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Determinants of health care use and mothers' preventative and curative health care practices in Burkina Faso

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ABSTRACT

In about two-thirds of all countries in sub-Saharan Africa, low coverage of effective interventions to prevent maternal and child deaths has been attributed to both weaknesses in the supply and demand for health services. These interventions require access to and use of health services. Conceptually, the availability, quality of health care, financial and geographical accessibility, socio-economic and demographics factors and cultural barriers are the main factors associated with health care use. These associated factors and the causes of low utilization of health services have been studied by several authors in Burkina Faso and other countries, often from the point of view of health care demand or supply. The effect of health care supply and demand, taken together in a single analysis, on the use of health care services should be documented. This study aims to contribute to the results of previous studies by considering in a single analysis the factors affecting the supply and demand of health care in the analysis of the factors associated with the with the use of health care services.

To achieve the objectives of this study, two quantitative data sources were used: baseline survey data (2013) and end-line survey data (2017) for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso. The PBF impact assessment was a blocked-by-region cluster random trial based on a pre-post comparison design. These data mad possible the analysis of the factors associated of health services use from point of view of health care demand and supply.

Several statistical methods will be used to answer the research questions. The analysis strategy is based on three successive stages, linked together and giving rise to complementary knowledge. The first analytical phase consists mainly of a description of the use of health services in their multiple dimensions and the associated factors identified in the scientific literature. The analyses consisted of making a differential analysis of variables related to the use of health services. In order to determine the relative contributions of the various factors predicting the health care use and their effect on the children health and survival, studied in the descriptive analysis, logistic regressions and multinomial logistic regression models were developed.

By using contextual factors, beyond individual factors, multilevel analysis was use in this research to achieves a better identification of populations at risk, useful in the development of health programs. Like other methods, multilevel models are able to take into account the hierarchical structure of the data when performing parameter estimation.

These news Scientific's evidences add to the corpus of knowledge that supports the development of evidence-based health programs and policies. Such interventions are necessary to improve maternal and child health indicators in sub-Saharan African countries. The progress made in maternal and child health since the 1990s is certainly laudable, but remains insufficient for the attainment by the end of 2030 of the third Sustainable Development Goal in the area of maternal and child health.

The evidence from this thesis will therefore fuel reflection on the development of policies and programs that promote better access and use of maternal and child health services. It remains to be seen, whether the movement towards universal health coverage will promote greater equity in the access and use of maternal and child health services in Burkina Faso.

Keywords: Determinants, health services use, health care-seeking, preventive health care, curative health care, maternal and child health interventions, Burkina Faso

DECLARATION

I declare that *Health care use and mothers' preventive and curative health care practices in Burkina Faso: determinants and impact on children's health* is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Hermann Badolo

Signed: ……

DEDICATION

In memory of my grandfather Raymond Nébongnè and my father Innocent. They gave me everything without receiving anything in return. They knew how to sow without thinking of the one who will reap

To Christine Batogoma, Benania Yidempen Astride, Benild Alowoayi Raymond, Berenice Yboula Mervine and Olivia Yiyé Brielle

To my siblings

To all those who work for a more just and human world

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LIST OF ACRONYMS AND ABBREVIATIONS

AIDS	: Acquired immuno deficiency syndrome
ANC	: Antenatal care
AOR	: Adjusted Odds Ratios
BCG	: Tuberculosis vaccination
CCI	: Composite Concentrated Index
CHW	: Community Health Workers
CI	: Confidence Intervals
CMA	: Medical center with surgical services
CSPS	: Centers for Health and Social Promotion
DHS	: Demographic and Health Survey
DPT	: Diphtheria-pertussis-tetanus
FPS	: Family Planning Needs Satisfied
HD	: Health Districts
HF	: Health Facilities
HIV	: Human Immuno Deficiency Viruses
ICC	: Intraclass correlation
INSD	: National Institute of Statistics and Demography
INSP	: National Public Health Institute
MIS	: Malaria Indicators' Survey
MSL	: Measles vaccination
ONSP	: National Population Health Observatory
OR	: Odds ratios
PBF	: Performance-Based Financing
RGPH	: General population and housing census
SBA	: Skilled Birth Attendants at delivery
SDGs	: Sustainable Development Goals
UNDP	: United Nations Development Programme
UWC	: University of the Western Cape
WAHO	: West Africa Health Organization
WB	: World Bank
WCV	: Well-child visits

WHO : World Health Organisation

CHAPTER I: INTRODUCTION

1.1 BACKGROUND

In about two-thirds of all countries in sub-Saharan Africa, low coverage of effective interventions to prevent maternal and child deaths has been attributed to both weaknesses in the supply and demand for health services (Bryce et al., 2013). While many efforts to achieve the Sustainable Development Goals (SDGs) have focused on health systems and health care delivery (Hafner and Shiffman, 2013; Sarrassat et al., 2018), including community management of childhood illnesses (Marsh et al., 2012a; Sousa et al., 2011), less attention has been paid to the demand for modern health care. However, it has been recognized that behavior change has an important role to play in improving the survival of women and children in low- and middle-income countries (Fox and Obregón, 2014; Sarrassat et al., 2018). Improving children's health in all developing countries depends as much on the application of knowledge gained through the use of health facilities than on new discoveries in medicine (Audibert and Mathonnat, 2013; Mrisho et al., 2009; Kruk and Freedman, 2008; Munyamahoro and Ntaganira, 2012; Audibert and Roodenbeke, 2005). The use of primary health care services is therefore one of the key factors promoting better health for the population.

According to some previous studies, many maternal, neonatal and infant deaths can be avoided by implementing interventions based on scientific evidence such as immunization of mothers against tetanus during antenatal care (ANC) visits, skilled attendance at birth (SBA), neonatal reanimation, exclusive breastfeeding, umbilical cord care, postnatal care and infection control of newborns (Bhutta et al., 2008; Chopra et al., 2013; Lassi et al., 2019, 2015, 2012; Victora et al., 2016). However, these medical and socio-health interventions require access to and use of health services, i.e. all the care essential for the management of normal pregnancy and high-risk pregnancy, childbirth and postnatal care, which is a package of services aimed at promoting and ensuring the health status of mothers and children following childbirth (Fort, 2012;

Gulland, 2012; Mezmur et al., 2017; Navaneetham and Dharmalingam, 2002; WHO, 2005).

There are several conceptual models of health care use, but the most common are: patient decision-making models, based on sociological theory and research; the health belief model, based on psychological theory; economic models of demand for medical care; and the behavioral model of health service use which has guided much health services research on access and use of health services (Aday and Andersen, 2014). Conceptually, the availability, quality of health care, financial and geographical accessibility, socio-economic and demographics factors and cultural barriers are the main factors associated with health care use (De Allegri et al., 2011; Djiguimdé, 1968; Hitimana et al., 2018; Ridde, 2015; Somé et al., 2020).

These associated factors and the causes of low utilization of health services have been studied by several authors in Burkina Faso and other countries, often from the point of view of health care demand (Groen et al., 2013; Comfort et al., 2013; Colbourn et al., 2013; Peters et al., 2008; Audibert and Roodenbeke, 2005; Somé et al., 2020; Djiguimdé, 1968; Tiruaynet and Muchie, 2019a) or supply (De Allegri et al., 2011; Gedle and Yarinbab, 2017; Hitimana et al., 2018; Jaffré, 2003; Ridde, 2003; Rusa et al., 2009; Soeters et al., 2011; Souares et al., 2005, 2005). This dichotomy in the literature may be explained by the data sources used Demographic and Health Survey (DHS) and other cross-sectional surveys). Many studies on child and maternal health in sub-Saharan countries have used DHS data and have not been able to cover the various factors in the conceptual frameworks that have been developed to explain the determinants of health care services use.

The effect of health care supply and demand, taken together in a single analysis, on the use of health care services should be documented. It is important to contribute to the results of previous studies by considering in a single analysis the factors affecting the supply and demand of health care in the analysis of the factors associated with the with the use of health care services.

1.2 OBJECTIVES OF THIS THESIS

This study is conducted to explore the factors associated with mothers' preventive and curative health care use and the effect on their children in Burkina Faso. This study aims to contribute in the research on the explanation of health care use by considering in a single analysis the factors affecting the health care supply and demand in the analysis of factors associated with the use of health care services.

The specific research objectives were:

1. Determine the factors associated with preventive health care use by considering in a single analysis the factors affecting the health care supply and demand in Burkina Faso;
2. Determine the factors associated with curative health care use by considering in a single analysis the factors affecting the health care supply and demand in Burkina Faso;
3. Identify the contextual and individual factors associated with the health facilities use by mothers in Burkina Faso;
4. Assess the effect of health care use by mothers on their children's health and survival in Burkina Faso.

1.3 STUDY CONTEXT

This study is conducted in Burkina Faso, a landlocked country sharing its borders with six countries. It is subdivided into regions, provinces, departments and villages. It is a country with limited resources whose economy is based on agriculture, animal husbandry, trade and a still embryonic industry. This situation is marked by poor access to basic social services. As the majority of the population is young, this poses enormous challenges in terms of employment, education and health (Ministere de la santé, 2017). Burkina Faso is facing an increase in internal and external security threats linked to terrorism and the instability raging in neighboring Mali and Niger. As the security situation continues to deteriorate, there are more than one million internally displaced people (United Nations High Commissioner for Refugees, 2019). The

sudden regime changes in 2014 also left room for deep political divisions in the country, resulting in greater vulnerability at all levels. The Government of Burkina Faso is working in collaboration with the international community to strengthen its resilience and improve the country's capacity to withstand these shocks.

The economy also remains marked by its undiversified character and its high dependence on imports. Economic activity is based mainly on agriculture, animal husbandry and trade. The industry remains underdeveloped. Despite the progress made in recent years, access to basic education remains limited in Burkina Faso.

The employment rate is 63.4% for the entire working-age population. It was 73.7% for men against 54.6% for women in the 1st quarter of 2014 (Institut National de la Statistique et de la Démographie, 2015).

According to the results of the demographic module of the survey the poverty coverage rate at the national poverty line was estimated at 40.10% of the total population (Institut National de la Statistique et de la Démographie, 2015). The United Nations Development Programme (UNDP) Human Development Index 2018 ranks it 182nd out of 189 countries and territories with comparable data.

