interpretations of the perceived effects of the interventions on their motivation and performance.

3.10.1 Analysis of quantitative data

The data were entered by four (4) data entry clerks using Epidata. Data were analyzed in STATA version 13 where basic statistics such as proportions and means were calculated. The descriptive statistics were used to summarize demographic variables such as age, years of working in maternal health, years of working in current facility among others in the health workers motivation survey. Descriptive statistics were also used to summarize demographic variables such as age, weeks of gestation, and number of pregnancies, number of antenatal visits, educational level, and type of delivery among others for the exit interviews.

Analysis of motivation data: To evaluate changes in motivational constructs and providers' performance from the perspective of the clients in the comparison versus intervention sites over time (baseline versus post-intervention), four response categories in the motivation questionnaire were recoded. The motivation tool had the following response categories namely: strongly agree, agree, disagree, and strongly disagree. These four response categories were re-grouped into two response categories during the analysis. The first two

response categories (coded 1: strongly agree and 2 agree) were considered as agree. The last two response categories (coded 3: strongly disagree, disagree and 4) were classified as disagree. To enable an easy comparison of the scores on different aspects of motivation, all scales were transformed to a scale with a minimum of 0 and a maximum of 100 by dividing the difference of the crude score and the minimum crude score by the score range and multiplying by 100. Afterwards, difference-in-difference (DiD) analysis was performed. The DiD method compared the change in outcomes in the intervention group to the change in outcomes in the comparison group over time. Using a 20-item index, we calculated an overall mean motivational score. The score was obtained by dividing motivation by 20 variables multiplied by 100.

Analysis of routine data: Statistical analysis was performed using STATA software version 12. Descriptive statistics and a proportion test were used to describe the study variables. The number of anti-tetanus vaccinations administered, number of women whose haemoglobin levels were checked, HIV/AIDS testing compliance, number of referrals during antenatal and labour care were calculated at baseline, midline and endline in the intervention and comparison health centres. A fraction was generated from each of these variables based on their absolute numbers and multiplied by 100%. The absolute numbers for antenatal attendance at baseline, midline and endline served as denominators for each of the variables while the numerators were absolute values for each of the variables–antitetanus vaccinations, HB checked, HIV/AIDS status checked and referrals for complications. The fraction generated from each of the performance variables was multiplied by 100% to get a proportion

for each of the variables. A difference in proportions at baseline, midline and endline in the intervention and comparison arms was tested and a significance level was set at 0.05.

Analysis of client satisfaction data: The five response categories found in the tools for antenatal and delivery satisfaction were recoded into two; 1 for satisfied and 0 for unsatisfied. The different items of the questionnaires on client satisfaction were subjected to exploratory factor analysis for the ultimate purpose of data reduction. Based on the factor-analysis results, groups of variables were defined (variables on performance of healthcare providers from the perspective of antenatal and delivery clients are technical performance, clients-provider interaction, health-worker availability and general satisfaction with care) and mean scores calculated for the total of the selected health facilities in intervention and comparison, for each variable, per group and for the overall study (Al Tehewy *et al.*, 2009, Van Duong *et al.*, 2004). The principal component analysis (PCA) method was used to extract the factors. PCA was used because of the various explanatory variables in the analysis that were correlated with one another. PCA is a data reduction method which reduces large number of variables into a smaller number of variables. The number of factors retained in the study was based on eigenvalues ≥1. Afterwards, difference-in-difference (DiD) analysis was performed using the logit model and controlling for potential confounders. The DiD method compared the change in outcomes in the intervention group to the change in outcomes in the comparison group over time. Crude estimates were generated and adjusted analysis was performed. Satisfaction was the main dependent variable adjusting for covariates such as age, days spent at facility, weeks of gestation, women with two or more antenatal visits, number of pregnancies and educational level Statistical significance was declared at 0.05.

3.10.2 Analysis of qualitative data:

Transcripts from the qualitative study were exported into NVIVO 10 to facilitate analysis (Bazeley and Jackson, 2013). The transcripts were read critically and later analysed thematically using the framework analysis strategy. Coding and analysis were done thematically and systematically (Ritchie and Spencer, 2002, Bryman and Burgess, 2002, Srivastava and Thomson, 2009). Transcripts were coded and categories as well as subthemes were identified which resulted in transparency and thoroughness (Ritchie and Spencer, 2002). The analysis strategy was both deductive and inductive. In terms of deductive, categories were derived from prior knowledge while for inductive, categories were generated from the data (Moretti *et al.,* 2011). A number of sub-themes emerged from the analysis. Triangulation of narratives of healthcare workers (midwives, nurses, medical assistants, district public health nurses and directors) at different levels of the health system in the two study arms added to the validity of the results.

3.11 ETHICAL CONSIDERATIONS

Ethical approvals were obtained from the Committee on Human Research, Publication and Ethics Kwame Nkrumah University of Science and Technology (Appendix 9). Permission was sought from the District Directors of Health Services and managers of health facilities to interview healthcare providers. The purpose of the study, procedures, benefits and risks were explained to study participants. Privacy and confidentiality were ensured during interviews. Both verbal and written informed consent were obtained from healthcare providers and their clients before interviews were conducted (Appendices 10, 11, 12 and 13).

Study participants who consented were included and those who did not consent were excluded.

3.12 ASSUMPTION

All responses provided by the study participants are assumed to be exact and reliable.

3.13 INTERVENTIONS

CDSS and PBIs interventions were tested in the Kassena-Nankana districts in the Upper East Region from April, 2012 to April, 2014 (Yé *et al.*, 2014, Blank *et al.*, 2013, Mensah *et al.*, 2015b, Dalaba *et al.*, 2014). The CDSS provided computerized guidance and clinical support for antenatal and delivery care (for up to 24 hours after delivery) (Blank *et al.*, 2013). It was based on the WHO guidelines *"Pregnancy, Childbirth, Postpartum and Newborn Care: a guide for essential practice"* (Garg *et al.*, 2005b, Blank *et al.*, 2013, WHO, 2006). CDSS facilitated management of antenatal and delivery clients and a source of training material for healthcare providers. Thirty five (35) maternal healthcare providers (midwives, community health nurses, health facility managers and district level staff) went through six (6) training programs before they commenced the use of the software. Six laptops with the CDSS installed on them were given to the users and they commenced using it for patient care in April, 2012 and ended in March, 2014. Figure 3.2 below depicts one phase of the CDSS.

Figure 3. 1 Computerised Decision Support System

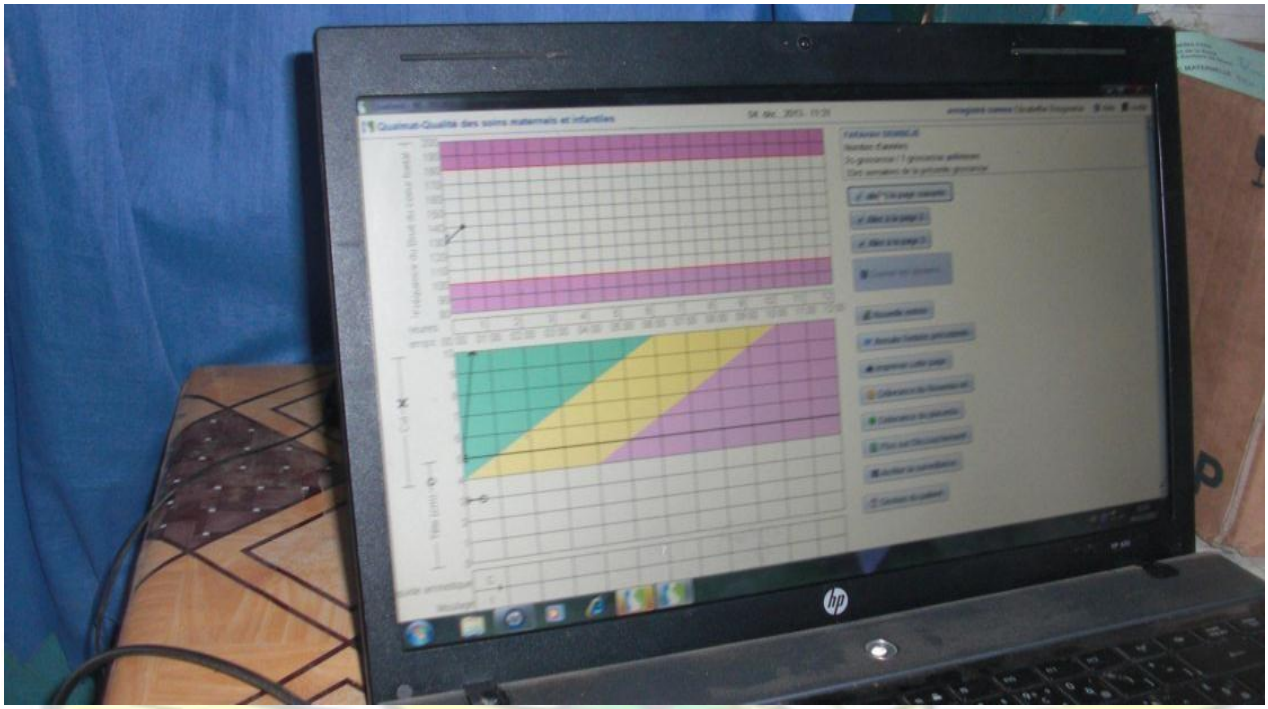


Figure 3. 2 An Antenatal Client Receiving Care from a Midwife

PBIs were introduced from July, 2012 to March, 2014 to boost the morale of users of the CDSS. Based on meetings with healthcare providers, regional and district health directorates key performance indicators were defined. The specific indicators include proportion of women who have had at least four ANC visits, proportion of pregnant women who received antitetanus vaccinations, women whose haemoglobin and blood pressure levels were continuously checked, proportion of antenatal and labor referrals, HIV testing compliance and proportion of births attended by skilled birth attendants.

To reward healthcare providers, three awards ceremonies were held. The first was held in December, 2012; the second in September, 2013 and a final one in February, 2014. During these awards ceremonies, best performing healthcare providers and health centres received

non-financial incentives such as fridges, television sets, blenders, saucepans, cloths, tea kettle, microwave and certificates of recognition. Other incentives given to them include regular supervision, verbal appreciation, furniture and a small monthly allowance ($20).

3.14 SUMMARY

This chapter outlined details of the study design, data collection methods and techniques, target population, data management, data analysis, ethical considerations and assumptions.

The next chapter presents both quantitative and qualitative results.

CHAPTER FOUR

4.0 RESULTS

4.1 INTRODUCTION

This chapter presents the results of the study on the effects of computerized decision support system (CDSS) and performance-based incentives (PBIs) on motivation and performance of maternal health care providers in the Kassena Nankana and Builsa districts in northern Ghana. It starts by describing demographic characteristics of respondents, effects of CDSS and PBI on motivation of maternal healthcare providers, effects of CDSS and PBI on performance of maternal healthcare providers. The major findings of the study are summarized at the end of the chapter.

4.2 DEMOGRAPHIC CHARACTERISTICS OF QUANTITATIVE STUDY RESPONDENTS.

4.2.1 DEMOGRAPHIC CHARACTERISTICS OF HEALTHCARE PROVIDERS IN QUANTITATIVE SURVEY

At baseline all respondents in both the intervention and comparison arms were females. However, at endline, of the 50 participants, 5 were males. At baseline, 3 and 4 of the intervention and comparison respondents respectively were between 40-49 years. At endline, 13 and 10 of the respondents in the intervention and comparison arms respectively were between 20-29 years old. Furthermore, at baseline, 18 and 17 of the intervention and comparison participants were midwives while at endline these numbers were 16 and 14.

At baseline, the same number (5) of intervention and comparison respondents respectively spent between 6 to 10 years working in maternal health. This situation didn't change at

endline; 5 respondents each in the intervention and comparison arms respectively spent between 6 to 10 years working in maternal health. Finally, at baseline, 3 and 4 of the comparison and intervention respondents respectively spent between 1-5 years working in the health facilities. At endline, 3 and 4 of the intervention and comparison respondents respectively spent between 1-5 years working in the health facilities (Table 4.1).

Table 4.

1 Demographic Characteristics of Healthcare Providers in Intervention and Comparison Arms

Variable	Baseline (2011)		End line (2014)	
	Intervention arm (number)	**Comparison arm (number)**	**Intervention arm (number)**	**Comparison arm (number)**
Sex:				
Females	24	26	23	22
Males	-	-	2	3
Age group:				
20 – 29	6	5	13	10
30 – 39	5	4	4	9
40-49	3	4	1	4
50-59	10	12	7	-
60+	-	1	-	2
Total	24	26	25	25
Profession:				
Community health nurse	5	6	7	10
Midwife	18	17	16	14
Others(Medical Assistants and Public Health Nurses)	1	3	2	1
Total	24	26	25	25
Years of working in maternal health:				
<1	4	1	4	1
1 – 5	4	5	4	5

6 – 10	5	5	5	5
11+	11	15	11	15
Total	24	26	24	26
Years of working in this facility:				
<1	6	3	6	3
1 – 5	14	19	14	19
6 – 10	4	3	4	3
11+	-	1	-	1
Total	24	26	24	26

4.2.2 DEMOGRAPHIC CHARACTERISTICS OF ANTENATAL CLIENTS

A total of 1,428 antenatal clients were studied. At baseline and at endline, the modal age group was 20 – 29 years. 52% and 48% of intervention and comparison antenatal clients respectively were between 20-29 years. At endline 58% and 51% of intervention and comparison antenatal clients respectively were between 20-29 years.

Weeks of gestation at baseline was almost the same (25% for intervention and 26% for comparison). At end line, weeks of gestation for antenatal clients were 25% and 23% in the intervention and comparison facilities respectively.

In terms of number of pregnancies, 33% of women in the intervention arm had just one pregnancy while 23% of women in the comparison arm had one pregnancy. At endline, about 27% of women had just two pregnancies while in the comparison arm 22.5% had two

Table 4.

pregnancies. At baseline, majority (52%) of the comparison respondents never attended school. This situation didn't change much at endline; 54% of comparison antenatal clients never attended school (Table 4.3).

2 Demographic Characteristics of Antenatal Clients

	Baseline		**Endline**	
Variable	**Intervention n(%)**	**Comparison n(%)**	**Intervention n (%)**	**Comparisonn (%)**
Age:				
10 to 19	54(15.9)	66(18.0)	54(14.3))	53(14.6)
20 to 29	19(5.19)	176(48.0)	220(58.2)	188(51.8)
30 to 39	83(24.5)	105(28.6)	98(25..9)	113(31.1)
40-49	3(0.88)	19(5.2)	6(1.6)	9(2.5)
50-59	1(0.3)	-	-	-
Total	160 (46.77)	366 (99.8)	378(100)	363(100)
Gestation age at time of consultation, Median (Range), Weeks				
Gestation age	25(3-40)	26(3-42)	28(6-42)	27(6-41)
Antenatal visits:				
1 Visit	57(20.0)	78(23.4)	82(21.7)	138(38.0)
2 Visits	57(20.0)	78(23.4)	82(21.7)	138(38.0)
3 Visits	47(16.5)	73(21.9)	53(14.0)	47(13.0)
Additional Visits	38(13.3)	46(13.8)	136(36.0)	30(16.5)

Total	199(69.8)	275(82.5)	353(93.4)	326(105.5)
Number of pregnancies including present one:				
1	113(33.1)	83(22.7)	97(25.8)	72(20.0)
2	76(23.2)	75(20.5)	101(26.9)	81(22.5)
3	47(13.8)	67(18.3)	70(18.6)	72(20.0)
4	56(16.4)	71(19.4)	50(13.3)	69(19.2)
5	31(9.1)	41(11.2)	39(10.4)	32(8.9)
6	11(3.2)	22(6.0)	13(3.5)	23(6.4)
7	2(0.6)	5(1.4)	5(1.3)	9(2.5)
8	2(0.6)	2(0.6)	1(0.3)	2(0.56)
Total	338(100)	366(99.9)	376(100.1)	360 (100.1)
Education :				
Never attended School	149(44.2)	181(51.7)	142(37.8)	197(54.1)
Primary/Junior High School	75(22.3)	123(35.1)	89(23.6)	93(25.6)
Senior High School	101(30.0)	40(11.4)	119(31.6)	66(18.1)
Tertiary Level	12(3.6)	6(2.0)	27(7.2)	8(2.2)
Total	337(100.1)	350(100.2)	377(100.2)	364(100)

4.2.3 DEMOGRAPHIC CHARACTERISTICS OF DELIVERY CLIENTS

A total of 1,263 delivery clients were included in the sample. At baseline, about 56% and 53% of delivery clients in the intervention and comparison arms respectively were between 20 to 29 years. At endline, 58% and 56% of intervention and comparison clients were between 20 to 29 years. At endline, majority (32.8%) finished Senior High School. Also, at baseline, 98% intervention delivery clients and 99% comparison delivery clients had normal vaginal deliveries. At endline, 96% intervention and 97% comparison delivery clients had normal deliveries (Table 4.4).

Table 4.

3 Demographic Characteristics of Delivery Clients in Intervention and Comparison Arm

	Baseline		Endline	
Variable	**Intervention arm n (%)**	**Comparison arm n(%)**	**Intervention arm n(%)**	**Comparison arm n(%)**
Age:				
10 -19	52(16.1)	61(16.1)	61(19.3)	39(16.3)
20 – 29	181(55.9)	202(53.3)	182(57.6)	135(56.3)
30 – 39	79(24.4)	105(27.7)	63(19.9)	56(23.3)
40-49	12(3.7)	11(2.9)	9(2.9)	10(4.2)
50 -59	-	-	1(0.32)	-
Total	324(100.1)	379(100)	316(100.02)	240(100.1)
Number of days spent at the facility as a result of delivery				
Normal (1 to 2 days)	208 (65.6)	205(62)	92(37.1)	82(21.6)
Average (3 to 5 days)	3(0.9)	30(9.1)	1(0.4)	19(5)
Longer period (6 to 48 days)	106(33.4)	95(28.8)	155(62.5)	278(73.4)
Total	317 (99.9)	330(99.9)	248(100)	379 (100)
Information on newborn:				
Health problems at delivery	6(1.8)	7(2.2)	0(0.0)	236(99.2)
In good health	320(97.9)	309(97.5)	372(99.7)	0(0.0)
Stillbirth	1(0.3)	1(0.3)	1(0.3)	240(2.7)
Total	327(100)	317(100)	373(100)	476(101.9)
Number of deliveries including the present one	328(2.7)	557(2.6)	378(2.8)	95(1.2)
Education level:				
Never attended school	82(24.9)	116(30.8)	76(30.0)	79(32.8)
Primary/Junior High School	82(24.9)	116(30.8)	76(24.0)	79(32.8)
Senior High School	91(27.7)	75(19.9)	104(32.8)	56(23.2)
Tertiary	11(3.3)	12(3.2)	14(4.4)	8(3.3)
Total	266(80.8)	319(84.7)	270(91.2)	222(92.1)

Table 4.

Kind of delivery				
Planned emergency	0(0.0)	1(0.3)	2(0.5)	3(1.2)
Emergency Caesarean	4(1.2)	1(0.3)	9(2.4)	0(0.0)
Vaginal assisted by equipment	4(1.2)	2(0.6)	4(1.1)	4(1.7)
Vaginal -normal	320(97.6)	313(98.7)	362(96.0)	234(97.1)
Total	328(100)	317(99.9)	377(100)	241(100)

4.3 DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS IN THE QUALITATIVE STUDY

Sixty-six (66) participants took part in the in-depth interviews. Majority (48) of qualitative study participants were maternal healthcare providers. The district level staffs were six (6) and facility managers were twelve (12). Sixty-four (64) participants were females (Table 4.4).

Table 4. 4 Demographic Characteristics of Qualitative Participants

	Position			**Sex**	
	District level staff	Facility manager	Healthcare provider	Female	Male
	6	12	48	64	2
Total	6	12	48	64	2

4.4 THE EFFECTS OF CDSS AND PBI ON JOB SATISFACTION OF MATERNAL HEALTHCARE PROVIDERS

At baseline, the mean value for job satisfaction was 0.8 and 0.7 in the intervention and comparison facilities respectively (Table 4.2). At endline, the mean values for job satisfaction changed; 0.9 versus 0.7 in the intervention and comparison groups respectively. Baseline difference on job satisfaction was 0.1 but this was not statistically significant (p=0.9).

Improved job satisfaction was reported as a key benefit of CDSS and PBIs by all intervention health-workers.

'My satisfaction with my work improved when I received a certificate of recognition, a blender and a cloth.' (Midwife, aged 28, intervention facility)

'*Why I like performance-based incentives is that when you use the CDSS properly for patient care, you are awarded, you get the inner satisfaction to give your best at work.'* (Midwife, aged 53, intervention facility)

"My motivation to work as a midwife has improved over the past two years. If I am attending to a client and forget about a guideline, the CDSS will alert me to do it, I can't skip. Other incentives that come with using the CDSS inspired me to work hard" (Midwife, 38 years, intervention facility).

4.5 THE EFFECTS OF CDSS AND PBI ON ORGANISATIONAL COMMITMENT OF MATERNAL HEALTHCARE PROVIDERS

Mean values for organizational commitment in the intervention and comparison facilities was 0.4 and 0.3 at baseline while at endline they were 0.6 and 0.3. The endline difference on organizational commitment between the two groups was 0.2. This difference at endline was statistically significant (p=0.04) (Table 4.2).

All health-workers reported enthusiastically that the interventions increased their commitment to their facility. They indicated that they were not considering leaving their facility and would recommend their profession to their friends and relatives.

'*The award ceremonies creates in me a desire to work more and more in this facility and so I don't consider moving out'* (Nurse, aged 27, intervention facility)

'If these incentives (CDSS and PBIs) are given continuously to us in this facility, I will recommend to my relatives to also work in maternal health' (Midwife, aged 40, intervention facility)

4.6 THE EFFECTS OF CDSS AND PBI ON INTRINSIC MOTIVATION OF MATERNAL HEALTHCARE PROVIDERS

At baseline, the mean value was 0.3 and 0.6 for intrinsic motivation among health workers in the intervention and comparison health facilities respectively. The baseline difference for intrinsic motivation was 0.3 (p=0.1). At endline, the mean value was 0.9 and 0.7 for intrinsic motivation among healthcare providers in the intervention and comparison groups respectively. The difference between the two groups at endline was 0.2 (Table 4.2). The difference was not statistically significant (p=0.4).

All health-workers reported that extrinsic rather than intrinsic motivation (e.g. rewards, use of CDSS and competition with other facilities) inspired them to work harder.

'It was very effective. It inspired us to work very hard especially knowing that we will be judged and awarded.' (Midwife, aged 33, intervention facility)

'The way I related to my patients also changed, I have become most friendly to them and I try to encourage them to come for ANC and delivery since I know the more they come the more likely I am to get an award.' (Midwife, aged 60, intervention facility)

4.7 THE EFFECTS OF CDSS AND PBI ON TIMELINESS AND ATTENDANCE OF MATERNAL HEALTHCARE PROVIDERS

At baseline, the mean value for timeliness and attendance was 1.0 and 0.9 among healthcare providers in the intervention and comparison facilities respectively. The baseline difference

for timeliness and attendance was 0.1 but it was not statistically significant (p=0.3). At endline, the means for timeliness and attendance was 0.8 and 0.6 in the intervention and comparison arms respectively (Table 4.2). The endline difference was 0.2 but this was not statistically significant (p=1.0).

Majority of the health-workers reported that the interventions motivated them to provide timely maternal health services. As health-worker performance was assessed based on certain indicators of maternal health, failure to report to work early meant failure to meet targets set by the performance-based review committee and lack of recognition by the committee during award ceremonies.

'Knowing that I will be awarded at the end of the day makes me punctual at work to attend to my clients in good time.' (Midwife, aged 48, intervention facility)

'I was always punctual to work because of the CDSS, monthly allowance and awards such as tea kettle, smock, blender, and television sets which made me achieve our targets.' (Male nurse, aged 32, intervention facility)

However, one health-worker said the awards were too small to motivate her.

'The awards given by the review committee were too small to make me provide timely maternal health services' (Midwife, aged 38, intervention facility)

Also, a few district-level staff mentioned negative effects, such as fostering competitiveness or potentially demotivating those who were not awarded.

'The award system served as a disincentive to workers who were not awarded.' (Facility Head aged 34, intervention facility)

'Working with the back of your mind that you will be awarded is not all good. It made them work for the awards and not with passion' (District-level staff, aged 59, intervention facility)

In the comparison facilities, almost all maternal healthcare providers reported their motivation as unchanged at the end of the study period.

'Job satisfaction and overall motivation are still a challenge in the provision of care.' (Nurse, aged 26, comparison facility)

'Not much improvement especially in the area of overall motivation and organizational commitment. Inadequate remuneration results in low motivation to work and this sometimes hinder provision of effective and efficient healthcare in the facility.' (Midwife, aged 32, comparison facility)

However, one health-worker noted that timeliness and attendance had improved at her facility.

'Motivation for work has changed slightly within the two years with regards to timeliness and attendance at work as far as life-saving is involved, but more needs to be done on their job satisfaction and organisational commitment as they lack protocols and incentives to work.' (Midwife, aged 48, comparison facility)

District-level staff similarly reported no notable changes in health-worker motivation constructs in comparison facilities, with changes mentioned possibly due to other maternal health projects or even social-acceptability bias).

'Attendance to work is much better but generally motivation of health-workers is still a problem' (District Director, aged 54, comparison facility).

'*No change in some aspects of motivation such as job satisfaction, organisational commitment, but generally motivation has changed slightly over the past two years'* (District Public Health Nurse, aged 59, comparison facility).

4.8 THE EFFECTS OF CDSS AND PBI ON OVERALL MOTIVATION OF MATERNAL HEALTHCARE PROVIDERS

At baseline, the mean value on overall motivation was 0.6 and 0.7 among intervention and comparison healthcare providers respectively. At endline, the mean values were 0.8 and 0.7 in the intervention and comparison facilities respectively. Difference in difference analysis between the two groups at baseline and endline indicated 0.0 with a p-value of 0.9. (Table 4.5).

'As for the CDSS, allowances and the awards, they motivated us to work extra hard since we knew we were competing with others from other facilities. Getting something small at the end of the month also made me feel my work was appreciated.' (Midwife, aged 60, intervention facility)

'Knowing that you had some small allowance at the end of the month and also knowing that you will be awarded every six months also increased my drive to want to deliver maternal health services with ease.' (Midwife, aged 37, intervention facility)

Table 4. 2 Motivational constructs in the Intervention and Comparison Arms at Baseline and End line

	Baseline						Endline						DiD	
	Intervention		Comparison		Difference	P-value	Intervention		Comparison		Difference	P-value	Diff-Diff	P-value
Outcome Variable	**Obs**	**Mean**	**Obs**	**Mean**			**Obs**	**Mean**	**Obs**	**Mean**				
Job satisfaction	24	0.8	26	0.7	0.1	0.9	25	0.9	25	0.7	0.2	0.4	0.1	0.7
Intrinsic motivation	24	0.3	26	0.6	0.3	0.1	25	0.9	25	0.7	0.2	0.4	0.1	0.8
Timeliness and attendance	24	1.0	26	0.9	0.1	0.3	25	0.8	25	0.6	0.2	1.0	0.1	0.4
Organisational Commitment	24	0.4	26	0.3	0.1	0.8	25	0.6	25	0.3	0.3	0.04	0.2	0.2
Overall motivation	24	0.6	26	0.7	0.1	0.4	25	0.8	25	0.7	0.1	0.5	0.0	0.9

4.9 THE EFFECTS OF CDSS AND PBI INTERVENTIONS ON PERFORMANCE OF PROVIDERS IN TERMS OF MANAGEMENT OF ANTENATAL AND DELIVERY CLIENTS

At baseline, antenatal attendance in the intervention and comparison arms was 1, 2854 and 7,040 respectively. At midline, antenatal attendance was 9,191 and 7,036 in the intervention and comparison arm respectively. At endline, attendance was 1, 2682 and 7,050 in the intervention and comparison arms respectively.