The gross primary school enrolment rate is 83.7% for the year 2014-2015; it is 83.9% for girls and 83.6% for boys. The situation is no different in secondary and higher education (Ministere de la santé, 2017). According to the results of the 2014 INSD continuous multisectoral survey, the unemployment rate is 14.1% among those over 15 years of age.

Demographically, the preliminary results of the 5th general population and housing census (RGPH) of Burkina Faso, carried out in 2019, indicated a total resident population of 20,487,979 inhabitants (Institut National de la Statistique et de la Démographie, 2020). According to the same source, the vast majority of the population (73,7%) lives in rural areas in 2019 (Institut National de la Statistique et de la Démographie, 2020). This population is characterized by its youth (17.4% for those under 5 years and 46.6% for those under 15 years). This trend can be seen in both urban

and rural areas. People over 65 represents 3.4% (Institut National de la Statistique et de la Démographie, 2020).

Women of reproductive age (15-49 years) particularly concerned by reproductive health programs represent 45.6% of the female population and 23.56% of the total population. The total fertility rate is 6.2 children per woman. This makes Burkina Faso one of the countries with high fertility in the sub-region. The crude birth rate is 41.2‰. The level of general mortality (11.8 ‰), even if it is decreasing, is still high. The infant mortality rate drop from 65 ‰ to 42.68 ‰ (Institut National de la Statistique et de la Démographie, 2015). Maternal, newborn and child mortality rates remain high in Burkina Faso, despite significant gains over the past 20 years.

Improving access to maternal, newborn, and child health services has reduced mortality from very high levels, but further progress will be needed to advance the process equity and access, and more attention should be paid to the quality of primary health care services (Ministère de la santé du Burkina Faso, 2003).

The high rates of maternal and child mortality are mostly linked to preventable causes. Between 2000 and 2016, the neonatal mortality rate declined from 90.9 to 51.9 deaths per 1,000 live births, and the under-five mortality rate was halved, from 178.9 to 83 deaths per 1,000 live births (World Bank, 2020). In infants and children, deaths are mainly due to malaria (23.8%), acute respiratory infections (13.4%), diarrhea (11.5%), neonatal causes (22 , 2%), measles (3%) and HIV / AIDS (0.7%) (Institut national de la statistique et de la démographie and ICF international, 2012).

The maternal mortality rate remains high, at 320 deaths per 100,000 deliveries in 2016, but declining from 2000 when it reached 516 deaths per 100,000 deliveries (World Bank, 2020). Among the direct causes of these maternal deaths, most of which were preventable: hemorrhage (30%), infection (23%), placental retention (11.40%), uterine rupture (10%), complications following an abortion (10%) and eclampsia (4%) (Institut national de la statistique et de la démographie and ICF international, 2012).

According to the Demographic and Health Survey conducted in 2010, 94.9% of women received at least one antenatal care during their pregnancy, but less than half of these women had received four antenatal consultations (Institut national de la statistique et de la démographie and ICF international, 2012). In 2016, the national coverage estimates were as follows: 80% of pregnant women had had one ANC visit, 70% had two ANC visits and 47% four or more ANC visits. According to the 2010 DHS results for Burkina Faso, fewer than 6 in 10 women (58.4%) make 2 to 3 antenatal visits during pregnancy and only 3 in 10 women (33.1%) make 4 or more visits during pregnancy (Institut national de la statistique et de la démographie and ICF international, 2012).

Obstacles to access to health care services were associated with a lack of information and knowledge, a perception of poor quality of care and socioeconomic conditions hampering the use of services (Ministère de la santé du Burkina Faso, 2017, 2014). Access to maternity services has improved over the past decade, but births in health facilities remain strongly associated with wealth level, and half of women in the poorest population quintile still give birth at home. Between 2005 and 2015, the proportion of births attended by a skilled attendant increased from 53.57% to 79.8% (World Bank, 2020). This gain of 26 percentage points in 10 years represents a remarkable progress which puts the country on very good track to reach the target set of 85% of births attended by qualified personnel (Ministère de la santé du Burkina Faso, 2016)

The health situation in Burkina Faso remains critical and is characterized by still high morbidity and general mortality. Factors linked to the environment (malaria, meningitis, yellow fever, cholera), specific nutritional deficiencies (iron, iodine, vitamin A), communicable diseases such as HIV/AIDS and poor health coverage help to explain these factors still high levels (Institut national de la statistique et de la démographie and ICF international, 2012).

1.4 FREE HEALTH CARE FOR CHILDREN UNDER 5 AND PREGNANT WOMEN

In 2016, the Government of Burkina Faso introduced Gratuity, a policy to replace user fees, aimed at increasing access to and use of health care services for women and children under 5. The free policy in Burkina Faso has a long history. Burkina Faso's health care system provided services free of charge until the 1980s. Increasing budget deficits led to a decline in the quality of state-subsidized health services, which ultimately led to the loss of health services. Introduction of user fees through the Bamako Initiative in 1990 (McPake et al., 1993). The first user fee exemption pilot projects started in Burkina Faso in 2008. Several more followed until 2015, often in partnership with non-governmental organizations (Ridde, 2015).

The free policy was designed to remove financial barriers to maternal, new-born and child health services and was adopted by the Council of Ministers of Burkina Faso on March 2, 2016. Gratuity is implemented in all public health facilities and a small number of private facilities. Contracted facilities provide a defined set of maternal, new-born and child health services free of charge, fully funded from the state budget. Instead of charging out-of-pocket payments, deed-amount payments are made to institutions by the central government (Boxshall et al., 2020).

The Free Benefit benefits all children under 5, as well as pregnant and postpartum women, and does not require prior patient registration. The service package includes the paediatric services defined in the protocols for the integrated management of childhood illnesses. For pregnant women, Free includes prenatal and postnatal care, childbirth, emergency obstetric care and caesarean sections. Treatment of obstetric fistulas as well as screening for precancerous lesions of the cervix and breast cancer are covered for all women (Boxshall et al., 2020).

Gratuity seems to have achieved its main objectives, namely to improve access to services and reduce direct health care costs borne by patients. For example, the average number of contacts between children under 5 and formal health services increased

from 1.7 per year in 2015 to more than 3 per year in 2017, after the introduction of Free health care for children under 5 and pregnant women.

Gratuity is not intended to directly induce an improvement in the quality of services. Unsurprisingly, no factual data shows that their quality has improved following the adoption of Free. The Gratuity was implemented against a backdrop of growing security challenges and significant social unrest (Boxshall et al., 2020). Both of these factors compromise improved quality and health outcomes. Nevertheless, the quality of services is an important underlying challenge for health in Burkina Faso. The fact that Gratuity is not explicitly linked to quality may be a missed opportunity (Boxshall et al., 2020).

The study was focused in six administrative regions (Boucle du Mouhoun, Centre-Est, Centre-Nord, Centre-Ouest, Nord and Sud-Ouest) of Burkina Faso.

1.5 READER'S ORIENTATION

In accordance with the regulations of the University of the Western Cape and to achieve the objectives of this study, this thesis is structured into height chapters. Overall, the chapters attempt to respond to the overall objective and specific objectives of the study.

The first chapter introduces the thesis by presenting the context and the rationale for the study. The literature review is the subject of the second chapter. It is here that the state of knowledge on the factors associated with the use of health services and on the theories explaining the use of modern health care. The third chapter deals with the presentation of the methodology. It presents the data and presents the analytical methods to be used. Four chapters present the results of this study:

- Chapter 4: Determinants of antenatal care utilization among childbearing women in Burkina;
- Chapter 5: Factors associated with mothers' health care-seeking behaviors for childhood fever in Burkina Faso: findings from repeated cross-sectional household surveys;

- Chapter 6: Children's health status: examining the effect of mothers' preventive health care use;
- Chapter 7: Mothers' preventive health care practices and children's survival in Burkina Faso: findings from repeated cross-sectional household surveys.

This study ends with Chapter 8 which presents the discussion of the results and the conclusion of the study.

CHAPTER II: LITERATURE REVIEW

2.1 THEORETICAL MODELS OF HEALTH SERVICES USE AND CONCEPTUAL FRAMEWORK

The modern health care services use is a complex notion, and its conceptualization differs between authors (Langlois, 2015). Health care utilization models provide guidance for defining factors, specifying the relationships between them regarding access and use of health services (Aday and Andersen, 2014). In the scientific literature there are several typical models of health care use, but the most common are: patient decision-making models, based on sociological theory and research; the health belief model, based on psychological theory; economic models of demand for medical care; and the behavioral model of health service use which has guided much health service research on access and use of health services (Aday and Andersen, 2014).

In 2012, Babitsch re-revisiting Andersen's Behavioral model of health services usewhich aimed to explain the use or not of health care services (Babitsch et al., 2012). The conceptual framework in question suggests that people's use of health services is a function of their predisposition to use services, factors which enable or impede use, and their need for care (Babitsch et al., 2012; Von Lengerke et al., 2014). By predisposing factors, these are the factors that encourage use (social and demographic characteristics of the patient or his immediate entourage, opinions on the care system, beliefs and values concerning health and illness, about the disease…). Enable factors (proximity to formal health services or distance between home and health facility, geographic accessibility, availability of means of transport, place of residence, household economic level, etc.), to them, allow this propensity to consult to be expressed while removing the barriers related to geographic and economic accessibility. In this model, the use of health services is seen as the confluence of these three groups of factors (Babitsch et al., 2012; Von Lengerke et al., 2014).

In 1995, Andersen described the use of health services as "realized access" to care, which differs from "potential access" defined by the presence of facilitating factors and

the absence of barrier (Amin et al., 2010). Facilitating resources are therefore considered necessary but not sufficient for the use of health services (Amin et al., 2010). In particular, Andersen's classic behavioral model has served as a framework for analyzing the use of modern health services in several low- and middle-income countries (Amin et al., 2010).

For his part, Kroeger (1983) classifies the factors likely to influence the use of care into three categories related: (1) to individuals; (2) the disease and its perceptions; and (3) the services offered and the perceptions thereof (Kroeger, 1983). The choice of recourse is made following the dual perception of the characteristics of health services and of the characteristics of the disease. The characteristics of the services are perceived in terms of a diversified offer, spatial and financial accessibility, quality and efficiency of care, while the characteristics of the disease are understood through the nature of the disease, its severity and its duration. It is in this wake that the therapeutic choice integrates many cultural, social, economic, health and medical dimensions (Koné-Pefoyo and Rivard, 2006).

Frenk (1992) differentiated the attributes relating to the demand for health services, that is to say individual and household characteristics, called "use power", from attributes relating to the supply or "resistance factors" (Ibn El Haj et al., 2013). This conception is reminiscent of Donabedian's notion of the "degree of fit" between resources and population, or that of the "functional relationship"(Ibn El Haj et al., 2013). It has also been argued that the use of health services can be studied in conjunction with health services per se, individual health seeking behavior, or spatial and temporal expressions of use (Koné-Pefoyo and Rivard, 2006).

Temporality also takes its importance in the model of the three delays of Thaddeus and Maine, which conceptualizes the use of emergency services in the event of an obstetric complication (Gabrysch and Campbell, 2009; Mwaliko et al., 2014). These authors developed a so-called "three deadlines" model, the first delay of which lies in the decision-making process to use modern health services. The latter is influenced by socioeconomic and cultural factors, as well as the perception of accessibility and

quality of care (Gabrysch and Campbell, 2009; Mwaliko et al., 2014). The second delay relates to the identification and reaching of a health facility, including transport, this time depending on the accessibility of the health facility. Finally, the third delay lies in taking charge and providing adequate treatment, a delay largely associated with the quality of institutional obstetric services (Gabrysch and Campbell, 2009; Mwaliko et al., 2014).. The Thaddeus and Maine three delays model is widely cited in the literature on access and use of maternal and child health services in low- and middle-income countries. Although developed for the analysis of emergency obstetric services, it has also been applied to the study of the use of skilled delivery assistance in the context of eutocic labor (Gabrysch and Campbell, 2009). On the other hand, the three delays model is criticized for its oversimplification and for the lack of nuance in the complexity of the factors at each level (Rai et al., 2012).

By adapting the model of Penchansky and Thomas (1981) (Penchansky and Thomas, 1981), Peters et al. (2008) summarized the barriers to access and use of health services according to four dimensions: (1) availability, (2) geographic accessibility (geographic accessibility), (3) financial accessibility (affordability) , and finally (4) acceptability (Peters et al., 2008). Ensor and Cooper (2004), De Brouwere et al. (2010) and O'Donnell (2007) (De Brouwere et al., 2010; Ensor and Cooper, 2004; O'Donnell, 2007) underlined the need to intervene concomitantly at the level of barriers related to the demand and supply of health care services (O'Donnell, 2007). James et al. (2006) underlined the frequent interactions between the said barriers to the use of health services (James et al., 2006). Similarly, McLaughlin et al. (2002) suggested the need to measure and model the interactions between the determinants of health care service delivery and the needs of patients (McLaughlin and Wyszewianski, 2002).

Gabrysch and Campbell (2009) finally classified the factors related to the use of skilled childbirth assistance in low- and middle-income countries into four categories: (1) socio-cultural factors, (2) perceived benefits / needs, (3) affordability and (4) physical accessibility (Gabrysch and Campbell, 2009).

In the 1990s, Zoungrana (1993) developed a study on the use of maternal and child health services in Bamako, Mali. To this end, it distinguished two types of factors: factors relating to the supply of care (accessibility, cost and quality of services) and factors relating to the demand for care which are subdivided into simple factors (socio-economic status of the patient). household, women's education, women's activity, migration status, socio-cultural characteristics, women's age and parity, marital status). In addition, susceptibility factors (sex of the child, type of birth and state of health of the woman) also influence the use of health services.

One of the traits common to all of these models is the character of the modern health service. These different conceptual models of the use of health services make it possible to conduct analyzes to find the determinants of the use of health services.

2.2 DETERMINANTS OF HEALTH CARE UTILIZATION

2.2.1 Socio-economic and demographic factors

The socio-demographic characteristics of women and households affect health behavior mainly through the process of demand for modern health services, influenced among other things by maternal age.

2.2.1.1 Maternal age

The use of services increases proportionally with maternal age, a phenomenon explained in the literature by increased decision-making power within the household, previous experience in the use of health services and biological risks more important (Burgard, 2004; Glei et al., 2003; Katenga-Kaunda, 2010; Stephenson et al., 2006). Thus, adolescents aged 15 to 19 represent the age group with the lowest propensity for institutional deliveries (Guliani et al., 2012). According to Guliani et al. (2012), women aged 30 and over are 50% more likely than adolescents aged 15 to 19 to use skilled support services at a health center (Guliani et al., 2012). Maternal age is also strongly correlated with the parity of women.

2.2.1.2 Parity

In obstetrics gynecology, parity refers to the number of deliveries to a woman, specifically the number of new-borns delivered alive, excluding stillbirths. Nulliparas and women with low parity have a higher propensity to use skilled antenatal care and skilled birth attendants at delivery (Mezmur et al., 2017; Navaneetham and Dharmalingam, 2002; Stephenson et al., 2006), explained by Stephenson et al. (2006) by an underestimation of the expected benefit in multiparas without a history of major complication (Stephenson et al., 2006). The low use of maternal health services among multiparous women may also be associated according to Simkhada et al. (2008) to family management and negative perceptions resulting from previous institutional deliveries (Simkhada et al., 2008).

Also, the mother's experience of childcare is enriched as the number of children is increased. As the child's rank increases, she is less likely to benefit from modern remedies. Short & Zhang (2004) agree, and argue that the mother's decision to give birth in a health facility is negatively influenced by the accumulated experience, for example the derogatory attitude of health workers as well as knowledge and confidence gained from previous deliveries (Short and Zhang, 2004).

However, the association between parity and the use of maternal health services is not straightforward, and varies depending on the context. In Botswana, for example, low parity women are less likely to use health services, while low parity is associated with a high propensity to seek care in Kenya and Ethiopia (Letamo and Rakgoasi, 2003; Mezmur et al., 2017; Mwaniki et al., 2002).

Some authors explained this discrepancy by the likelihood of developing a medical complication. Bai et al. (2002) identified a higher risk of maternal and neonatal complications from a parity of 4 or 5, hence the frequent use in the literature of this threshold to define "large multiparas" (Bai et al., 2002). Compared to first-time women, large multiparas (> 5) have a higher risk of obstetric complications, perinatal mortality and neonatal morbidity (Bai et al., 2002). In Nigeria, high multiparity (> 5) has been

associated with an increased occurrence of gestational diabetes, maternal anemia, cephalopelvic disproportion and fetal macrosomia (Omole-Ohonsi and Ashimi, 2011). However, there is also an excess risk in nulliparous women, in comparison with multiparas, with regard to hypertensive disorders of pregnancy. In a systematic review of the evidence for the association between parity and preeclampsia, Luo et al. (2007) report that nulliparas are 2.4 times more at risk of preeclampsia than multiparas (Luo et al., 2007). In Burkina Faso, nulliparity has been associated with a higher risk of preterm delivery, intrauterine growth retardation, and low birth weight new-borns (<2500 g) (Meda et al., 1995).

2.2.1.3 Women's autonomy

The question of women's autonomy as a determinant of the use of health services and children's health concerned many authors and affirmed that the autonomy of women is a major explanatory variable of demographic behavior, likely to determine the use of health services for children (Locoh, 1996; RAKOTONDRABE, 2004).

Furuta and Salway (2006) and Hou and Ma (2013) understood maternal autonomy through its power in decision-making about fertility and the use of modern health services (Furuta and Salway, 2006; Hou and Ma, 2013). This decision-making power influences in particular the mobility of women and their access to financial and material resources (Bloom et al., 2001; Furuta and Salway, 2006; Thaddeus and Maine, 1991). In the People's Republic of China, for example, women who do not share a residence with their parents or in-laws report more power in the decision to seek health care, and better use of health care services (Anson, 2004).

For Mistry et al. (2009), although linked to the status of women, autonomy is not a question of prestige or social position, but of being able to act (agency) for the benefit of one's health. "Autonomy is not necessarily granted to women like social status, but rather represents personal capacities" (Mistry et al., 2009). In addition, the number of young children in the household has been identified in some studies as a proxy for

mobility difficulties in parturient women (Gage, 2007; Hodgkin, 1996; Magadi et al., 2000; Mekonnen and Mekonnen, 2003a).

2.2.1.4 Women's marital status

The effects of marital status on the use of health services are mixed. Some authors have reported that within polygamous households, there appears to be preferential treatment of the head of the household based on the rank of the woman (Gibson and Mace, 2007; Gyimah et al., 2006; Mekonnen and Mekonnen, 2003a; Onah et al., 2006). Many studies suggested that the number of co-wives and marital status have an impact on the use of health services and the health status of women, with the first wife being favored at the expense of the second or third, where applicable (Gibson and Mace, 2007; Mekonnen and Mekonnen, 2003a; Onah et al., 2006). Moreover, compared to monogamous households, some polygamous households make less use of skilled birth attendants at delivery services, especially in Kenya (Gyimah et al., 2006; Mekonnen and Mekonnen, 2003a; Onah et al., 2006). One of the causal paths advanced in the literature to explain the influence of marital status on the use of health services is found in maternal occupation, traditional beliefs, knowledge and attitudes towards maternal health.

2.2.1.5 Mother's occupation

African societies have undergone profound changes in mentalities and mores in recent years. One of the most visible aspects is the fact that female work has had to leave the domestic sphere to enter the paid labor market (Adjamagbo et al., 2006). The activity carried out by the woman contributes to raising the standard of living of the household, through the acquisition of goods and services favorable to the maintenance of the health of the children. Similarly, female work increases the economic power of women in the household and promotes the use of modern medicine. Authors like Kambale et al. (2017) claim that improving the economic status of the mother has a positive impact on the health of children (Kambale et al., 2017). In the context of therapeutic use, Musuyi et al (2021), in Democratic Republic of the Congo, finds that

the use of modern medicine in cases of malaria in children under five years old is higher among employee mothers (Musuyi et al., 2021).