At baseline, out of the 1, 2854 antenatal attendance, intervention midwives administered anti-tetanus vaccinations to about 14% of the women while in the comparison health centres, midwives administered anti-tetanus vaccinations to about 25% of antenatal attendance. At midline, there was an increase (28%) in the proportion of women who received anti-tetanus vaccinations from intervention midwives. At this same time, midwives in the comparison arms, administered anti-tetanus vaccinations to about 21% of pregnant women. At end line, intervention midwives administered tetanus vaccinations to about 13% of women while comparison midwives, administered tetanus vaccinations to 20% of women who visited for care.

At baseline, proportion of women tested for HIV/AIDS by intervention and comparison midwives respectively was 14% and 25%. At midline, proportion of women whose HIV status were checked by intervention midwives increased to 28% while that of the comparison arm reduced to 22%. However, end line, proportion of women whose HIV/AIDS status was determined by midwives was the same; 20 %.

At baseline, proportion of women whose haemogloblin (HB) levels were checked by midwives in the intervention arm was 14% while midwives in the comparison arm checked about 29% of women. At midline, proportion of women whose HB was checked by intervention midwives increased to 67% while that of the comparison arm reduced to 21%. At endline, HB checked by intervention midwives reduced to 54% and that of the comparison arm was 18%.

At baseline, intervention respondents referred 2% of antenatal and labour clients while comparison respondents referred 3% of antenatal and labour clients. At midline, referrals by intervention midwives increased to 3%. Referrals by comparison midwives also increased to 4%. At endline, referrals by intervention midwives reduced to 2% and increased to 4% in the comparison arm.

At baseline, 1,579 skilled deliveries were conducted by intervention midwives while 1,178 skilled deliveries were conducted by comparison arms. At midline, 1,463 skilled deliveries were conducted by intervention midwives while 1,373 deliveries were conducted by comparison midwives. At endline, 1,455 deliveries were conducted by intervention midwives while 1,277 deliveries were managed by comparison midwives (Table 4.6).

Qualitative participants reported that CDSS and PBIs strategies have enhanced providers' management of antenatal and delivery clients. CDSS facilitates adherence to reproductive health guidelines and so diagnosis and prescriptions are done at ease. CDSS alerts and prompts providers on what action to take for a client who can't be managed at the facility level. Generally, CDSS has improved morbidity and mortality:

"*It has helped me to know more especially if you are educating an ANC woman, you can just educate the woman without cracking your brains. The information we get from the CDSS to educate the women has helped improve the quality of care"* (Midwife, 33 years, intervention facility).

"I will say quality of maternal care has improved. We are now prompted to administer certain drugs like albendazole and dewormers" (Midwife, 60 years, intervention arm).

"It has affected the blood pressure check because if you check a client and it is high, the CDSS will ask you to check in an hour's time. So you will have to make the client to rest for you to re-check. If it is still high then you will take the urine and test for protein" (Midwife, 50 years, intervention arm).

"When you are using the CDSS, it usually alerts you on what to do. So I will say it guides us on what to do and how to do but before, you have to make your own decisions without guidelines" (Midwife, 33 years, intervention arm).

"It has reduced maternal deaths because if a woman comes and you monitor to a certain level, the CDSS will just tell you to refer and so it makes us refer early" (Midwife, 44 years, intervention arm).

"With the CDSS if a clients' BP is high, it will ask you to recheck and if it is still high, it will ask you to do something for the client, either you refer or detain. With the paper-based

protocols most often you just skip these vital things. CDSS also makes it easy to access previous patient's history" (Midwife, 27 years, Intervention arm).

"It alerts us on what to do and because of that we are able to do things. For the albendazole, that one if you have not given to the woman and you are entering it will ask you whether you have given the drug. It has also reduced maternal deaths because if a woman comes and you monitor her to a certain level, the CDSS will just tell you to refer so it makes us refer early. It has affected antenatal coverage because you are able to attend to more clients in a day. Sometime we attend to about 50 women in a day. It has affected intermittent preventive treatment (IPT) because the way the book is, sometimes you can forget that the person has not taken IPT but the computer will alert you. On the CDSS you are able to know if the woman has taken the 3rd dose so that you give the 4th one. For PNC, after delivery you have to check the woman frequently 15minutes, 30 minutes, 1hour for 6 hour and at the end you are able to know the woman is now well" (Midwife, 34 years, intervention facility).

Medical assistants in the intervention arm affirmed these views expressed by the midwives as follows:

"Performance has improved in the sense that if you open the 2012 and the 2013 registers, you will see vast difference. Now we check all the HB of the clients and we also counsel them a lot. Also, if the woman comes and she is 28 weeks, the computer will tell you what to do since it is pre-term labour" (Medical Assistant, 54 years, intervention facility).

"The interventions have contributed to performance because the midwife is more committed to work. She barely even leaves the maternity and I think it has even increased some of the indicators and deliveries over the past few years. Our facility has contributed significantly to the district performance which has been recognized by the district. There has been an improvement in anti-tetanus vaccinations to pregnant women and intermittent preventive treatment. I realized that previously there were issues of IPT3, child welfare and penta 3 but I think over the past 2 years there have been an improvement. I think in 2013, there was a massive improvement in all those indicators" (Medical Assistant, Male, 37 years, intervention facility).

A municipal public health nurse and a district public health nurse also confirmed what the midwives and medical assistants have reported about the interventions in the following quotes:

"I think it has improved their performance greatly. Kologo Health Centre used not to have a lot of clients but since this project started their numbers have gone up. Antenatal, IPTI, deliveries, partograph use and postnatal… have all gone up. Navrongo Health Centre gets more ANC clients in the municipality and this is because they have a good attitude towards the patients. Also, the CDSS has improved their knowledge and it has put them on their toes and they know what they are supposed to do. Also, with the paper-based protocols, they are mostly in their cabinets and not on their tables and that make them feel lazy using them but this one makes you alert as you are entering the data while reviewing the protocol. Without the protocol some even refer cases that they are not supposed to refer. The CDSS has

improved the midwives knowledge and helps them refer clients early. Quality of maternal healthcare has improved because you don't do things in abstract" (Municipal Public Health Nurse, 58 years, Female, intervention facility).

"The computer also has all the protocols so because this district we don't have a doctor, the computer is now our doctor. The computer guides us; the nurse doesn't panic because the computer tells them what to do" (District Public Health Nurse, 54 years, intervention facility).

Intervention participants mentioned some challenges they encountered in using CDSS for patient care. They are: i) the software requires that you administer only one Intermittent preventive treatment (IPT) to pregnant women, ii) faulty electronic partograph that leads to unnecessary referrals, iii) increased workload of nurses and midwives as you have to still complete facility forms after administering treatment to clients, and, iv) power fluctuations also affected regular use of the software for client care. Some midwives had this to say:

"There are certain things in the CDSS that should be improved. The IPT should be first second and third. It's only once in the CDSS" (Midwife, 54 years, intervention facility).

"If you want to follow the partographs strictly on the CDSS you will end up referring all your delivery clients" (Midwives, 29 years, intervention facility).

"In fact to use the computer to monitor a patient is sometimes difficult, it doesn't need one person. If a woman is in labour, you can't come to the computer again" (Midwife, 56

years, intervention facility).

"It has also increased our workload because we have to use the computer and attend to the woman and at the same time enter it into the book" (Midwife, 29 years, intervention facility).

"The only complain they (clients) give is that they keep long because you enter their personal information into the maternal book and afterwards you enter the same information into the CDSS" (Midwife, 33 years, intervention facility).

"Sometimes too if the is light out and the battery is down you can't use it for patient care" (Midwife, 40 years, intervention facility).

All participants in the comparison arm reported an improvement in their performance but added that there is still much room for improvement. They said they require protocols, incentives, logistics such test kits, blood pressure apparatus to enhance their work. Poor use of partographs was also reported.

"There is a slight improvement in performance but there is still more room for improvement. Protocols and incentives that are supposed to enhance our performance are inadequate" (Midwife, 48 years, comparison facility).

A community health officer also affirmed what the midwife said about the performance of their facilities as expressed below;

"Performance is moderate because we don't have the requisite protocols in the facility to make clinical decisions. Partograph utilization is poor in most cases" (Community health officer, 27 years, female, comparison facility).

A District information officer also affirmed views expressed by the midwife and the community health officer;

"Generally, performance of nurses is encouraging; although some indicators have declined, it is still not bad. Partographs' utilization is poor but labor and delivery services, tetanus care coverage, and pregnancy at risk referred seem to be looking good based on the statistics" (District Health Information Officer, Comparison facility).

All participants in the comparison facilities suggested provision of computerized decision support system, phone-based guidelines, performance-based incentives, additional staff, promotion and logistics such as blood pressure apparatus and hemoglobin machines. A participant said:

"Authorities should introduce electronic decision support systems to enhance patient-based care" (Midwife, 57 years, comparison facility).

The District information officer and District director expressed similar sentiments as expressed below:

"All facilities should have computers where the providers can also learn new protocols in maternal and neonatal health services through the internet. They should be trained on how

to use these computers to monitor labour and they should be given financial package" (District health information officer, 37 years, comparison facility).

"I will suggest improved logistics and human resources, provision of financial package to both clients and workers to boost their morale" (District Director, 59 years, comparison facility).

TABLE 4.3 EFFECTS OF CDSS AND PBI ON MANAGEMENT OF CLIENTS

Outcome Variable		Baseline		Midline			Endline		
	Intervention	Comparison	p-value	Intervention	Comparison	pvalue	Intervention	Comparison	pvalue
	n (%)	n (%)		n(%)	n(%)		n(%)	n(%)	-
Antenatal Attendance	12854	7040	-	9191	7036	-	12682	7050	-
Anti-tetanus vaccinations	1736(13.51)	1762(25.03)	0.001	2595(28.23)	1485(21.11)	0.001	1639(12.92)	1458(20.39)	0.001
HIV/AIDS tested	1847(14.37)	1986(25.03)	0.001	2537(27.60)	1566(22.26)	0.001	2564(20.22)	1458(20.68)	0.7278
Haemoglobin checked	1808(14.07)	2032(28.89)	0.001	6190(67.35)	1467(20.85)	0.001	6872(54.19)	1248(17.70)	0.001
Antenatal and labour referrals	293(2.28)	256(3.64)	0.345	306(3.33)	288(4.09)	0.624	274(2.16)	284(4.03)	0.203
Labor clients	1769	1178	-	1463	1374	-	1470	1178	-
Skilled delivery	1579(89.3)	1021(86.7)	0.044	1322(90.4)	1373(99.9)	0.001	1455(99.0)	1277(92.7)	0.001

4.10 EFFECTS OF CDSS AND PBIS ON ANTENATAL CLIENTS' PERCEPTIONS OF PROVIDERS' PERFORMANCE

At baseline, the mean values for antenatal clients who reported technical performance of providers was 0.6 and 0.6. There was no difference between the intervention and comparison clients' perception on providers' technical performance. At endline, the mean was 0.6 and 0.5 on antenatal clients' perspectives on providers' performance. The endline difference was 0.1 and the difference was statistically significant (p=0.001). At baseline, in terms of technical performance, clients reported no difference between providers in intervention and control districts but at endline, clients reported a statistically significant difference between the two (p-value=0.001)

At baseline, the mean values on clients perception on the nature of interaction between them and the healthcare provider was 0.7 and 0.6 in the intervention and comparison arms respectively. There was no baseline difference in terms of clients-provider interaction in the intervention and comparison arm. At endline, there was statistically significant difference between intervention and comparison groups (0.2) and the difference was statistically significant (p=0.001).

There was no difference at baseline in terms of clients' perception on providers' availability. At endline, there was a statistically significant difference in terms of clients' perception on providers' availability; difference in difference value was 0.2 and a p-value of 0.001. At both baseline and endline, there exists a statistical significant difference on clients' perception on general satisfaction with antenatal services (Table 4.4).

Table 4.

4 Antenatal Clients' Satisfaction with Services in the Intervention and Comparison Arms at Baseline and Endlie

Outcome Variable	Baseline						Endline						DiD
	Intervention		Comparison				Intervention		Comparison				
	Obs	Mean	Obs	Mean	Difference	P-value	Obs	Mean	Obs	Mean	Difference	Pvalue	Diff - Diff
Technical Performance	341	0.6	369	0.6	0.0	0.6	378	0.6	365	0.5	0.1	0.001	0.1
Client-provider interaction	341	0.7	369	0.6	0.1	0.2	378	0.9	365	0.7	0.2	0.001	0.1
Healthcare provider availability	341	0.6	369	0.6	0.0	0.3	378	0.7	365	0.6	0.1	0.001	0.2
General satisfaction	341	1.0	369	0.9	0.1	0.0	378	0.9	365	1.0	0.1	0.5	0

Table 4.