According to Gabrysch & Campbell (2009), economic activity outside the household can give women better access to information and resources, in addition to broadening their social contacts and their range of travel, all of which are that promote the use of health services (Gabrysch and Campbell, 2009).

2.2.1.6 Religion, traditional beliefs and attitudes towards health

The Health Belief Model attempts to explain and predict health behaviors by focusing on the attitudes and beliefs of individuals (Noumbissié, 2010). These attitudes and beliefs are strongly anchored in the norms and values specific to a society. However, behavioral intention is conditioned by a set of values and norms shared within a community. It is in this wake that the theory of reasoned action of Ajzen (1991) finds its full meaning insofar as the social environment influences the behavioral intention of the individual through a subjective standard set by expectations. of the entourage(Ajzen, 1991). According to FOURNIER & HADDAD (1995), the use of health services is the sum of individual behavior towards the health care system (Koné-Pefoyo and Rivard, 2006). Thus, traditional beliefs and values have often been cited as a barrier to the use of modern health services in sub-Saharan Africa. Among the beliefs recurrently mentioned in the literature are the inevitability of maternal deaths and the belief that pregnancy and childbirth should be hardships for women (Kyomuhendo, 2003). In many parts of Pakistan, for example, home births are carried out in light of the conservative values associated with "purdah", which prevents women from being seen by unrelated men (Agha, 2011). In Nigeria, Babalola and Fatusi (2009) argue that cultural norms restrict the use of obstetric services in the antenatal and intrapartum period (Babalola and Fatusi, 2009a). They associate the low rates of service utilization with the so-called “kunya” (embarrassment or modesty) belief that newly pregnant women should not draw attention to their pregnancy, and any mention of pregnancy should be avoided in the process. conversations. This social pressure to remain silent and modest restricts women in acquiring obstetrical

knowledge, and creates a major barrier to the use of skilled assistance during childbirth. Moreover, in Hausa culture, giving birth to your first child alone, without any assistance, is an action that is taken with great pride " (Babalola and Fatusi, 2009a).

The influence of social norms and traditional beliefs is no exception in the use of postnatal services. Iyoke et al. (2011) associate, among other things, inappropriate perceptions of postnatal maternal complications with cultural beliefs about maternal morbidity following childbirth (Iyoke et al., 2011).

2.2.1.7 Maternal education level

The modern school instils attitudes favourable to the adoption of both preventive and curative measures, which can improve the use of health services and the health of the child. It thus modulates beliefs relating to the causes of the disease (Baya, 1999) and consequently orient the therapeutic choice in favour of modern medicine. Indeed, the use of modern health services, especially obstetric services, is positively associated with maternal education (Burgard, 2004; Furuta and Salway, 2006; Nikièma et al., 2008; Raghupathy, 1996; Stephenson et al., 2006; Thaddeus and Maine, 1991) and husband education (Elo, 1992; Short and Zhang, 2004). Education is strongly correlated with the income, socioeconomic status and ability to pay of women and households, but it also has an effect independent of the level of wealth (or poverty).

In a meta-analysis based on Demographic and Health Survey (DHS) data from 31 low- and middle-income countries, Ahmed et al. (2010) conclude that the odds ratios of skilled attendance at childbirth for parturient who have completed at least primary education are nearly five times higher than less educated women (Ahmed et al., 2010).

Education is associated with improved ability to access and process new information, increased autonomy and decision-making power, better control over the resources available to the household, and greater efficiency in producing health outcomes (Cleland and Van Ginneken, 1988; Gabrysch and Campbell, 2009; LeVine et al., 2004). According to Guliani et al. (2012), these causal mechanisms confer on maternal education an effect independent of the education of the husband (Guliani et al., 2012).

Some argue that education promotes a sense of worth and self-confidence that promotes health-seeking behaviors (Sharma et al., 2007; Strassmann et al., 2005). Educated women also appear to be more receptive to health information and familiar with modern medical culture (Haddad, 1992).

2.2.1.8 Maternal health knowledge

Health literacy thus plays an important role in the process of using modern health services. Reproductive health attitudes have been associated with women's level of knowledge of obstetric complications, which is itself related to counseling (Gage, 2007; Phoxay et al., 2001; Stekelenburg et al., 2004) and the availability of maternal health information (Koné-Pefoyo and Rivard, 2006; Navaneetham and Dharmalingam, 2002; Stephenson et al., 2006). It goes without saying that access to and integration of information is also a function of the educational level of the woman and the household. The education of the wife and husband also plays a role in the contextual factors associated with the use of health services.

2.2.2 Contextual factors

There is a growing interest in the scientific literature on the use of health services regarding the effect of contextual determinants, beyond just individual and household factors. The use of reproductive health services has been statistically significantly associated with community-level attributes, for example, community level of education, notably in India, China and sub-Saharan Africa (Jat et al., 2011; Liu et al., 2011; Stephenson et al., 2006; Stephenson and Tsui, 2002). These scientific evidences highlight the contextual effects that influence the use of maternal health services in settings with limited resources. Gabrysch and Campbell (2009) thus identify a large number of community factors that are not or difficult to observe, in particular attitudes towards health and healthcare-seeking behaviors or practices surrounding birth, or relating to the availability and accessibility of services. health (Gabrysch and Campbell, 2009). Rai et al. (2012) further underline that the location of a household

(urban vs. rural) underlies important contextual differences, beyond just geographic accessibility (Rai et al., 2012).

Urban and rural areas, regardless of the disparities in the provision of care, do not use the same remedies. Urban dwellers tend to resort to modern while rural dwellers use traditional health services. The results of the study conducted by Akoto et al. (2002) show that city dwellers are at least 73% less likely than peasants to use traditional medicine, rather than modern medicine. For Akoto et al. (2002) the variable area of residence allows us to verify whether urbanization justifies the importance of modern remedies (Akoto et al., 2002). Wilheims et al. (2001) highlight the differences in modern remedies between rural and urban areas in a health district of Ouagadougou (Willems et al., 2001). They show that modern consultations for fever in children under five are 34% in urban areas against 17% in rural areas. This is explained by the dominant way of thinking in cities and the greater availability of modern health services, unlike in rural areas. Thus, the favorable perceptions of modern health care systems in cities and their availability are explanatory factors for modern remedies.

The influence of contextual determinants in the process of seeking care is also reminiscent of the growing importance in public health given to social determinants of health, particularly transport infrastructure (Marmot and Wilkinson, 2005).

Some have also identified the community level of poverty (Rai et al., 2012) as a contextual factor determining the use of health services. In sub-Saharan Africa, Guliani et al. (2012) demonstrated that controlling for individual and household attributes, residents of poor regions have a 35% lower probability of giving birth in a health facility compared to residents of non-poor regions (Guliani et al., 2012). The level of poverty is also one of the major issues to consider in the issue of financial accessibility to health services.

2.2.3 Quality of health care

Donabedian conceptualizes the quality of care in two parts: on the one hand the structural quality, comprising the resources (notably the medical equipment and the

health professionals) and the adequate infrastructures, and on the other hand the quality of the process., namely the provision of quality medical care. Following this conceptual framework, appropriate medical procedures (processes) can lead to favourable health outcomes (Ibn El Haj et al., 2013). The perception of the health care system by the population influences the choice of a remedy. It is widely accepted that the quality of care provided in a health facility and the perception of this quality is a determinant of the use of maternal health services, especially obstetric services (Amooti-Kaguna and Nuwaha, 2000; Griffiths and Stephenson, 2001; Mrisho et al., 2007; Thaddeus and Maine, 1994). The quality of medical services per se depends not only on the medical and technical equipment and consumables available, but also on the qualifications of health workers. The qualification of personnel determines, among other things, the readiness to manage obstetric complications, identified as an important determinant of the quality of obstetric services provided in sub-Saharan Africa, particularly in Benin and Côte d'Ivoire (Gohou et al., 2004; Saizonou et al., 2006).

Perceptions of quality of care have been associated with staff attitudes, and a potential conflict between the "health culture" of health service providers and users (Amooti-Kaguna and Nuwaha, 2000; Griffiths and Stephenson, 2001; Mrisho et al., 2007). Such conflicts include, for example, the obligation for women to give birth in a lying position despite a request to give birth on their knees (Torres-Pereyra, 1988; White et al., 2012), or the prohibition for a family member to assist the parturient during the birth. obstetrical work (White et al., 2012).

In addition, in the study of skilled attendance at childbirth, Hussein et al. (2004) stress the importance of analyzing the presence of a qualified professional, but also the enabling environment of the health center, including resources (equipment, drugs, reagents) and infrastructure (Hussein et al., 2004). Hussein agrees here with Donabedian's conception of the quality of care, which combines in the “structure” aspect of quality both resources (material and human) and health infrastructure (Ibn El Haj et al., 2013). In developing countries, especially in sub-Saharan Africa, the

debate on institutional vs. Home births - assisted or not by qualified personnel - is made more complex by the context of limited resources, and the problem of recourse to maternal health services cannot be independent of contextual factors and community determinants (Costello et al., 2006; Stanton, 2008).

2.2.4 Geographic accessibility

Geographic accessibility is an attribute of health care supply, but also influences demand for services, by anticipating travel time and opportunity costs (Prices, 2008). Physical accessibility means transport time (Joseph and Phillips, 1984), geographic region (Say and Raine, 2007), Euclidean distance (km) between a household and a health facility (Amooti-Kaguna and Nuwaha, 2000; Gage, 2007; Griffiths and Stephenson, 2001; Hounton et al., 2008; Thaddeus and Maine, 1994), the quality of roads (Gage, 2007; Gage and Guirlène Calixte, 2006; Glei et al., 2003), means of transport, the ability to mobilize these (Gage, 2007; Gage and Guirlène Calixte, 2006; Glei et al., 2003), and seasonality (eg rainy season) (Thaddeus and Maine, 1994). The scientific literature shows a greater propensity of women in urban (vs. rural) sectors to give birth in the presence of qualified nursing staff (Addai, 2000; Mekonnen and Mekonnen, 2003a; Say and Raine, 2007). A distance of 5 km and less from a primary health center is also associated with the use of skilled childbirth assistance in sub-Saharan Africa (De Allegri et al., 2011).

Some also argue for a modification of the effect of distance by the level of household poverty. In sub-Saharan Africa, for example, traditionally the poorest subsistence farmers who live in rural areas and far from health facilities must take into account the opportunity cost of prolonged absence, particularly during the harvest season (Gabrysch and Campbell, 2009). Similarly, the geographic accessibility rate measured by the World Bank by the percentage of the population living within 5 km of a health facility is 91.2% in the richest areas of Burkina Faso for example, and 54.9% in the poorest areas, ie a gradient of 36.3% (Banque Mondiale, 2003). In the country, 40.10%

of the rural population lives below the poverty line vs. 20% for the urban population (Institut National de la Statistique et de la Démographie, 2015). The distance between a household and the nearest health facility is therefore of major importance in the problem of the use of health services, but cannot in itself explain the complex phenomenon of recourse to care. The latter must also be studied in the light of the socio-demographic factors of women and households and affordability.

2.2.5 Affordability

Financial accessibility is much more understandable by the direct costs generated by the use of health services (travel costs, costs of consultations, examinations and drugs) and the opportunity costs related to the shortfall in terms of of economic production (Muntaner and Parsons, 1996). This factor justifies the extent of non-use of the health center in most studies. For Talani et al. (2003), the lack of money as a reason for not going to the health center in case of fever of the child was mentioned by 40.1% of households (Talani et al., 2003).

The financial barrier is at two levels: (1) the supply of care, through the direct costs of services, drugs and other consumables, and (2) demand, i.e. the perception that households have of the costs (direct, indirect and opportunity) (Gabrysch and Campbell, 2009; Haddad, 1992; Thaddeus and Maine, 1991). The apprehension of high costs and difficulties in mobilizing financial resources thus affects the decision to use health services (Gabrysch and Campbell, 2009).

Numerous studies have shown that direct costs and opportunity costs represent a major obstacle to the use of maternal health services on the African continent, particularly in Burkina Faso, Ghana, Uganda, South Africa, Kenya, Democratic Republic of the Congo and Madagascar (Bosu et al., 2007; James et al., 2006; Perkins et al., 2009; Ridde and Morestin, 2011; Xu et al., 2007). In a systematic review on the determinants of the use of antenatal care, Simkhada et al. (2008) identify financial constraints as the most important factor in the non-use of antenatal consultation services (Simkhada et al., 2008).

2.2.5.1 Direct charges to users

In sub-Saharan Africa, direct payments at the point of service were implemented within cost recovery policies, inspired by the Bamako Initiative (1987) and in the wake of structural adjustment policies introduced in the fourties. - twenty by the World Bank (WB) and the International Monetary Fund (IMF) (Haddad et al., 2006; Ridde, 2003). Adopted more than 25 years ago, the Bamako Initiative introduces the pricing of care and community participation in the management of resources, including essential drugs now sold to users. The goal of policy makers at the time was to ensure the financial sustainability of health facilities and health systems in countries with limited resources. According to this logic, user fees would in principle make it possible to ensure a continuous supply of essential drugs, and improve the technical quality of health services, in particular by providing medical equipment (eg microscopes), renovating social infrastructure. -sanitary and technical training of health professionals. However, this technical increase in the quality of care was not sufficient to compensate for the additional financial barrier created by the increase in the costs of services (Koné-Pefoyo and Rivard, 2006).

The scientific literature reports that medical costs are inversely proportional to the use of health services in low- and middle-income countries (Amooti-Kaguna and Nuwaha, 2000; Lagarde and Palmer, 2011; Mayhew et al., 2008; Navaneetham and Dharmalingam, 2002; Thaddeus and Maine, 1994). In Burkina Faso, for example, direct user fees in the country have generated a net 15% decrease in the use of services over a period of 3 years (Haddad et al., 2006; Ridde, 2003) which corroborates the experience of other West African countries (Haddad et al., 2006; Ridde, 2003).

In low- and middle-income countries, many households are repeatedly faced with a lack of financial liquidity, particularly in rural areas, during the gap period just before harvest. Even a user fee considered "minimal" can drastically reduce the use of health services by the indigent, that is, the poorest members of the community (Sachs, 2012). Moreover, Sachs (2012) points out that within a household, the economic and cultural

division of labor often leaves the mother without any access to financial resources, despite the existence of these (Sachs, 2012).

2.2.5.2 Household ability to pay

In addition to characteristics associated with supply, including the costs of health services, affordability is a function of demand for services, including the ability of households to pay. The demand for services then depends on the apprehension of the associated costs and the difficulties in mobilizing financial resources (Gabrysch and Campbell, 2009; Hotchkiss et al., 2005; Thaddeus and Maine, 1994). The use of services by women from the poorest households is more elastic compared to the better-off families. In this sense, Hotchkiss et al. (2005) demonstrated in rural contexts of Morocco that an increase in user fees led to a more than proportional reduction in the use of childbirth assistance services in public health facilities (Hotchkiss et al., 2005). The demand for services thus depends on a household's ability to pay. The latter is a function of household income, which is often inconsistent and difficult to measure, hence the frequent need to use an indirect measure such as the level of household expenditure or an estimate of socioeconomic status (Koné-Pefoyo and Rivard, 2006).

The ability to pay also relates to the ability of households to mobilize financial resources, either through borrowing or monetary donations from family or other members of the community. Household ability to pay and use of health services are largely associated with socioeconomic status in low- and middle-income countries, and inequalities in service use can be substantial (Bonu et al., 2009; Koné-Pefoyo and Rivard, 2006).

2.2.5.3 Subsidy of user fees

Some African countries have adopted programs and policies for partial or complete exemption from payment for maternal health services, notably in Uganda, South Africa, Ghana, Mali, Niger, Benin, Burundi and Burkina Faso (Asante et al., 2007; Bosu et al., 2007; Chuma et al., 2009; Ridde and Morestin, 2011). In a systematic review on the abolition of user fees in Africa, Ridde et al. (2011) underline the predominantly

positive effects on the use of health services (Ridde and Morestin, 2011). In Ghana, following the complete exemption from payment for skilled attendance at childbirth, studies show an increase from 10% to 36% in the proportion of skilled attendance at childbirth (Asante et al., 2007; Bosu et al., 2007; Penfold et al., 2007; Witter et al., 2007). In Uganda, results suggest an increase from 10% to 34% after the abolition of medical fees in 2001 (Nabyonga-Orem et al., 2008; Ridde and Morestin, 2011; Xu et al., 2006).

Over the past decade, 17 African countries have adopted policies to raise user fees for maternal and child health services (Dzakpasu et al., 2012, 2014a). Based on experiences in various African contexts, subsidizing health services appears to be effective in increasing healthcare uptake (Gulland, 2012; Lagarde and Palmer, 2011; Ridde and Morestin, 2011). In a systematic review on the effectiveness of financial barrier removal in low- and middle-income countries, Lagarde and Palmer (2008) corroborate the increase in rates of use of health services (Lagarde and Palmer, 2011).

Social prejudices, in particular the disappearance of elements of traditional behavior prejudicial to health, for example the traditional resistance to use the means of modern medicine, play a determining role in the use of modern health services. This justifies the fact that several researchers have attempted to dissociate cultural and sociological factors from essentially economic and individual factors.

The study of the use of health services according to differential access to health services and income requires consideration of each social category. For each of them, access can be considered under three aspects: institutional (or legal), material and cultural. There may be health services in an area without different segments of the population using them in the same way and with the same intensity. Masuy-Stroobant (2002) shows that in Togo, an ethnic group located more than an hour's walk from a dispensary uses the latter more for preventive and curative care than another located nearby (Masuy-Stroobant, 2002). This shows that the geographic or financial distance separating the population from health services is much less important than the cultural distance. For some of the proponents of this approach, health education, changes in personal and collective hygiene have been far more important than income.

Currently, the approach of most authors is part of a recognition of the multiplicity and complexity of the factors that come into play in determining the level of use of modern health services.