Bivariate regression analysis shows that, three covariates (number of pregnancies, antenatal visit 3 and 4) contribute significantly to clients' perception of technical performance of healthcare providers. Other antenatal visits also contributed significantly to clients' perception on client-provider interaction ($p<0.001$). However, none of the covariates were associated with clients' perception of healthcare provider availability and general satisfaction with antenatal services (Table 4.8).

Table 4.

5 Bivariate Analysis on Antenatal Clients' on Perception of Providers' Performance

	Technical performance		Client –provider		Health worker availability		General satisfaction	
Covariate	**Estimate (Standard Error)**	**P-value**	**Estimate (Standard Error)**	**Pvalue**	**Estimate (Standard Error)**	**Pvalue**	**Estimate (Standard Error)**	**Pvalue**
Age	-0.01(0.00)	0.12	0.00(0)	0.45	0.01(0.00)	0.08	-0.001(0.00)	0.39
Number of pregnancies	0.06(0.01)	0.001	0.01(0.01)	0.27	0.01(0.01)	0.57	0.01(0.01)	0.32
Weeks of gestation	-0.00(0.00)	0.21	-0.003(0.00)	0.08	-0.00(0.00)	0.21	0.00(0.00)	0.82
Visits 2	-0.09(0.05)	0.06	-0.05(0.05)	0.32	-0.09(0.05)	0.06	0.02(0.02)	0.46
Visit3	-0.09(0.05)	0.05	-0.05(0.04)	0.27	-0.07(0.05)	0.14	0.02(0.02)	0.49
Visit 4	-0.10(0.05)	0.04	-0.02(0.04)	0.69	-0.06(0.05)	0.21	0.00(0.02)	0.89
Additional visits	0.05(0.05)	0.33	0.11(0.04)	0.001	-0.02(0.05)	0.71	0.02(0.2)	0.28
Primary School	-0.028(0.04)	0.42	-0.02(0.03)	0.44	0.06(0.03)	0.07	-0.02(0.02)	0.21

Table 4.

Secondary School	0.07(0.04)	0.08	-0.02(0.4)	0.31	0.06(0.04)	0.14	-0.01(0.2)	0.75
Tertiary School	0.11(0.08)	0.17	-0.11(0.07)	0.09	-0.14(0.08)	0.08	-0.06(0.04)	0.11

Multivariable regression analysis that controlled for all the covariates revealed that the CDSS and PBIs interventions had a statistically significant effect on the intervention clients' as compared to the comparison clients' at endline (Table 4.6). DID value depicted that general satisfaction was also statistically significant (p=0.05).

Table 4.

6 Multivariable Logistic Regression Analysis on Antenatal Clients' Satisfaction with Services

	Baseline						End line						DiD	
	Intervention		Comparison				Intervention		Comparison				Diff - Diff	P-value
Outcome Variable	Obs	Mean	Obs	Mean	Difference	P-value	Obs	Mean	Obs	Mean	Difference	Pvalue		
Technical Performance	276	0.6	309	0.7	0.1	0.9	368	0.7	345	0.6	0.1	0.001	0.0	0.001
Client-provider interaction	276	0.6	309	0.6	0.0	0.2	368	0.9	345	0.7	0.2	0.001	0.2	0.001
Healthcare provider availability	276	0.5	309	0.6	0.1	0.3	368	0.6	345	0.5	0.1	0.001	0.0	0.001
General satisfaction	276	1.0	309	0.9	0.1	0.1	368	1.0	345	1.0	0.0	0.60	0.1	0.05

4.11 EFFECTS OF CDSS AND PBIS ON DELIVERY CLIENTS' PERCEPTIONS OF PROVIDERS' PERFORMANCE

At baseline, there was statistically significant difference in three variables on delivery clients' perception on providers' performance; technical performance, healthcare provider availability and general satisfaction with care (p=0.001). At endline, technical performance, healthcare provider availability and general satisfaction remained significant. Delivery clients' perception on client-provider interaction became highly significant at endline (p<0.001)(Table4.7).

Table 4.

7 Delivery Clients Satisfaction with Services in the Intervention and Comparison Arms at Baseline and Endline

	Baseline						Endline						DiD	
	Intervention		Comparison		Diff		Intervention		Comparison				DiffDiff	Pvalue
Outcome Variable	Obs	Mean	Obs	Mean		Pvalue	Obs	Mean	Obs	Mean	Difference	Pvalue		
Technical Performance	330	0.9	379	0.8	0.1	0.001	317	0.9	248	0.9	0.0	0.9	0.1	0.001
Clientprovider interaction	330	0.7	379	0.6	0.1	0.10	317	0.9	248	0.7	0.2	0.0	0.1	0.001
Healthcare provider availability	330	0.7	378	0.7	0.0	0.001	317	0.5	248	0.6	0.1	0.0	0.1	0.001
General satisfaction	330	1.0	378	0.9	0.1	0.001	317	1.0	248	0.9	0.1	0.1	0.0	0.05

Bivariate regression analysis showed that delivery by caesarean section (p=0.03) was associated with clients' perceptions of technical performance of healthcare workers (Table 4.8). Delivery clients' perceptions of their interaction with providers was associated with primary school education while health worker availability was associated with senior high school (p=0.02) and tertiary education (p=0.03). General satisfaction with delivery services was not associated with any of the covariates (Table 4.8).

Table 4.

8 Bivariate Regression Analysis of Delivery Clients' Perception of Providers' Performance

	Technical performance		Client -provider		Health worker availability		General satisfaction	
Covariate	**Estimate (Standard Error)**	**P-value**	**Estimate(Standad Error)**	**P-value**	**Estimate (Standard Error)**	**P-value**	**Estimate (Standard Error)**	**P-value**
Age	-0.00(0.00)	0.20	-0.00(0.00)	0.48	(0.00.00)	0.42	-0.00(0.00)	0.82
Number of deliveries	0.02(0.01)	0.17	0.02(0.01)	0.62	0.00(0.01)	0.79	-0.00(0.00)	0.76
Days spent at health facility	-0.00(0.00)	0.20	-0.00(0.00)	0.57	-0.00(0.00)	0.87	0.00(0.00)	0.06
Primary	-0.05(0.03)	0.13	-0.08(0.03)	0.02	-0.06(0.4)	0.09	0.01(0.02)	0.47
Secondary	-0.04(0.03)	0.22	-0.01(0.04)	0.83	-0.09(0.04)	0.02	-0.03(0.02)	0.07
Tertiary	-0.03(0.07)	0.71	0.02(0.08)	0.75	-0.18(0.09)	0.03	0.04(0.04)	0.26
Caesarean	0.19(0.09)	0.03	-0.05(0.1)	0.65	-0.01(0.11)	0.96	-0.01(0.05)	0.92

Multivariable regression analysis that controlled for all the covariates revealed that at baseline, two of the variables were statistically significant: technical performance, clientprovider interaction and general satisfaction with services (p=0.001). At endline, clientprovider interaction remained statistically significant but general satisfaction with care was not significant (Table 4.9).

Table 4.

9 Multivariable Logistic Regression Analysis of Delivery Clients' Satisfaction with Services

Outcome Variable	Baseline						Endline						DiD	
	Intervention		Comparison				Intervention		Comparison				Diff-Diff	Pvalue
	Obs	Mean	Obs	Mean	Difference	Pvalue	Obs	Mean	Obs	Mean	Difference	Pvalue		
Technical Performance	313	1.0	333	0.9	0.1	0.001	211	1.0	94	0.9	0.1	0.10	0.0	0.5
Clientprovider interaction	313	0.8	333	0.8	0.0	0.50	211	1.0	94	0.9	0.1	0.001	0.1	0.0
Healthcare provider availability	313	0.7	333	0.7	0.0	0.10	211	0.4	94	0.4	0.0	0.40	0.0	0.9
General satisfaction	313	1.0	333	0.9	0.1	0.001	211	1.0	94	1.0	0.0	1.00	0.1	0.0

Table 4.

4.12 SUMMARY AND CONCLUSION

CDSS and PBIs were associated with improvements in maternal healthcare providers' motivation and performance in the intervention facilities compared with the comparison arm. At endline, constructs of motivation that improved were job satisfaction, intrinsic motivation, organizational commitment, timeliness and attendance. Additionally, there was a statistically significant difference in antenatal clients' perception of providers' technical performance, client-provider interaction and healthcare providers' availability to provide care. Furthermore, delivery clients reported that technical performance, healthcare provider availability and general satisfaction with delivery services improved greatly at endline.

Delivery clients' perception of client-provider interaction was statistically significant at endline in the intervention facilities. The next chapter discusses the results presented in Chapter four.

CHAPTER FIVE

5.0 DISCUSSION

5.1 INTRODUCTION

This chapter discusses the implications of the results presented in chapter 4. The relevance of the results will be discussed in relation to relevant literature. The chapter is structured as follows: Effects of Computerized Decision Support System (CDSS) and PerformanceBased Incentives (PBI) on constructs of motivation of maternal healthcare providers and the effects of CDSS and PBI on performance of maternal healthcare providers.

5.2 EFFECTS OF CDSS AND PBI ON CONSTRUCTS OF MOTIVATION OF MATERNAL HEALTHCARE PROVIDERS

This study provides evidence that CDSS and PBIs are associated with improvements in motivation and performance of maternal healthcare providers in the intervention primary facilities as compared to the comparison facilities. The results suggest some potential effects of CDSS and PBIs that could improve delivery of maternal health services by nurses and midwives and ultimately maternal and newborn health in Ghana. Organizational commitment was significantly higher among intervention health-workers than comparison health-workers at endline. Other constructs that improved at endline were job satisfaction, intrinsic motivation, and timeliness/attendance, though none were statistically significant. Though not all motivation constructs were significantly different from comparison values, several constructs had improved further from baseline values than had their comparison values. Qualitative findings indicated that intervention health-worker motivation had improved while that of comparison health-workers was generally unchanged. Timeliness and attendance

improved in comparison facilities, though other constructs remained unchanged or worsened slightly. Improvement in this construct may have been due to implementation of the Ghana Essential Health Project (GEHIP) to improve the quality of maternal and neonatal health, which initiated measures for promoting facility-based delivery and training on emergency referrals to reduce care delays in emergencies (Awoonor-Williams *et al.,* 2013). Study findings are encouraging, because baseline studies conducted in intervention facilities showed that low health-worker motivation affected provision of maternal health services (Prytherch *et al.,* 2013b, Yé *et al.*, 2014, Dalaba *et al*., 2013).

Similar studies on the effects of CDSS and PBIs on health-worker motivation are rare but studies on the single effects of PBIs on motivation of health professionals support study findings. Patouillard *et al* found PBIs enhance motivation among health professionals with not as much of intrinsic motivation (Edith Patouillard, 2015). PBIs were also associated with improved motivation and satisfaction among health professionals in the Democratic Republic of Congo (Huillery and Seban, 2013). Furthermore, PBIs motivated healthworkers to increase control over service outputs in Rwanda and Haiti (Soeters *et al*., 2006, Basinga *et al.*, 2010). In Benin, healthcare providers were satisfied with PBIs to the extent that they departed from normal service provision and became more professional and respected organizational norms (Paul *et al.,* 2014). A qualitative study on health-worker motivation and PBIs in district hospitals indicated improvement in Rwanda (Paul, 2009a).

Ryan and Deci advocate the necessity of incentives for any employee to fulfill their workplace obligations (Ryan and Deci, 2000c).

Additional studies on the single effects of CDSS on motivation of health professionals are rare but two studies report that CDSS improves attitudes of health professionals. In Burkina Faso, users of CDSS exhibited a positive attitude towards the use of CDSS for maternal health care (Zakane *et al.*, 2014). A study that assessed medical doctors' motivation using an intrinsic motivation tool revealed that physicians were motivated to use computer software at point-of-care and CDSS was perceived to be valuable for clinical care (O'Sullivan *et al.*, 2011). However, another study reports that the attitudes of health workers toward CDSS did not change after its implementation for one year (Peters *et al.*, 2006).

Although evidence indicates that CDSS and PBIs have a potential to improve health-worker motivation, studies were conducted for different settings and they lacked baseline measurement. Most of these studies only report on either the effect of CDSS on motivation of workers or the effects of PBIs on motivation of workers. This study has therefore attempted to fill a gap in the evidence by investigating the combined effects of CDSS and PBIs among nurses and midwives in primary facilities in twelve primary facilities in northern Ghana. Findings are encouraging, despite the relatively underpowered sample for the motivation survey, because they indicate that CDSS and PBIs may contribute to improving nurses and midwives performance within the Ghanaian health system. The primary role of these primary-level health-workers is to provide maternal health services, thus reducing maternal and newborn morbidity and mortality (Sakeah *et al.*, 2014b, Sakeah *et al.*, 2014a).

5.3 EFFECTS OF CDSS AND PBIs ON CONSTRUCTS OF PERFORMANCE OF MATERNAL HEALTHCARE PROVIDERS

CDSS and PBIs strategies improved performance of nurses and midwives in terms of management of antenatal and delivery clients. There was a statistically significant increase in the proportion of anti-tetanus vaccinations; HIV/AIDS testing compliance and hemoglobin checked during antenatal care (ANC) consultations in the intervention health centres at midline. Proportion of skilled deliveries conducted at midline in the comparison facilities was significantly higher when compared with that of the intervention facilities. Higher referrals were seen in the comparison facilities as compared with the intervention facilities at midline. A higher proportion of women in the intervention facilities HB levels were checked at endline while hemoglobin levels checked for women in the comparison facilities were low. Higher proportions of skilled deliveries were conducted at endline in the intervention facilities. HIV/AIDS testing compliance was about the same at endline in the two groups. Also, after two years of implementing the interventions, there was a decrease in proportion of anti-tetanus vaccinations administered to women while in the comparison arms these vaccinations were higher. Referrals were higher in the comparison facilities as compared with the intervention facilities but this was not statistically significant. Endline qualitative findings revealed that CDSS and PBIs interventions have improved performance of providers as compared to the performance of their counterparts in the comparison facilities. The interventions have enhanced providers' knowledge of WHO reproductive health treatment guidelines and adherence to these guidelines. In particular, CDSS prompted them on actions such as diagnosis, prescriptions, checking blood pressures of clients and use of partograph to

monitor progress of labour. They also perceived that all these actions taken at the point of care-improved quality of maternal care and improved maternal mortality. Also, comparison respondents perceived a slight improvement in their performance but admitted that there was still much room for improvement if treatment protocols were easily accessible and incentives in place. Improvement in some aspects of performance in the comparison facilities might be due to implementation of the GEHIP (Awoonor-Williams *et al.,* 2013).

Furthermore, the CDSS and PBIs interventions had a statistically significant influence on antenatal clients' perception of performance of nurses and midwives in terms of technical performance, client-provider interaction and availability of providers. Bivariate regression analysis showed that none of the covariates were associated with clients' perception of healthcare provider availability and general satisfaction with antenatal services.

Multivariate regression analysis that controlled for all the covariates revealed that the CDSS and PBIs interventions had a statistically significant effect on the intervention clients as compared to the comparison clients at endline. General satisfaction was also statistically significant at endline. Also, the interventions improved delivery clients' perception of nurses and midwives performance in terms of technical performance, provider availability and general satisfaction with delivery services. Delivery clients' perception on clientprovider interaction became highly significant at endline. Bivariate analysis revealed that general satisfaction with delivery services was not associated with any of the covariates.

Multivariate regression analysis showed that at endline, client-provider interaction and general satisfaction with care was statistically significant.

The findings show that CDSS and PBIs had a positive effect on performance in terms of management of antenatal and delivery clients in primary facilities in northern Ghana. Studies elsewhere also found similar results in which CDSS influenced prescribing and diagnosis skills of healthcare providers and ultimately their performance (Garg *et al*., 2005b, Gertler and Vermeersch, 2013, Haynes and Wilczynski, 2010, Kortteisto *et al.*, 2012, Randell *et al*., 2007). Regular use of CDSS by health professionals culminated in high performance(Garg *et al.*, 2005a). This was also the case in this study where CDSS improved performance of healthcare providers in terms of management of antenatal and delivery clients.

After a year of implementing CDSS in primary facilities in India, CDSS increased healthcare utilization, enhanced provider-client interaction, technical quality, and clients' general satisfaction with care (Peters *et al*., 2006). This was also true in the current study.

A study in South Africa that affirmed results of this study reported that CDSS improved compliance with antenatal guidelines (Horner *et al.*, 2013). Although the study supports the findings of the current study, evaluation was only done in one health facility with 125 antenatal clients(Horner *et al.*, 2013).

Studies in sub Saharan Africa where the QUALMAT interventions were implemented also reported findings that are in line with the study findings. In Ghana, after one year of CDSS implementation, it led to a reduction in the proportions of complications during delivery and a decline in maternal mortality (Dalaba *et al.*, 2014).A more recent study revealed that CDSS intervention improved health workers detection of pregnancy complications during antenatal care and the number of complications during labor reduced (Dalaba *et al.*, 2015a).

Mensah and his colleagues also reported that CDSS positively influenced clients' history taking and physical examinations by users in primary facilities in Tanzania and Ghana. In particular a lot of task categories were performed in an organized way, and the percentage of history taking increased significantly (Mensah et al., 2015a). A mixed method study conducted in primary facilities in Tanzania and Ghana revealed that CDSS was used in 71% and 59% of all antenatal clients. It was also used in 83% and 67% of all deliveries in Tanzania and Ghana respectively (Sukums *et al.*, 2015).

Furthermore, studies that report the effects of PBIs on performance of health professionals affirm findings of the current study. Another study that evaluated the impact of pay for performance (P4P) on the use and quality of antenatal and delivery care revealed that P4P had a significant positive impact on quality of antenatal and delivery care. However, there was no effect on the number of antenatal care visits (Basinga *et al*., 2010). A study that assessed the effect of performance-based payment of healthcare providers on use and quality of child and maternal care services in healthcare facilities in Rwanda revealed that facilities in the intervention group had a 23% increase in the number of institutional deliveries and increase in the number of preventive care visits by children (Basinga *et al.*, 2011a). There were however, no improvements in the number of women completing four antenatal care visits or of children receiving full immunization schedules (Basinga *et al.,* 2011a). Like the current study, the main outcome measures were antenatal care visits and institutional deliveries. PBI has also been credited for improving coverage and reducing mortality in Burundi. In particular, PBI was responsible for increases in ANC utilization, skilled birth attendance, and contraception prevalence (Soe-Lin *et al.*, 2014). This evidence is also in line

with the findings of the current study that PBIs improved performance in terms of management of antenatal and delivery care. Another study in Burundi that estimated the effects of PBI on the utilization and quality of maternal and child care revealed that the quality of care provided during antenatal care visits improved significantly, the probability of an institutional delivery increased significantly with four percentage points, although timeliness and number of ANC visits did not change (Bonfrer *et al.*, 2014b). A similar study of the effects of PBIs on quality of maternal health services in Bangladesh revealed that quality scores of the facilities increased from 55% to 78% after fourteen months of the intervention with significant improvement in antenatal care, postnatal counseling, institutional delivery and client satisfaction (Rob and Alam, 2014). The current study also reported similar findings after two years of implementing the interventions.

Studies on the combined effects of CDSS and PBIs on motivation and performance of healthcare providers are rare. A study that affirm the findings of this study reports that postintervention quality scores were generally slightly higher for aspects of quality such as management and treatment during antenatal consultation as well as counseling on vaginal bleeding in the intervention facilities after implementation of the QUALMAT interventions (Duysburgh *et al.*, 2015). Although this study assessed quality of care using a number of data collection tools, qualitative interviews involving indepth interviews were not among the data collection strategies to unearth participants' perspectives on the combined effects of the interventions on quality of antenatal and childbirth care.

CDSS and PBIs have a great potential to improve performance of maternal healthcare providers in northern Ghana. This means that without CDSS and PBIs, healthcare providers

will not be adequately motivated in these primary facilities to render quality maternal healthcare putting antenatal and delivery clients at risk of maternal morbidity and mortality. In particular, CDSS enhance healthcare providers access to WHO treatment as well as adherence to these guidelines that could improve quality of maternal care in health facilities in Ghana (Evans, 2003). CDSS allows health providers to adhere to algorithm and patient care guidelines and it provides checks, which prompt nurses to complete the whole cycle of client care in primary facilities. With the CDSS, clients' features and clinical data are matched to a computerized clinical knowledge base and suggestions are then presented to the midwives to come out with a decision at the point of health care (Dalaba *et al*., 2015b). Effective use of CDSS by health professionals could result in early detection of maternal complications and a reduction in maternal mortality in Ghana (Dalaba *et al.*, 2015b). If providers' performance is improved through CDSS and PBIs, maternal morbidity and mortality will be improved which will ultimately help to improve the post MDGs goals christened SDGs 3 in primary facilities in Ghana. CDSS has a potential to create a conducive work environment for nurses and midwives which will ultimately enhanced their motivation, beef up their knowledge and adherence to maternal health treatment guidelines (Blank *et al*., 2013).

The findings further imply that computers could be used among inexperienced health workers provided they are properly trained to use CDSS and if some incentives go with computer usage it will motivate workers to perform. Study findings are encouraging, because baseline studies conducted in intervention facilities showed limited knowledge of computers as well as sub-optimal performance among nurses and midwives in the intervention facilities (Dalaba *et al.,* 2014, Sukums *et al.,* 2014). Several regular training programmes and supportive

supervision equipped these health workers with skills to use computers to provide maternal care. It is therefore advocated that before workers can use

CDSS for patient care, they must be rigorously trained (Dalaba *et al*., 2014, Field *et al*., 2008, Trivedi *et al.*, 2009).

The Ghana Health Service and Ministry of Health have put in place strategies to use health information technology in health facilities to improve quality of health care which is a good foundation for the future of CDSS(MOH, 2005). The Ghana Health Service and Ministry of Health could therefore extend the CDSS and PBIs to other facilities in preparation for a national roll out to boost motivation as well as performance of nurses and midwives.

5.4 LIMITATIONS AND STRENGTHS OF THE STUDY

There is no empirical evidence on the combined effects of CDSS and PBI strategies on motivation and performance of maternal healthcare providers and so this study has filled this gap. However, some limitations that must be mentioned include the fact that the study looked only at maternal healthcare providers in the Kassena-Nankana and Builsa districts which raises a potential selection bias because other health workers also contribute to performance in a health system. Also, the study was conducted in two rural districts in each country; quality of antenatal and childbirth care provided in the facilities in these districts might differ from other rural districts and from urban areas. Additionally, two intervention district level staff was not available for the interviews and so there could be some bias in the qualitative interviews**.** However, this limitation creates an opportunity for future research on the effects of CDSS and PBI on motivation and performance of general nurses in hospitals and private

facilities. Additionally, the sample for the motivation survey was small and it may be difficult to generalize the findings of the motivation survey. A larger sample would have provided a greater statistical power for the findings on constructs of motivation. Unfortunately, the present study is nested from a larger study called Quality of maternal and neonatal care project (QUALMAT) and so the sample size was limited by the number of healthcare providers at the QUALMAT study sites. However, results from the satisfaction surveys enhanced the strength of the findings obtained from the healthcare providers. Furthermore, qualitative findings expatiated the findings obtained from the quantitative study with providers and thereby improved the reliability and generality of the findings. Furthermore, the satisfaction survey showed that at baseline the intervention and comparison groups were already statistically different. This could affect the results**.** Our multi-method approach enabled us to assess the effect of the interventions in a comprehensive and unique way. Findings from the different study tools were generally in line with each other. In addition, qualitative methods complemented the quantitative data. The qualitative data supported the quantitative findings and provided some insights into the experiences and perceptions of the health workers. Lastly, performance-based incentive schemes are being implemented in many African countries as a possible way to strengthen health workers' motivation and performance. However, there are concerns about their sustainability. Despite these limitations, available evidence that are in consonance with the findings of this study show that implementing CDSS and PBI strategies separately are associated with improvement in motivation and performance of practitioners (Sukums *et al.*, 2015, Mensah *et al.*, 2015b, Dalaba *et al.*, 2015a, Dalaba *et al.*, 2014, Paul, 2009b, Petersen *et al.*, 2006, Robyn *et al.*, 2014, Bonfrer *et al*., 2014a).

5.5 SUMMARY

This chapter discussed the implications of the results presented in chapter 4. The relevance of the results was discussed in relation to literature. There is potential for CDSS and PBIs to make a contribution to maternal health care, and ultimately improve SDG 3 in Ghana if CDSS is introduced in the health system and workers are motivated with incentives. Also, some limitations were discussed. The next chapter discusses the conclusions and recommendations derived from the findings of the current study.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter presents the conclusions and recommendations of the study towards improving motivation and performance of maternal healthcare providers in Ghana.

6.2 CONCLUSIONS

This study used a quasi-experimental design with a before and after measurements to test the following hypothesis: maternal healthcare providers who use a computerised decision support system and are beneficiaries of performance-based incentives have higher levels of motivation and performance. The study showed that CDSS and PBIs improved motivation and performance of healthcare providers in primary facilities in northern Ghana. Key conclusions of this study are presented as follows:

6.2.1 Effects of CDSS and PBIs on Motivation of Maternal Healthcare Providers

There was an improvement in motivation of healthcare providers at endline in the intervention arm when compared with the comparison arm. At endline, constructs of motivation that improved were: job satisfaction, intrinsic motivation, timeliness and attendance. In particular, at endline, healthcare providers in the intervention arm had a statistically significant improvement in organizational commitment. Qualitative findings also affirmed that intervention healthcare providers' motivation had improved as a result of the interventions. The use of CDSS together with PBI could enhance motivation of nurses and midwives to provide quality maternal health services to improve maternal health in Ghana.

6.2.2 Effects of CDSS and PBI on Performance of Maternal Healthcare Providers

CDSS and PBIs strategies improved performance of nurses and midwives in terms of management of antenatal and delivery clients. There was a statistically significant increase in the proportion of anti-tetanus vaccinations, HIV/AIDS testing compliance and hemoglobin checked during antenatal care consultations in the intervention health centres at midline. Higher proportions of skilled deliveries were conducted at endline in the intervention facilities. The qualitative study results corroborated the quantitative findings.

There was improvement in performance of providers in terms of clients' satisfaction with maternal health services. There was a statistically significant difference on antenatal perception of providers' technical performance, client-provider interaction and providers' availability to provide care. Furthermore, delivery clients' perceptions of providers' technical

performance, healthcare provider availability, client-provider interaction and general satisfaction with delivery services improved significantly at end line.

6.3 RECOMMENDATIONS

To improve motivation and performance of maternal healthcare providers in Ghana, stakeholders should consider the following recommendations:

6.3.1 Recommendations to District Health Management Team (DHMT) & Regional Health Management Team (RHMT)

Since, CDSS and PBIs could enhance motivation and performance of nurses and midwives, the DHMT and the RHMT should scale-up CDSS and PBIs to nurses and midwives by 2020. This will contribute towards an increase in output and improvement in their motivation and performance as well as improving maternal and newborn health in the Upper East Region of Ghana.

6.3.2 Ministry of Health/Ghana Health Service and other policy makers

i The Ministry of Health (MOH) and Ghana Health Service (GHS) should scale up incentive programs in other health facilities to address problems of low motivation and suboptimal performance among maternal healthcare providers in Ghana in preparation for a national roll out in 2020.

ii. The MOH and GHS should work together to develop a national incentive policy modeled on what was done in this study to boost morale of midwives to provide quality

maternal health services in Ghana. If provision of maternal health services is enhanced, maternal and newborn deaths will be reduced. A PBI policy will boost the morale of staff to enhance providers' performance. Recognition and rewards to hardworking staff at least twice a year should also be considered.

iii. MOH and GHS should consider introducing a policy on the use of CDSS by all nurses and midwives to facilitate adherence to WHO reproductive health guidelines in Ghana.