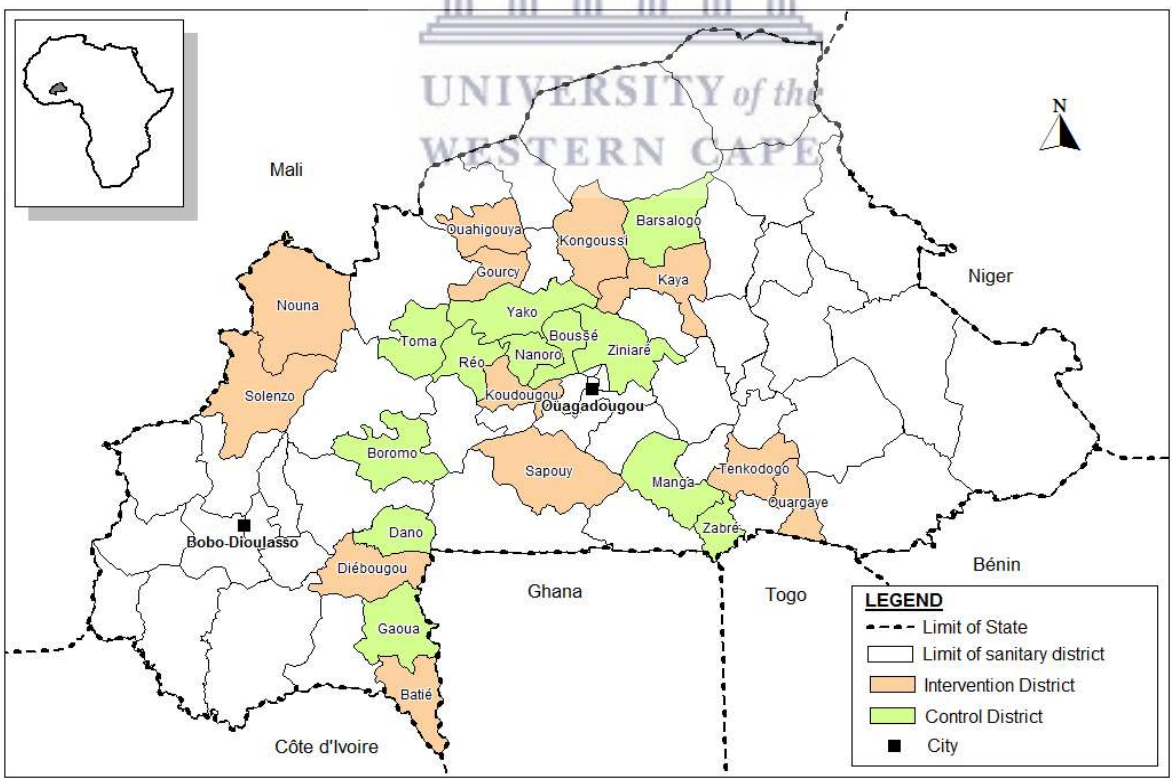
CHAPTER III: DATA AND METHODS

3.1 DATA SOURCES

3.1.1 Baseline and end-line survey data for the impact evaluation of PBF

To achieve the objectives of this study, two quantitative data sources were used: baseline survey data (2013) and end-line survey data (2017) for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso. The PBF impact assessment was a blocked-by-region cluster random trial based on a pre-post comparison design. This process of random allocation seeks to ensure that the different study groups are comparable in terms of observed and unobserved characteristics that could affect treatment outcomes, thereby allowing average differences in outcomes to be causally attributed. The aim was to compare the indicators between intervention and control areas over a period before and after the intervention. In the protocol, it was planned to trace households and health facilities from the baseline survey to the final survey.

Figure 3 1: Study area – Control and intervention health districts for baseline and endline survey, Burkina Faso



Source: Author's own production from base maps of the Geographic Institute of Burkina Faso

The choice of health regions was guided by the low level of maternal and child health indicators there. In each region (Center North, Center West, North, South West, Boucle du Mouhoun and Center Est), two health districts (HD) of intervention were selected by the Ministry of Health and two control districts in the same or in a neighboring region based on their relative proximity and similarity to the intervention districts in the targeted regions (Figure 1). Within each HD of intervention, all the health facilities (HFs) – Centre de santé et de promotion sociale (CSPS), or Centers for Health and Social Promotion, and Centre médical avec antenne chirurgicale (CMA), a medical center with surgical services, and a district hospital – were included. In each HD control, the number of selected HFs was proportional to the size of the health district.

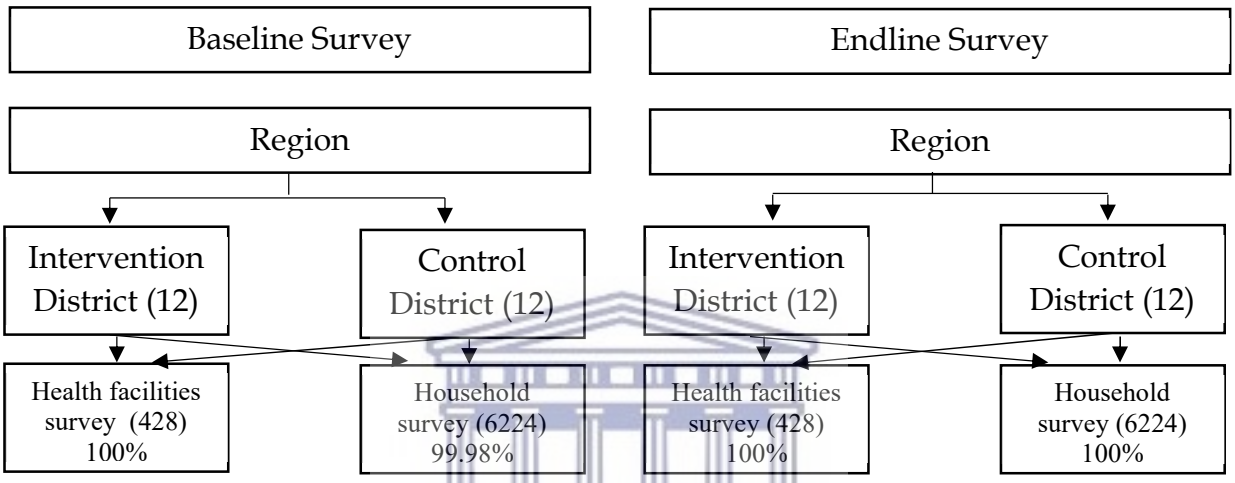
A simple random draw of the number of HFs was performed in each health district based on one HF control for four HFs of intervention. A total of 529 HFs were investigated, including 428 rural CSPS. To be exact, 413 were visited in the intervention zones, and 116 in the control zones.

Each rural CSPS was associated with a village in its health area in which 15 households were selected for the survey. Fifteen households were randomly drawn from each village. Data collection for the baseline and end-line survey included a household and a facility-based survey. The household survey applied a two-stage sampling procedure (15 households per selected village). The questionnaire was administered to the head of household and women aged 15-49 years. The sample was derived in a three-stage cluster sampling procedure, described in detail elsewhere (De Allegri et al., 2019).

Data collection for the baseline and end-line survey included a household survey and a facility-based survey. The household survey collected data on household characteristics and household members, the health status of each member of the household and the use of health services, perception of the quality of services, antenatal care, postnatal care, immunization of children and use of the services of

community health workers. The facility-based survey comprised different tools for data collection with different data sources and respondents: Health facility records, providers' questionnaire, direct observations (curative consultations of under-5 and antenatal consultations), exit interviews (curative consultations and antenatal consultations), Community Health Workers (CHW) (questionnaire). All health facilities and all households included in this study responded to the questionnaires. This paper is based on the health facilities and household survey.

Figure 2: Survey design diagram



3.1.2 Routine health facility data

Routine health facility data from January, 2013, to December, 2013 and January, 2017, to December, 2017, were obtained from the General Directorate of Studies and Sectoral Statistics of the Ministry of Health. For 24 health districts included in PBF, the numbers of resident population and the number of health facilities were provided.

3.2 METHODS OF ANALYSIS

In the context of this study, the analysis methods used are diverse and depend on the objectives pursued at the level of each chapter (or article). Several statistical methods will be used to answer the research questions. The analysis strategy is based on three successive stages, linked together and giving rise to complementary knowledge. In

this part, it is a question of presenting the methods of analysis used in chapters 4, 5, 6 and 7 of this thesis.

3.2.1 Descriptive analysis

The first analytical phase consists mainly of a description of the use of health services in their multiple dimensions and the associated factors identified in the scientific literature. The analyses consisted of making a differential analysis of variables related to the use of health services. Since the variables retained for our study are all categorical, the chi-square statistic, measured at the 95% significance level, was used to analyze the associations that exist between the different independent variables and the dependent variables.

3.2.2 Logistic regression analysis

In order to determine the relative contributions of the various factors predicting the health care use and their effect on the children health and survival, studied in the descriptive analysis, logistic regressions models were developed.

Logistic regression is frequently used in the social sciences because it allows reasoning said all things being equal. More precisely, the purpose of logistic regression is to isolate the effects of each variable, i.e. to identify the residual effects of an explanatory variable on a outcome variable, once the others have been taken into account. explanatory variables introduced into the model (Menard, 2002a).

Ordinary logistic regression or binary logistic regression aims to explain a variable of binary interest (ie of type "yes / no" or "true / false"). The explanatory variables that will be introduced into the model can be quantitative or qualitative.

Coefficients were estimated and presented as odds ratios with 95% confidence intervals. Odds ratios (ORs), adjusted odds ratios (aORs) and *p-value* were estimated to capture the association between each independent and covariate variable and child survival (Harrell Jr, 2015).

3.2.3 Mulnomial and ordered multivariate analysis

Multinomial logistic regression is an extension of logistic regression to qualitative variables with three or more categories, ordinal logistic regression to qualitative variables with three or more categories that are ordered hierarchically (Engel, 1988; Menard, 2002a).

Multinomial logistic regression makes it possible to model a nominal random variable which can take more than 2 modalities according to a certain number of explanatory variables which can be continuous or categorical. This model does not take into account the order between the modalities. Similar to multiple linear regression, multinomial regression is a predictive analysis. Multinomial regression is used to explain the relationship between a dummy dependent variable and one or more independent variables (Menard, 2002b). This method of analysis also allows an estimate of the probabilities associated with each of the modalities of the variable of interest.

Ordinal logistic regression makes it possible to model a nominal random variable which can take more than 2 modalities according to a certain number of explanatory variables which can be continuous or categorical, but this time taking into account the order relation between the modalities of the response variable (Menard, 2002b). It is possible to model an ordinal nominal variable with a multinomial logistic model but by varying the reference modality for each equation.

This model allows a local interpretation, namely the probability for the response variable to move from one level to another, but this information depends on the modality of the response variable. To overcome this, the Cumulative LOGIT model allows both to capture the order relationship between the modalities, while providing global information on the probability of occurrence of the modalities of the response variable as well as on the role of the explanatory variables (Menard, 2002b).

Multinomial and ordinal logistic regression analysis methods were used due to the nature of some dependent variables and certain objectives of our study.

3.2.4 Multi-level analysis

Until recently, the study of the determinants of the use of health services had focused mainly on the individual determinants of health and access to care, dissociated from the geographical, economic or social context (Diez-Roux, 2000; Duncan et al., 1996; Subramanian et al., 2003). But the existence of context effects on the health of individuals and their access to care is increasingly recognized (Diez Roux, 2001; Subramanian et al., 2003).

By using contextual factors, beyond individual factors, multilevel analysis achieves a better identification of populations at risk, useful in the development of health programs(Chaix and Chauvin, 2002; Subramanian et al., 2003). Multilevel models, currently widely used in research circles, are particularly suited to the analysis of contextual data, because they take into account their hierarchical structure. Like other methods, multilevel models are able to take into account the hierarchical structure of the data when performing parameter estimation. But beyond that, and more specifically, they also constitute tools for investigating contextual effects (Chaix and Chauvin, 2002).