CDSS offer a great potential to improve management of antenatal and delivery clients in Ghana as compared to paper-based treatment protocols that are sometimes not available and rarely used. A policy on the use of CDSS to enhance access to reproductive health guidelines including safe motherhood protocols should be developed to further boost the motivation and performance of midwives. Implementation of CDSS would involve procuring laptop computers, training programmes and regular supportive supervision. Regular training programmes make staff familiarize themselves with the software. In addition, careful support and assistance to the District Health Directorate in implementing CDSS and PBI could improve their applicability in these facilities. For CDSS to be used properly, midwives have to be supervised on regular basis. Supervision should be done to address problems and not seen as an avenue to criticize the efforts of midwives. Facilities implementing these interventions should have medical equipment and basic logistics such as blood pressure apparatus, drugs and test kits to be successful.

iv. MOH and Ghana Health Service should also ensure that the electronic partograph is revised to avoid unnecessary referrals.

v. The GHS should improve the staffing situation in health facilities. In Ghana, an increasing workload affects service delivery which also has some implications for the use of CDSS. MOH and GHS should develop initiatives including opening more Nursing Training Institutions to improve the staff situation in health facilities to promote CDSS use. vi. If CDSS is to be used effectively by nurses and midwives, the use of paper-based protocols has to be phased out to avoid increase in workload as a result of using CDSS and paper-based protocols at the same time to provide care to clients.

6.3.3 Recommendations for Future Research

Future research is needed on whether CDSS and PBI together are cost-effective and yield the expected gains in primary facilities in northern Ghana.

More rigorous research on the long-term impact of CDSS and PBIs interventions on motivation and performance of nurses and midwives is required. This would assess whether the benefits from CDSS and PBIs strategies are maintained over time.

The current study should be replicated in hospitals and health facilities using a large sample of nurses and midwives so that the results could be generalized to all maternal healthcare providers in Ghana. Additional research is also required to test or validate the results of this study in other continents.

CONCLUSION

This final chapter discussed conclusions and recommendations of the study. The Ministry of Health and Ghana Health Service should scale up CDSS and PBI in other health facilities in

Ghana in preparation for a national roll out in 2020 to boost motivation of midwives so as to improve maternal and newborn health and to attain SDG 3.

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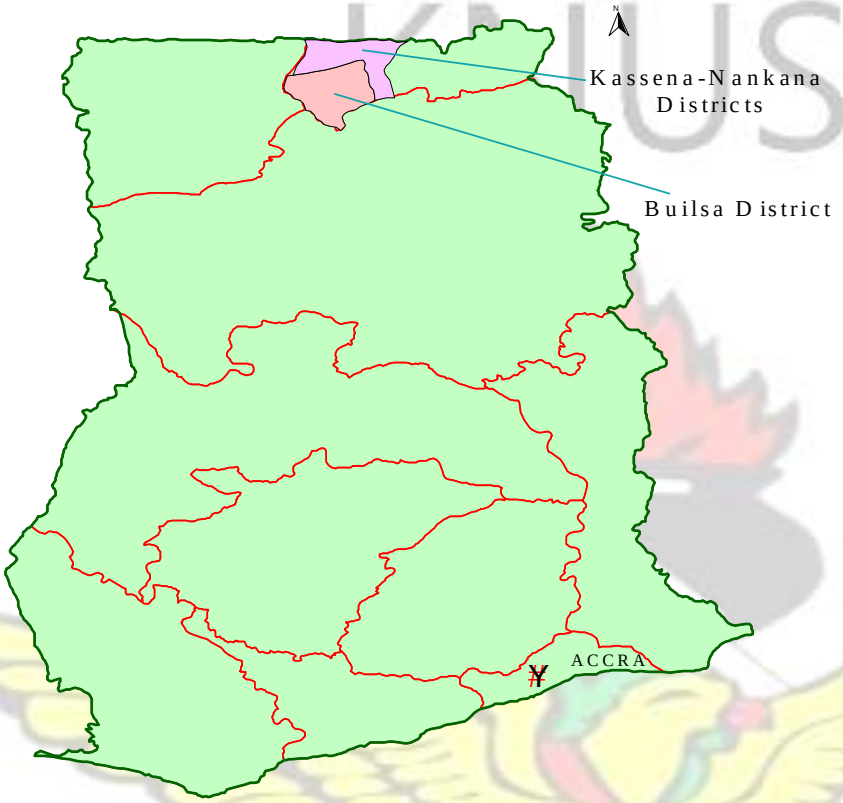
APPENDICES

APPENDIX 1: A MAP OF GHANA SHOWING THE STUDY DISTRICTS



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APPENDIX 2: STUDY QUESTIONNAIRE FOR HEALTH FACILITY STAFF 1

PART I

Please tell us something about yourself by filling out this questionnaire. Please be assured that the questionnaire is strictly anonymous and your responses will be kept confidential.

Please write in the empty spaces or tick a box where appropriate ☐

1. Give your age in years ……

2. ☐ Female ☐ Male

3. Which options best describe your current family situation: You may tick more than one if appropriate.

   ☐ Single

   ☐ Married

   ☐ Widowed

   ☐ Divorced or separated

   ☐ Currently living apart from spouse/partner because of work

   ☐ Currently living apart from some or all of your children

4. How many dependents are you financially responsible for?

..... (number of persons)

5. Is this your home district? ☐ Yes ☒ No

6. What is your profession?

☐ community health nurse ☐ enrolled nurse ☐ medical assistant

☐ midwife ☐ nurse ☐ public health nurse ☐ staff nurse

☐ community health officer ☐ nursing officer ☐ nurse assistant

Other, please specify .....

7. Before starting your professional training how many years of schooling did you have in total? ..... (years)

8. How many years have you been working in Maternal & Child Health?

..... (years) .....(months).

9. How many years have you been working at your current level/position?

..... (years) .....(months).

10. How long have you been working in this facility? .....(years) .....(months)

Part II

Now we would like to learn what you think and how you feel about your job and the work environment at the facility where you are currently working. Please read each statement and decide to what extent it is true for you or how much you disagree. Tick the box with the answer that reflects your opinion or is most near to it.

☐☐☐☐ means "I agree strongly"

☐☐☐☐ means "I agree"

□□□□ means “I disagree”

□□□□ means “I disagree strongly”

No	Statement	Agree strongly	Agree	Disagree	Disagree strongly
1	This facility provides everything I need to perform well at work.	□	□	□	□
2	There are enough health workers to do the work in this facility.	□	□	□	□
3	Too often the referral system does not work efficiently.	□	□	□	□
4	Maintenance of broken equipment at this facility is prompt and reliable.	□	□	□	□
5	My job duties and responsibilities are clear and specific.	□	□	□	□
6	Relevant guidelines such as *National Safe Motherhood Service Protocol* are easy to access at this facility.	□	□	□	□
7	I often feel left alone when I have to make difficult decisions about a patient's care.	□	□	□	□
8	I regularly have access to relevant trainings to keep my skills up to date.	□	□	□	□
9	My performance is appraised regularly.	□	□	□	□
10	Promotions do not depend on how well or badly one works on the job.	□	□	□	□
11	It is difficult for me to speak openly to my superiors about how	□	□	□	□

No	Statement	Agree strongly	Agree	Disagree	Disagree
	things are really going at work.				
12	Suggestions made by health workers on how to improve the facility are generally ignored.	☐	☐	☐	☐
13	The facility management shows very little concern for me.	☐	☐	☐	☐
14	Our rights as health workers are generally not respected.	☐	☐	☐	☐
15	I do not get feedback from my superiors so it is hard to improve my performance.	☐	☐	☐	☐
16	The feedback I get from my co-workers helps me to improve my work.	☐	☐	☐	☐
17	Good performance is recognized by our superiors.	☐	☐	☐	☐
18	This facility has a fair system for rewarding staff.	☐	☐	☐	☐
19	Some of the team members work well, yet others do not and so this facility doesn't perform well overall.	☐	☐	☐	☐
20	We do not know how our facility is performing compared to others in the district.	☐	☐	☐	☐
21	Our facility has clear goals that we are working towards.	☐	☐	☐	☐
22	I am keen to use any new tools to improve my performance.	☐	☐	☐	☐
23	This facility has a good reputation in the community.	☐	☐	☐	☐
24	I understand how my work contributes to the facility's overall goals.	☐	☐	☐	☐
25	It makes me feel appreciated when patients are grateful.	☐	☐	☐	☐
26	I am proud to be working for this health facility	☐	☐	☐	☐
27	I am proud to tell others that I work in maternal and neonatal health care.	☐	☐	☐	☐
28	I usually cope well with changes that occur at work.	☐	☐	☐	☐
29	I intend to leave this facility as soon as I can find another position.	☐	☐	☐	☐
30	I would recommend to my children that they choose a profession in maternal health care.	☐	☐	☐	☐
31	I am willing to put in a great deal of effort to make this facility successful.	☐	☐	☐	☐
32	These days I feel motivated to work as hard as I can.	☐	☐	☐	☐
33	My profession helps me to achieve my goals in life.	☐	☐	☐	☐

34	Overall, I am very satisfied with my work in maternal and neonatal care.	☐	☐	☐	☐	
35	I am very satisfied to have a position where one works closely with	☐	☐	☐	☐	

strongly

No	Statement	Agree strongly	Agree	Disagree	Disagree strongly
	the community.				
36	This job gives me a feeling of achievement and accomplishment.	☐	☐	☐	☐
37	I am punctual about coming to work.	☐	☐	☐	☐
38	I work hard to make sure that no patient has to wait a long time before being seen.	☐	☐	☐	☐
39	I am careful not to make errors at work.	☐	☐	☐	☐
40	When I am not sure how to treat a patient's condition I look for information or ask for advice.	☐	☐	☐	☐
41	I try to get on well with the other health staff because it makes the work run more smoothly.	☐	☐	☐	☐
42	I get along well with my superiors at work.	☐	☐	☐	☐

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APPENDIX 3: QUESTIONNAIRE FOR WOMEN'S SATISFACTION WITH

ANTENATAL CARE

Administrative Information		
Facility Information		
A.1	Name health facility	

A.2	Name district	
Information about interview		
A.3	Name interviewer	
A.4	Date interview	_ _ / _ _ / _ _ _ _
A.5	**Time interview started**	**h m**
Information about pregnant woman		
A.6	Age	
A.7	Week of gestation	_____ weeks
A.8	Nr of ANC visit	○ Visit 1 ○ Visit 2 ○ Visit 3 ○ Visit 4 ○ Other, specify: _____
A.9	Reason of ANC visit	○ Visit for routine ANC ○ Visit due to symptoms or disease
A.10	Was this a	○ Scheduled visit ○ Unscheduled visit
A.11	Number of pregnancies (including present pregnancy)	
A.12	Literate	Can read: ○ Yes ○ No Can write: ○ Yes ○ No
A.13	Education level	○ Never attended school

		○ Primary school started ○ Primary school finished ○ Vocational training started ○ Vocational training finished ○ Secondary school started ○ Secondary school finished ○ Higher education started ○ Higher education finishes
Inform patient that: The study looks at management of ANC The study is completely confidential No name is written on this questionnaire She can refuse to answer individual questions if she wishes The interview will take less than 15 minutes		
Now I'm going to ask you some questions about the antenatal visit you just attended.		
1	Are you satisfied with the reception you received at the health facility? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
2	Are you satisfied with the level of privacy provided during the consultation? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

3	Are you satisfied with the level of respect you received from the health worker? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
4	Are you satisfied with the level of support you received from the health worker? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
5	Are you satisfied about not having had to wait too long before seeing a health worker? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
6	Did you have enough time with the health worker, or would you prefer? *(read out the options)*	1 = a lot more time 2 = a little more time 3 = time is about right 4 = less time
7	Was the information you received about looking after your own health: *(read out the options)*	1 = not enough 2 = as much as you wanted 3 = too much 4 = no information received 5 = don't remember

8	Was the information you received about any tests (e.g. blood, urine) during pregnancy: *(read out the options)*	1 = not enough 2 = as much as you wanted 3 = too much 4 = no information received 5 = don't remember
9	Was the information you received about any treatment you might need during this pregnancy: *(read out the options)*	1 = not enough 2 = as much as you wanted 3 = too much 4 = no information received 5 = don't remember
10	Was the information you received about labour: *(read out the options)*	1 = not enough 2 = as much as you wanted 3 = too much 4 = no information received 5 = don't remember
11	Was the information you received about breastfeeding: *(read out the options)*	1 = not enough 2 = as much as you wanted 3 = too much 4 = no information received 5 = don't remember
12	Do you know danger signs that can occur during pregnancy? *(read out the options)*	1 = yes 2 = no

	If the answer on 12 is 'yes' go to 13 **If the answer on 12 is 'no' go to 14**

13	Can you mention some of these danger signs? *(**do not** read the options, tick the signs the woman mentions)*	○ haemorrhage ○ rupture of membranes ○ dizziness and fainting ○ fever ○ premature contractions ○ headache and blurred vision ○ swelling of fingers, face and/or legs ○ severe abdominal pain ○ fast or difficult breathing ○ convulsions ○ others, specify: _____

14 Were you told how to recognise and proceed about some serious problems that can happen in pregnancy

(read out the problem and ask for each problem if it was explained how to recognise and how to proceed)

	Told how to recognise	Told how to proceed
vaginal bleeding	1 = yes 2 = no	1 = yes 2 = no
rupture of membranes	1 = yes 2 = no	1 = yes 2 = no
fever	1 = yes 2 = no	1 = yes 2 = no
swelling of fingers, face and/or legs	1 = yes 2 = no	1 = yes 2 = no
premature contractions	1 = yes 2 = no	1 = yes 2 = no
dizziness and fainting	1 = yes 2 = no	1 = yes 2 = no
headache and blurred vision	1 = yes 2 = no	1 = yes 2 = no
convulsions	1 = yes 2 = no	1 = yes 2 = no

	fast or difficult breathing	1 = yes 2 = no	1 = yes 2 = no
	severe abdominal pain	1 = yes 2 = no	1 = yes 2 = no

15	Are you satisfied about the clinical examination done by the health worker? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
16	Are you satisfied with the treatment and/or advice you received from the health worker? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
17	Are you satisfied with the drugs prescribed by the health worker? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = no drugs prescribed
18	Are you satisfied about the level of knowledge of the health worker? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

19	Are you satisfied about the attitude of the health worker? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
20	Are you satisfied with the opportunity you received to ask questions? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
21	Are you satisfied with the opportunity you received to express your concerns? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
22	Are you satisfied about the drugs you received at the health facility? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = did not receive any drugs

23	Are you satisfied about the medical equipment available at the health facility? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
24	Are you satisfied about the hygiene at the health facility? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
	Finally, three questions to sum up	
25	If you get pregnant again will you come back to this health facility? *(read out the options)*	1 = yes 2 = no 3 = don't know *(always ask)* Why? _____ _____
26	Would you recommend this health facility to a relative or friend for their antenatal checkups? *(read out the options)*	1 = yes 2 = no 3 = don't know

27	In general, how satisfied are you with the antenatal care you received during the consultation just finished? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

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APPENDIX 4: QUESTIONNAIRE FOR WOMEN'S SATISFACTION WITH

DELIVERY CARE

Administrative Information

Facility Information		
A.1	Name health facility	
A.2	Name district	
Information about interview		
A.3	Name interviewer	
A.4	Date interview	_ _ / _ _ / _ _ _ _
A.5	**Time interview started**	**h m**
Information about the interviewed woman		
A.6	Age	
A.7	Number of deliveries (including this delivery)	
A.8	Literate	Can read: ○ Yes ○ No Can write: ○ Yes ○ No
A.9	Education level	○ Never attended school ○ Primary school started ○ Primary school finished ○ Vocational training started ○ Vocational training finished ○ Secondary school started ○ Secondary school finished ○ Higher education started ○ Higher education finishes
Information about the delivery		
A.10	Kind of delivery	○ vaginal delivery – normal

		○ vaginal delivery – assisted by equipment (vacuum or forceps) ○ a planned caesarean delivery ○ an emergency caesarean delivery
A.11	Information on the newborn	○ in good health at the time of the interview ○ health problems at the time of the interview ○ stillbirth ○ child died after the delivery (neonatal death) If child died: When; how many days after the delivery? _____ days.
Inform patient that: The study looks at management of delivery The study is completely confidential No name is written on this questionnaire She can refuse to answer individual questions if they wish The interview will take less than 15 minutes		
Now I'm going to ask you some questions about your delivery in the health facility.		
1	Are you satisfied with the reception you received at the health facility? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

2	Are you satisfied with the level of privacy provided during your stay in the health facility and the delivery? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
3	Are you satisfied with the level of respect you received from the health worker(s)? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
4	Are you satisfied with the level of support you received from the health worker(s)? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
5	Are you satisfied with the information you received from the health worker(s) during labour, delivery and after the delivery? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

6	Was the time you had to wait between arriving at the health facility and seeing a health worker; *(read out the options)*		1 = far too long 2 = long 3 = neutral 4 = I was helped immediately; I did not had to wait.
7	Was the time the health worker(s) spend with you during labour and delivery; *(read out the options)*		1 = not enough 2 = enough 3 = neutral 4 = there was all the time a health worker with me
8	How long (hours and if applicable days) did you spend in the health facility after you delivered? _____hours (_____ days)		
9	Was the time you spent in the health facility after you delivered; *(read out the options)*		1 = not long enough 2 = neutral (=enough) 3 = too long
	Are you satisfied with the information you received about:		
10		□ Breastfeeding *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = I did not received any information on this topic

11		□ Your own nutrition *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = I did not received any information on this topic
12		□ Postpartum care and hygiene *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = I did not received any information on this topic
13		□ Family planning *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = I did not received any information on this topic

14		Danger signs after childbirth for the mother - when you have to seek care again at a health facility *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = I did not received any information on this topic
15		Can you give/mention some of these danger signs? *(**do not** read the options, tick the signs the woman mentions)*	○ vaginal bleeding ○ convulsions ○ fast and difficult breathing ○ fever and too weak to get out of bed ○ severe abdominal pain ○ fever ○ breast swollen, red or tender breasts, or sore nipple ○ urine dribbling or pain on micturition ○ others: _____

16		□ Danger signs after childbirth for the child - when you have to seek care again at a health facility *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = I did not received any information on this topic
17		Can you give/mention some of these danger signs? *(**do not** read the options, tick the signs the woman mentions)*	○ difficulty in breathing ○ convulsions ○ fever ○ feels cold ○ diarrhoea ○ difficulty in feeding ○ no feeding at all ○ pus from eyes ○ skin pustules ○ yellow skin ○ a cord stump which is red or draining pus

18	Are you satisfied about the clinical examination performed by the health worker(s) during labour and after the delivery? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

19	Are you satisfied with the level of assistance provided by the health worker(s) during the delivery? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
20	Are you satisfied with what was done to relief your pain during labour and delivery? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = nothing was done
21	Are you satisfied with the level of attention and care given to your newborn baby after delivery? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

22	Are you satisfied with the level of attention and care given to you after delivery? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

23	Are you satisfied with the help received for breastfeeding? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = no help received
24	Are you satisfied with the drugs prescribed by the health worker(s)? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = no drugs prescribed
25	Are you satisfied about the level of knowledge of the health worker(s)? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

26	Are you satisfied about the attitude of the health worker(s)? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

27	Are you satisfied with the opportunity you received to ask questions? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
28	Are you satisfied with the opportunity you received to express your concerns? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
29	Are you satisfied about the drugs you received at the health facility? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied 6 = did not receive any drugs

30	Are you satisfied about the medical equipment available at the health facility? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
31	Are you satisfied about the hygiene at the health facility? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied
	Finally, three questions to sum up	
32	If you have to deliver again will you come back to this health facility? *(read out the options)*	1 = yes 2 = no 3 = don't know *(always ask)* Why? _____ _____
33	Would you recommend this health facility to a relative or friend for them to deliver? *(read out the options)*	1 = yes 2 = no 3 = don't know

34	In general, how satisfied are you with the care you received during your delivery at this health facility? *(read out the options)*	1 = very satisfied 2 = satisfied 3 = neutral 4 = unsatisfied 5 = very unsatisfied

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APPENDIX 5: IN-DEPTH INTERVIEW GUIDE FOR MATERNAL HEALTHCARE PROVIDERS IN THE INTERVENTION HEALTH CENTRES

Perceived combined effects of Computerized Decision Support System (CDSS) and Performance-based incentives (PBIs) on motivation

1. Age, Sex, Education, Profession, Name of health centre
2. What does motivation mean to you?
3. What aspects of your work encourage you to work hard?
4. What aspects of your work discourages from working hard?
5. How was your motivation (eg. attitudes to work and work behaviour) prior to the introduction of the CDSS and PBI interventions?

6. What are the combined effects of computerized decision support system and performance-based incentives on your motivation?

-If not mentioned probe: general motivation, keenness to use CDSS, competence, pride to work, attitude towards clients, job satisfaction, commitment at work, conscientiousness, timeliness and attendance

7. How long do you intend to work in this facility? Probe intentions to leave the facility, recommend profession to children etc.

Perceived combined effects of Computerised Decision Support System (CDSS) and Performance-based incentives (PBIs) on performance

1. How would you describe your performance (management of antenatal, labour & delivery clients, adherence to clinical guidelines) in this facility?
2. How was your performance before the introduction of the CDSS and PBI interventions?
3. How has paper-based guidelines enhanced your management of antenatal, labour and delivery clients?
4. How will you describe your performance in terms of management of antenatal, labour and delivery care since the CDSS and PBI interventions were introduced in this facility?

Probe: adherence to computer-based clinical guidelines, BP checked, HP checked, patient satisfaction, partograph utilization, reduces error rates, previous patient history easily

assessed, reminders and alerts are useful tools, improves clinical decision making, clinical diagnosis, and enhanced adherence to clinical guidelines?

5. How has the CDSS and PBI interventions negatively influenced your performance?
6. How should these interventions be improved?
7. What additional information do you have on what has been discussed so far?

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APPENDIX 6: IN-DEPTH INTERVIEW GUIDE FOR DISTRICT PUBLIC HEALTH NURSE AND HEALTH FACILITY MANAGERS FROM THE INTERVENTION HEALTH CENTRES/DISTRICTS.

1. Age, sex, profession, years in current profession, name of health centre, years in current facility and population of facility/District.
2. What does worker motivation and performance mean to you?
3. What are the combined effects of the CDSS and PBI interventions on MNH providers' motivation?

If not mentioned probe: general motivation, keenness to use CDSS, competence, pride to work, attitude towards clients, job satisfaction, commitment at work, conscientiousness, timeliness and attendance

4. What are the combined effects of the CDSS and PBI interventions on performance of users in terms of management of antenatal, labour and delivery clients?

Probe: adherence to computer-based clinical guidelines, BP checked, HP checked, patient satisfaction, partograph utilization, reduces error rates, previous patient history easily assessed, reminders and alerts are useful tools, improves clinical decision making, clinical diagnosis, and enhanced adherence to clinical guidelines?

8. How has the CDSS and PBI interventions negatively influenced their performance?

5. How should these interventions be improved?

6. What other additional information do you have on what has been discussed so far?

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APPENDIX 7: IN-DEPTH INTERVIEW GUIDE FOR COMPARISON
MATERNAL

HEALTHCARE PROVIDERS.

Demographic Characteristics

Age, Sex, profession, years in current profession, name of health centre and years in current facility.

Maternal healthcare providers' motivation

1. What does health worker motivation mean to you?

2. What aspects of your work encourage you to work hard?

3. What aspects of your work discourages from working hard?

4. How has your motivation improved over the past four years?

If not mentioned probe: general motivation, attitude towards clients, job satisfaction, timeliness and attendance, organization commitment, conscientiousness etc.

5. What interventions are responsible for this change in your motivation?

6. How long do you intend to work in this facility? Probe intentions to leave the facility, recommend profession to children etc.

Maternal healthcare providers' performance

9. How would you describe your performance (management of antenatal, labour & delivery clients) in this facility?

10. How has your performance changed over the past four years?

Probe: Adherence of safe motherhood protocols, competence strengthening, task meaningfulness, provision of antenatal and delivery care (tests conducted for pregnant women, physical examinations performed), partograph used to monitor labour, behaviour towards clients etc.

11. What interventions have improved your performance over these years?

12. What should be considered as interventions for you to improve your motivation and performance? Probe: Computerized clinical guidelines, financial and non-financial incentives.

13. What additional information do you have on what has been discussed so far?

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APPENDIX 8: IN-DEPTH INTERVIEW GUIDE FOR DISTRICT LEVEL STAFF

AND HEALTH FACILITY MANAGERS IN THE COMPARISON ARM

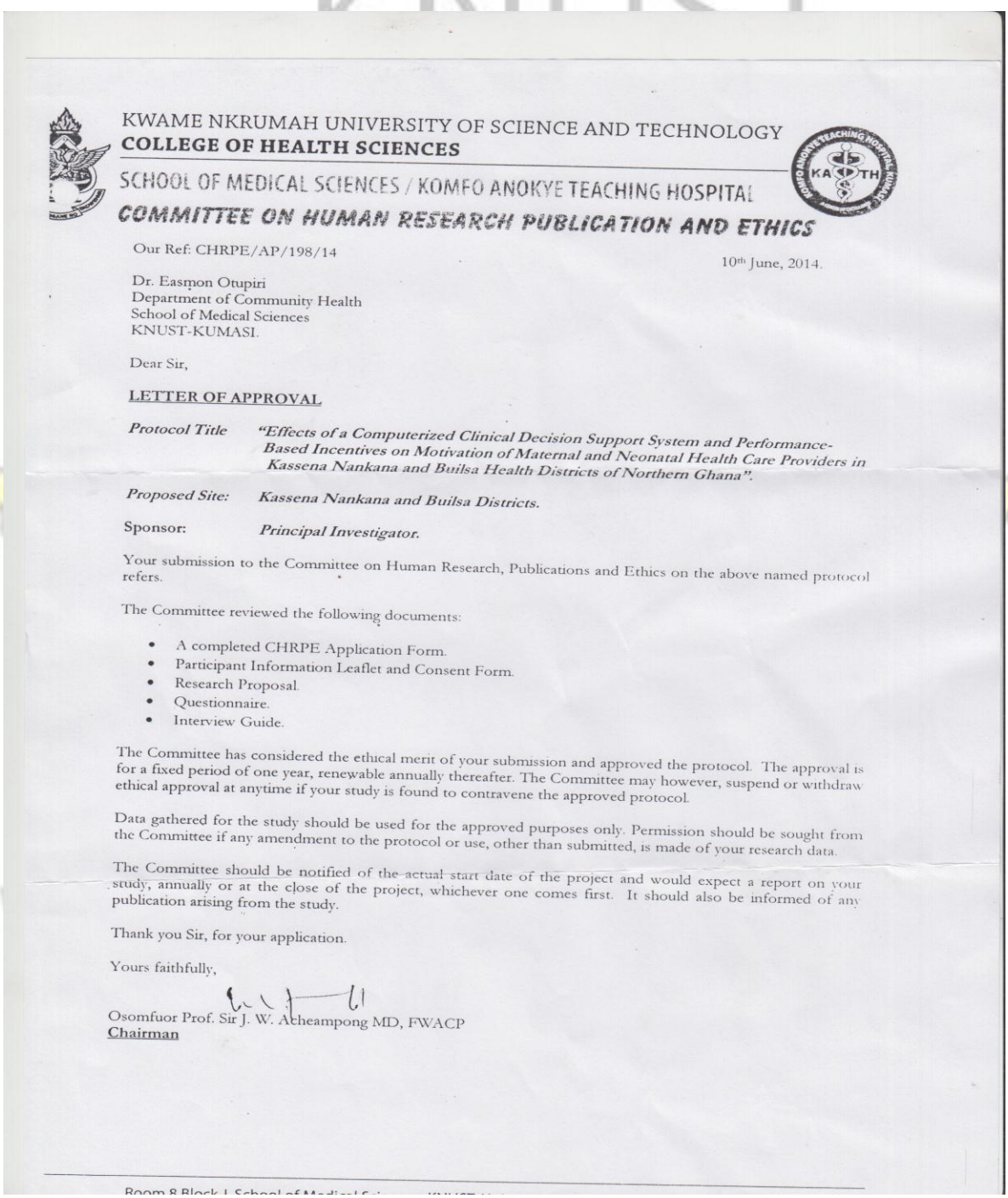
1. Age, sex, profession, years in current profession, name of health centre, years in current facility and population of facility/District.
2. What does worker motivation mean to you?
3. How has maternal and neonatal healthcare worker motivation changed since 2010 to date? Probe: improvement in job satisfaction, timeliness and attendance, general motivation, attitudes towards patients etc
4. What does maternal and neonatal healthcare worker performance mean to you?
5. What is your perception of the performance of MNH providers in this facility since 2010 to date?