The choice of this method corresponds to the desire to go beyond the classical regressions (linear, logistic, etc.) to take into account all the unobserved factors in the probability of using a health facility and to examine the origin of this unexplained variability. It is possible to distinguish the characteristics intrinsic to the mother (discrimination effect), her household (demand effect), or her place of residence (contextual effect). Conventional regressions ignore the hierarchical structure of the data and attribute residual variability to unmeasured factors of variation between mothers.

The interest of the multilevel models in our study is to take this correlation into account by introducing one or more contextual error terms into the regression equations (Raudenbush and Bryk, 2002).

Thus, the multi-level approach allows not only to exceed the individual level, but also to measure the part of the studied phenomenon whose explanation lies in each of the levels considered (Individual, community, District). Presence of heterogeneity, such as the variability in the probability of health facilities use between individuals, community and the health district can be test, what conventional models cannot achieve.

Finally, these methods have the advantage of providing more valid estimates due to the underestimation of standard errors by conventional methods (Raudenbush and Bryk, 2002).

Data from the baseline and end-line survey lend themselves well to this type of analysis by their hierarchical nature: Health district, community and household/individual's levels.

In baseline and endline survey data for the impact evaluation of PBF in Burkina Faso, individual-level data followed a three-level hierarchical structure with the individual (women and household) at level 1 (i), nested within communities (or enumeration section (village)) at level 2 (j), and health districts at level 3 (k). Multilevel statistical techniques provide a technically robust and efficient framework to account for the complex survey design and assess variation in outcomes by multiple levels (Goldstein, 2011; Subramanian et al., 2003). As suggested by its name, multilevel modelling enables simultaneous examination of the circumstances of individuals at one level in the context of multiple higher geographic, administrative and social levels and thereby discerns the relative contribution of different levels to the scientific question of interest (Goldstein, 2011; Subramanian et al., 2003).

3.3 ETHICS AND CONSENT CONSIDERATIONS

The Ethics Committee of the Medical Faculty of the University of Heidelberg (Protocol number S-272/2013) and Burkina Faso National Ethics Committee (Protocol number 2013-7-06) have approved the study and the verbal informed consent form. All household members and parents/guardians for children were informed about all

relevant aspects of the study including its aim, procedures, potential risk and hazards. The participants gave their verbal consent and decided to participate in the study voluntarily. All information would remain confidential and anonymized. There are no constraints or restrictions weighing on the autonomy and independence of the study or the publication of its results.

CHAPTER IV: DETERMINANTS OF ANTENATAL CARE UTILIZATION AMONG CHILDBEARING WOMEN IN BURKINA FASO

This chapter has been published in Frontiers Global Women's Health Quality of Life:
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ABSTRACT

Introduction: Antenatal care (ANC) is one of the pillars of maternal and child health programs aimed at preventing and reducing maternal and child morbidity and mortality. This study aims to identify the factors associated with ANC use, considering both health care demand and supply factors in the single analysis.

Methods: We used data from the endline survey conducted to evaluate the impact of the performance-based financing program in Burkina Faso in 2017. This study was a blocked-by-region cluster random trial using a pre-post comparison design. The sample was derived in a three-stage cluster sampling procedure. Data collection for the endline surveys included a household survey and a facility-based survey. Women of childbearing age who gave birth at least once in the past two years prior to this survey and residing in the study area for more than six months were included in this study. Multilevel statistical techniques were used to examine individual and contextual effects related to health care demand and supply simultaneously and thus measure the relative contribution of the different levels to explaining factors associated with ANC use.

Results: The working women were five times (OR: 5.41, 95% CI 4.36-6.70) more likely to report using ANC services than the women who were not working (OR: 5.41, 95% CI 4.36-6.70). Women living in a community with high poverty concentration were 32.0% (OR: 0.68, 95% CI 0.50-0.91) less likely to use ANC services than those in a community with low poverty concentration. Women living in a community with a medium concentration of women's modern contraceptive use were almost twice (OR:

1.88, 95% CI 1.70-2.12) more likely to use ANC services than those living in a community with a low concentration of women's modern contraceptive use. Women living in the health area where the level of ANC quality was high were three times (OR: 2.96, 95% CI 1.46-6.12) more likely to use ANC services than those in the health area where the ANC quality was low.

Conclusion : Policies that increase the opportunity for improving the average ANC quality at the health facility, the level of women's modern contraceptive use and women employment would likely be effective in increasing the frequency of use of antenatal services.

Keywords: Antenatal care, multilevel analysis, determinants, health services utilization, Burkina Faso

4.1 INTRODUCTION

To achieve the sustainable development goals (SDGs), about two-thirds of sub-Saharan African countries will need to accelerate the reduction in maternal and under-five deaths.(Sophie Sarrassat et al., 2018; You et al., 2015) In these countries, while much effort towards achieving the SDGs has focused on health systems and the supply side, including community case management of childhood illnesses(Hafner and Shiffman, 2012; Marsh et al., 2012b; Sousa et al., 2011), less attention has been paid to increasing demand for health care in general and antenatal care (ANC) in particular.(Sophie Sarrassat et al., 2018)

ANC is one of the pillars of maternal and child health programs aimed at preventing and reducing maternal and child morbidity and mortality.(Fournier et al., 2009; Kehinde, 2018; Ronsmans et al., 2003; World Health Organization, 2018) It is the recognition of this fact that has made ANC one of the main objectives of health programs, concerning the health needs of women during pregnancy.(Adegboyega and Ayodele, 2018; De Allegri et al., 2011; World Health Organization, 2018) ANC has been shown to provide opportunities for early detection of potential obstetric risks and, through counselling and education, motivates women to seek skilled assistance at birth.(Babalola and Fatusi, 2009b; Mpembeni et al., 2007; Renkert and Nutbeam, 2001) Thus, access to and adequate use of ANC services are essential to reduce both maternal and neonatal mortality.(Fournier et al., 2009; Ronsmans et al., 2003) Improved maternal and neonatal outcomes have been associated with the utilization of ANC services.(Kehinde, 2018; Babalola and Fatusi, 2009b; Babalola, 2014; Mekonnen and Mekonnen, 2003b)

Like other African countries, Burkina Faso has a low utilization level of health care services in general and ANC services in particular.(Institut national de la statistique et de la démographie and IFC international, 2012) Indeed, despite the considerable efforts by the government and its development partners to promote the use of health care services, the rate of utilization of ANC does not seem to be increasing significantly. Indeed, the recent data showed that only a third of women (33.7%)

received at least four ANC services in Burkina Faso, and among them, only 4.9% received it in their first trimester.(Institut national de la statistique et de la démographie and IFC international, 2012)

The causes of low utilization of health services in general and ANC in particular have been studied by several authors in Burkina Faso and other countries, either solely from the point of view of health care demand(Kehinde, 2018; Tiruaynet and Muchie, 2019b; Kaphle et al., 2018; Badu et al., 2018; Saad–Haddad et al., 2016; Sirpe, 2011; Niang, 2014; Djiguimdé, 1968; Somé et al., 2020) or supply.(De Allegri et al., 2011; Gedle and Yarinbab, 2017; Gnawali et al., 2009; Hitimana et al., 2018; Ridde et al., 2013; Souares et al., 2005) The effect of health care supply and demand, taken together in a single analysis, on the use of ANC services should be documented. It is important to overcome the limitations of previous studies by considering in a single analysis the factors affecting the health care supply and demand in the analysis of factors associated with the use of ANC.

This study aims to address these limitations in the research on the explanation of the health care utilization by identifying the factors associated with expecting mothers' use of ANC, accounting jointly for the influence of demand and supply factors.

4.2 METHODS

4.2.1 Study setting

The study was conducted in six administrative regions (Boucle du Mouhoun, Centre-Est, Centre-Nord, Centre-Ouest, Nord and Sud-Ouest) of Burkina Faso. The preliminary results of the 5th general population and housing census of Burkina Faso, carried out in 2019, indicated a total resident population of 20,487,979 inhabitants.(Institut National de la Statistique et de la Démographie, 2020) According to the same source, the vast majority of the population (73,7%) lives in rural areas in 2019. (Institut National de la Statistique et de la Démographie, 2020)

According to the results of the demographic module of the continuous multisectoral survey carried out in 2019 in Burkina Faso, the vast majority of the population was

affected by illiteracy (65.5% in 2014), and the poverty coverage rate at the national poverty line was estimated at 40.10% of the total population.(Institut National de la Statistique et de la Démographie, 2015) The 2018 Human Development Index of the United Nations Development Program ranks Burkina Faso 182nd out of 189 countries and territories with comparable data. According to the 2010 demography and health survey results for Burkina Faso, less than 6 in 10 women (58.4%) make 2 to 3 antenatal visits during pregnancy, and only 3 in 10 women (33.1%) make 4 or more visits during pregnancy.(Institut national de la statistique et de la démographie and ICF international, 2012)

4.2.2 Data source

To achieve the objectives of this study, two quantitative data sources were used: endline survey data (2017) for the impact evaluation of performance-based financing (PBF) in Burkina Faso and routine health facility data.

4.2.2.1 Endline survey data for the impact evaluation of PBF

The PBF impact evaluation was a blocked-by-region cluster random trial using a pre-post comparison design. The aim was to compare the indicators between intervention areas (12 PBF intervention districts) and control areas (12 districts selected as controls) over a period before and after the intervention within the framework of the PBF impact evaluation (Figure 1). The sample was derived in a three-stage cluster sampling procedure, described in detail elsewhere.(De Allegri et al., 2019).

Data collection for the endline surveys included a household survey and a facility-based survey. The household survey collected data on household characteristics and members: the health status of each member of the household and the use of health services, perception of the quality of services, ANC, postnatal care, immunization of children and use of the services of community health workers (CHW). The facility-based survey comprised different tools for data collection with different data sources and respondents: health facility (HF) records, providers' questionnaire, direct observations (curative consultations of under-five and antenatal consultations), exit interviews (curative consultations and antenatal consultations), and CHW

questionnaire. All health facilities and all households included in this study responded to the questionnaires. This paper is based on the HF and household surveys.

4.2.2.2 Routine health facility data

Routine health facility data from January, 2017, to February, 2017, were obtained from the General Directorate of Studies and Sectoral Statistics of the Ministry of Health. For 24 health districts included in PBF, the numbers of resident population and health facilities were provided.