Probe: management of antenatal, labour and delivery clients, adherence to clinical guidelines (safe motherhood protocols), tetanus care coverage, pregnancy at risked referred, HIV testing compliance, assisted delivery, HB checked, BP checked, partograph used etc. 6. What interventions have improved maternal and neonatal healthcare worker motivation and performance since 2010 to date?

7. What should be considered as interventions for MNH providers to improve their motivation and performance? Probe: Financial and non-financial incentives, clinical guidelines in computer, mobile phone etc.

8. What additional information do you have on what has been discussed so far?

APPENDIX 9: ETHICAL APPROVAL LETTER



KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF MEDICAL SCIENCES / KOMFO ANOKYE TEACHING HOSPITAL
COMMITTEE ON HUMAN RESEARCH PUBLICATION AND ETHICS

Our Ref: CHRPE/AP/198/14

10th June, 2014.

Dr. Easmon Otupiri
Department of Community Health
School of Medical Sciences
KNUST-KUMASI.

Dear Sir,

LETTER OF APPROVAL

Protocol Title *"Effects of a Computerized Clinical Decision Support System and Performance-Based Incentives on Motivation of Maternal and Neonatal Health Care Providers in Kassena Nankana and Builsa Health Districts of Northern Ghana".*

Proposed Site: *Kassena Nankana and Builsa Districts.*

Sponsor: *Principal Investigator.*

Your submission to the Committee on Human Research, Publications and Ethics on the above named protocol refers.

The Committee reviewed the following documents:

- A completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Proposal.
- Questionnaire.
- Interview Guide.

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, renewable annually thereafter. The Committee may however, suspend or withdraw ethical approval at anytime if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you Sir, for your application.

Yours faithfully,

Osomfuor Prof. Sir J. W. Acheampong MD, FWACP
Chairman

Room 8 Block L School of Medical Sciences KNUST-Kumasi

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
APPENDIX 10: CONSENT FORM FOR ANTENATAL AND DELIVERY CLIENTS

Information Sheet

I work at Navrongo Health Research Centre and a PhD Student of KNUST, Kumasi. We are doing research on the effects of CDSS and PBI strategies on performance of healthcare providers in primary health care facilities in this district.

Purpose of the research

The intervention research project was done health facilities in the Kassena Nankana and Builsa Districts in Ghana to improve the quality of maternal and neonatal care. Twelve health facilities participated in this project. To be able to measure the effect on the quality of ANC and delivery care of the interventions introduced by the QUALMAT research project several tools were developed. One of these tools is interviewing women/clients about their satisfaction with the ANC and delivery care provided at the health facility.

Procedures

I will ask few questions regarding the ANC consultation/delivery and postpartum care you received at this health facility. If you do not wish to answer any of the questions you may say so. The interview will be conducted at a place convenient to you. The information recorded is anonymous, your name or any other information that may disclose your identity is not recorded on file. All information recorded is considered confidential, and no one else except

the researchers will have access to the records. The records will be kept at Navrongo Health Research Centre, Ghana. The expected duration of the interview is about 15 minutes.

Risks and discomforts

There is a chance that you may feel uncomfortable about talking about some of the topics. However, we do not wish this to happen, and you may refuse to answer any question, if you feel they are personal or if talking about them makes you uncomfortable.

Benefits

There will be no direct benefit to you. But your participation is likely to help us find out more about how to improve maternal and neonatal care.

Appreciation for participation

You will be provided two cakes of soap as an incentive to take part in the research.

Confidentiality

The information that we collect from this research project will be kept confidential. Information collected from the study will not be divulged to anyone except the researchers and all reporting will be anonymous.

Right to refuse or withdraw

You do not have to take part in this research if you do not wish to do so, and this will not affect you in any way. You may stop participating at any time that you wish to, without losing any of your rights to medical care.

Who to contact

If you have any questions, you may ask me now or call Mrs. Gifty Apiung Aninanya at the Navrongo Health Research Centre on her mobile number: 0244467280. You may also contact Dr. Abraham Oduro at the Navrongo Health Research Centre or call him on 0244593231.

The Navrongo Health Research Centre Institutional Review Board and KNUSTIRB has reviewed and given approval for this study to be conducted. If you have questions with regards to your rights as a participant in the study, you may contact the Chairman, Dr. John Awoonor Williams on mobile number: 0244564120.

If you have any questions you may ask them now or later. If you wish to ask questions later, you may contact me on the following number: 0244467280.

Certificate of Consent for Patient Interview

I have been invited to take part in the research project in Ghana.

I have read the information sheet/Information sheet has been read to me. I have had the opportunity to ask questions about it and any questions I asked have been answered to my satisfaction. I consent voluntarily to participate in this study and understand that I have the

right to withdraw from the study at any time without in any way affecting me and my family as a health care seeker.

Participant's Name Signature/Thumb impression of Participant

_____ _____

Moderator's name Signature of Moderator

_____ _____

Date _____ Place_____

(If participant is illiterate)

Witness Name Signature/Thumb impression of witness

_____ _____

Date _____ Place _____

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPENDIX 11: CONSENT FORM FOR ALL MATERNAL HEALTHCARE PROVIDERS

Project Title: Effects of a computerized decision support system on motivation and performance of MH providers in Kassena Nankana East and West Districts.

I am Gifty Apiung Aninanya, a PhD student from KNUST. I am conducting a research for my doctoral thesis on effects of a computerized decision support system on motivation and performance of midwives/nurses. Your facility is among those selected to participate in this study.

Study Procedures

I would be very grateful if you would fill out the attached questionnaire. It features a number of statements that address issues to do with your workplace, working conditions, the organization of your work, the support you receive, your performance and how satisfied you are with your job. You are asked to rate your agreement or disagreement with each statement by ticking one of the boxes. It will take you about 30 minutes to fill out the questionnaire.

After you have finished filling the questionnaire out I will collect the responses back. Next, I will give you a shorter set of similar statements and ask you to fill them out for another colleague who is also present and taking part in the survey. This colleague will be chosen at random -by pulling the name out of the hat. I will then write the name of the colleague upon this shorter questionnaire. Your name, however, is not required for this step. By filling out this shorter questionnaire you will be giving us your opinion of your colleague. This means

that we can then look for any differences between how staff sees themselves and how their colleagues see them. Altogether this second step will take approximately 1 hour.

What happens with the information?

The information you provide us with will only be used by the research centre and will be kept strictly private and confidential. Although I do ask you to give us your name, this will not be used at any other stage in the analysis process. Rather, it would be used to match up your responses on the baseline questionnaire to see whether your motivation has changed. Having your name will make it easier to identify who has already taken part and which colleagues may have left or joined the facility. We would be very grateful if you would agree to join in for the entire period.

Benefits/Risks of the study

There is a slight risk that you may share some personal or confidential information by chance, or that you may feel uncomfortable talking about some issues. But be rest assured that every information you share with me will be kept confidential.

There will be no direct benefit to you but your participation will help improve the quality of maternal and neonatal health.

What you can expect

You will not be paid anything for participating in this study.

Confidentiality

The information that we collect from this research project will be kept confidential. I promise to anonymous the data at the reporting stage.

Right to refuse or withdraw

You do not have to take part in this research if you do not wish to do so, and this will not affect you in any way. You may stop participating at any time that you wish to, without losing any of your rights to medical care.

Questions

If you have any questions, you can ask me now or call Mrs. Gifty Apiung Aninanya at the Navrongo Health Research Centre on her mobile number; 0244467280. You can also contact Dr. Abraham Oduro at the Navrongo Health Research Centre or call him on 0244593231.

The Navrongo Health Research Centre Institutional Review Board and KNUSTIRB has reviewed and given approval for this study to be conducted. If you have questions with regards to your rights as a participant in the study, you can contact the Chairman, Dr. John Awoonor Williams on mobile number 0244564120.

Certificate of Consent for Patient Interview

I have been invited to take part in this end line study.

I have been adequately informed (or I have read and understood) the purpose, procedures, potential risks and benefits of the study. I have had the opportunity to ask questions about it and the questions I asked have been answered to my satisfaction. I understand that any

information collected will be treated confidentially. I consent voluntarily to participate in this study and understand that I have the right to withdraw from the study. Upon signing this consent form, I will receive a copy for my personal records.

Participant's Name Signature/Left Thumb print

_____ _____

Moderator's name Signature of Moderator

_____ _____

Date _____ Place_____

Affidavit of person administering consent:

I certify that I have explained to the above individual the nature and purpose of the study, potential benefits and possible risks associated with the participation in this research project. I have answered any questions that have been raised and have witnessed the above signature on the date indicated below:

Printed name of the individual obtaining consent:----------

Position: ----------

Signature----------

Signature:----------

Date:…….....

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPENDIX 12: CONSENT FORM FOR DISTRICT LEVEL STAFF/FACILITY MANAGERS

Project Title: Effects of a computerized decision support system on motivation and performance of MH providers in Kassena Nankana East and West Districts.

Introduction and Purpose

I work with the Navrongo Health Research Centre. I am also a PhD student of KNUST and I am evaluating the effects of a computerized decision support system on motivation and performance of MNH providers in the Kassena Nankana districts of Northern Ghana.

Study Procedures

I will ask few questions regarding the effects of the CDSS and PBI on motivation and performance of health providers. If you do not wish to answer any of the questions you may

say so. The interview will be conducted at a place convenient to you. I will record the interview so as to be able to capture all the issues you will tell me. The information recorded will be reported anonymously, your name or any other information that may disclose your identity will not be recorded. All information recorded is considered confidential, and no one else except the researcher and research assistants will have access to the records. The records will be kept at the Navrongo Health Research Centre and will be used for the intended purposes only. The transcripts will be destroyed after 3 years of storage. The expected duration of the interview is about 60 minutes.

Risks and benefits of the study

The study would carry a minimal amount of risk which would be divulging personal information or feeling uncomfortable discussing or being asked certain questions. But be rest assured that every information shared with me will be kept confidential.

Benefits from this study would include the information being used to improve the quality of maternal health service delivery.

Appreciation for participation

You will be provided two cakes of soap as an incentive to take part in the research.

Confidentiality

The information that we collect from this research project will be kept confidential.

Your voice will be recorded during interview. The information about you will be stored in a file that will be stored in a file that will not have your name written on it, but a number assigned to it instead. Information collected from the study will not be divulged to anyone except the researchers.

Right to refuse or withdraw

You do not have to take part in this research if you do not wish to do so, and this will not affect you in any way. You may stop participating at any time that you wish to, without losing any of your rights to medical care.

Who to contact

If you have any questions you can contact Mrs. Gifty A. Aninanya, mobile number, 0244467280. You can also contact Dr. Abraham Oduro at the Navrongo Health Research Centre or call him on 0244593231.

The Navrongo Health Research Centre Institutional Review Board has reviewed and given approval for this study to be conducted. If you have questions with regards to your rights as a participant in the study, you can contact the Chairman, Dr. John Awoonor Williams on mobile number 0244564120.

Certificate of Consent for Patient Interview

I have been invited to take part in the quality assessment study of the QUALMAT research project by the Navrongo Health Research Centre.

I have been adequately informed (or I have read and understood) the purpose, procedures, potential risks and benefits of the study. I have had the opportunity to ask questions about it and the questions I asked have been answered to my satisfaction. I understand that any information collected will be treated confidentially. I consent voluntarily to participate in this study and understand that I have the right to withdraw from the study at any time without in any way affecting me and my family as a health care seeker.

Participant's Name _____

Signature/Left Thumb print _____

Moderator's name _____

Signature of Moderator _____

Date _____

Place _____

Affidavit of person administering consent:

I certify that I have explained to the above individual the nature and purpose of the study, potential benefits and possible risks associated with the participation in this research project. I have answered any questions that have been raised and have witnessed the above signature on the date indicated below:

Printed name of the individual obtaining consent:----------

Position:----------

Signature----------

Date:----------