4.2.3 Study population and sample sizes

The source populations for the study were all permanent female residents of the study area who were pregnant or gave birth at least once in the last two years preceding the endline survey irrespective of the outcome of delivery. Women of childbearing age who did not give birth at least once in the past two years prior to this survey and/or residing in the study area for less than six months were excluded from this study. The analysis focuses on responses from 8,174 women.

4.2.4 Selected variables

4.2.4.1 Outcome variable

In this study, the dependent variable was the utilization of ANC services. This is a dichotomous variable (Yes/No), defined by whether or not the respondent used the ANC services. This study classified the users of ANC services as women who have had at least four ANC visits for their pregnancies (<4 = 0 and ≥4 = 1). This classification was based on the reproductive health policy and standards of the Ministry of Health of Burkina Faso of a new model of ANC for women without complicated pregnancies.(Ministère de la santé, 2010).

4.2.4.2 Explanatory variables

Analyzing the determinants of health care utilization is particularly challenging. This complexity comes first from the large number of factors that may affect the utilization of health care. All these data are in practice never available for analysis, which limits the scope of the studies. With the multitude of studies describing patterns of utilization in different health care settings, several scholars have developed explanatory frameworks identifying predictors of health care utilization.(Ricketts and Goldsmith, 2005).

The variables used in the study are informed by previous literatures on determinants of ANC utilization.(Acharya et al., 2018; Chama-Chiliba and Koch, 2015, 2015; Nketiah-Amponsah et al., 2013; Sahito and Fatmi, 2018; Tiruaynet and Muchie, 2019b) At individual and household levels, this study used mothers' age, use of modern contraceptive, education, occupation, and household wealth index and size.

Table 4 1: Measurement of explanatory variables included in the estimated models.

Characteristics	**Measurement**
Mother's age at last birth	The questionnaire did not include a direct question on the age at last birth; we computed this indicator by subtracting the child's age from the woman's current age and rounding the result to the nearest whole number.
Mother's use of modern contraceptive	We measure this indicator through reported use of modern contraceptive (Yes/No).
Mother's education	The highest level of education attained is divided into two categories: none and primary and above (combining primary and higher education categories together).
Mother's occupation	It has been re-coded in two categories: not working and working.
Last birth order	We distinguish between mothers whose most recent birth is rank 1 and 2 and those whose most recent birth is of a higher rank. It has been re-coded first-order birth, second-order birth, third-order birth and above
Household wealth index*	We constructed a scale for household wealth index from information on possession of specific household items and utilities. The resulting scale was divided into five quintiles, coded poorest, poorer, middle, richer and richest.
Household size	It has been re-coded in 1–3, 4–5 and 6 and above.
Community concentration of female education	Aggregate values of community level of female education are measured by the proportion of women with a minimum of primary level of education derived from data on respondent's level of education categorized as: "0% = Low", "Less than 25% = Medium" and "25% and above =High"
Community concentration of poverty	Aggregate values of community-level poverty are measured by the proportion of households in the poorest wealth quintile derived from data on wealth index categorized as: "<15% = Low", "15%–40% =Medium" and ">40% = High".
Community concentration of modern contraceptive prevalence	Aggregate values of community level of modern contraceptive prevalence are measured by the proportion of women who are currently using modern contraceptive categorized as: "<=15% = Low", "15%–40%=Medium" and ">40% = High".

Type of place of residence	This variable was derived from the question on the type of place of residence. The variable place of residence recorded as rural and urban in the data set was retained without change.
Number of health facilities per 1,000 people	This information came from the routine health facility data.
The average quality of ANC at the facility	Data are captured by the facility survey from the exit interviews. The average quality of ANC at the facility, a composite quality index is constructed. The components considered, and demarcated as true/false, include the following: attendance by skilled health worker, weight and height measured, blood pressure checked, urine and blood sample taken, told about complications, given or bought iron tablets, and took fansidar as prophylaxis for malaria prevention (categorized as: "0% = Low", "0%–25% = Medium" and ">25% = High".
Average distance between HF and households	It is computed from the geographic coordinates of households and health facilities (categorized as 1 = Less than 1 km, 2 = 1–4 km and 3 = 5 km and above).
Performance-based financing**	It is categorized as 0 = control district and 1 = intervention district.

*Described in more detail elsewhere.(Rutstein, 2015)
**Described in more detail elsewhere.(De Allegri et al., 2019)

At the community level, variables often cited in the literatures (Chama-Chiliba and Koch, 2015; Osorio et al., 2014; Sahito and Fatmi, 2018) capture characteristics such as accessibility, economic status and other health system factors: community concentration of female education, community concentration of poverty, community concentration of modern contraceptive prevalence and type of place of residence.

For the health district/HF level, this study used health facility density (number of health facilities per 1,000 people), the average quality of ANC at the facility and the average distance between HF and households and PBF.

In this study, the supply side is proxied by the density of health facilities in the health district, the average distance between HF and households, and the average quality of ANC at the reference facility and PBF. ANC uptake indicates demand and distance to the nearest facility and captures interaction between both supply and demand.

4.2.5 Statistical analysis

Statistical analysis begun with cross-tabulations, and their statistical associations were used. The bivariate relationships indicated by the bivariate analysis may be due to interrelationships between the various characteristics measured as well as characteristics not measured at the community and health district level. We, therefore,

used multilevel modelling to find the determinants of ANC use and analyze the variance of ANC use in its fixed and random components.

In endline survey data for the impact evaluation of PBF in Burkina Faso, individual-level data followed a three-level hierarchical structure with the individual (women and household) at level 1 (i), nested within communities (or enumeration section (village)) at level 2 (j), and districts at level 3 (k). Multilevel statistical techniques provide a technically robust and efficient framework to account for the complex survey design and assess variation in outcomes by multiple levels.(Goldstein, 2011; Subramanian et al., 2003) As suggested by its name, multilevel modelling enables simultaneous examination of the circumstances of individuals at one level in the context of multiple higher geographic, administrative and social levels and thereby discerns the relative contribution of different levels to the scientific question of interest.(Goldstein, 2011; Subramanian et al., 2003).

For the binary outcome variable (ANC use (<4 = 0 and ≥4 = 1)), a series of three-level random intercept multilevel logistic regression models were estimated based on a logit link function.

The multilevel analysis began with an empty model to test the null hypothesis that the variance at the community and health district level in ANC services utilization is zero and assess whether our data justify the decision to assess random effects at the community and health district level.

The null model with no predictor variable was run to serve as a baseline to compare changes in variance estimates in subsequent models (Model 0):

Model 0: $logit(\pi_{ijk}) = \beta_0 + (f_{0k} + v_{0jk})$, (1)

where β_0 represents the median log odds of antenatal use across all study area, and the bracketed terms of model 0, represent random effects associated with districts and communities, respectively. The term f_{0k} is a district-specific residual that represents a

departure of each district from the national median log odds of antenatal use; v_{0jk} is a community-specific residual conditional on the district.

In subsequent models, all the individual-level covariates (X'_{ijk}) were included first in Model 1:

Model 1: $Logit(\pi_{ijk}) = \beta_0 + \beta X_{ijk} + (v_{0k} + u_{0j} + e_{ijk})$ (2)

Then, the variables related to community (Model 2) and district (Model 3) were added to evaluate the relative importance of the individual effect of ANC use versus contextual effect:

Model 2: $Logit(\pi_{ijk}) = \beta_0 + \beta X_{ijk} + \beta Y_{jk} + (v_{0k} + u_{0jk} + e_{ijk})$ (3)

Model 3: $Logit(\pi_{ijk}) = \beta_0 + \beta X_{ijk} + \beta Y_{jk} + \beta Z_k + (v_{0k} + u_{0jk} + e_{ijk})$ (4)

For each successive model, the proportion of variance in the log odds of ANC use explained by additional factors was computed by subtracting the variance of the model with more terms from the variance of simpler model and converting it to percentage. Data were prepared, and all multilevel models were estimated using STATA 13.0. For interpretation, we report odd ratios (OR) and 95% confidence intervals (CI).

4.3 RESULTS

Overall, among the respondents included in this study, it is noted that the proportion of women who used at least four ANC services during their last pregnancy was 80.80% in 2017.

Bivariate analysis

Tables 4.2 and 4.3 show the variations in the indicator of ANC services utilization according to certain socio-demographic, household, community, health facility and health district factors. Table 4.2 shows the distribution of women who paid at least four ANC visits during their last pregnancy according to the individual and

household's socio-demographic characteristics. There was a significant relationship ($p < 0.01$) between mother's age, mother's modern contraceptive use and ANC utilization indicator. There was also a significant relationship between the ANC indicator and household size. The relationship between ANC indicator and birth order as well as the household wealth index and size were not significant at the bivariate level.

Table 4 2 : Variations in indicators of the use of antenatal care services, by selected individual and household characteristics.

Characteristics	n	≥4 Antenatal care visits (%)	X2 probability
Mothers' age at last birth			
15–19	551	80.94	
20–24	1,688	80.15	
25–29	2,004	81.89	
30–34	1,717	80.84	0.03
35–39	1,298	79.51	
40–44	654	76.91	
45–49	262	73.28	
Mother's modern contraceptive use			
Yes	2,434	81.88	0.039
No	5,740	80.35	
Mother's education			
No education	7,265	80.56	0.035
Primary and above	909	82.73	
Mother's occupation			
Not working	4,231	72.52	0.000
Working	3,943	89.78	
Birth order			
First birth	3,848	80.57	
Second birth	3,704	80.74	0.311
Third birth and above	622	82.74	
Household wealth index			
Poorest	1,368	82.09	
Poorer	1,475	79.25	0.581
Middle,	1,592	80.15	
Richer	1,836	78.92	
Richest	1,903	80.82	
Household size			
1–3	750	61.07	
4–5	1,817	55.75	0.114
6 and above	5,607	43.64	
All respondents	**8,174**	**80.80**	

Source: Authors' own calculations from endline (2017) survey data for the impact evaluation of performance-based financing (PBF) in Burkina Faso.

Regarding the characteristics of the community, health facility and the health district (Table 4.3), there was a significant relationship between the type of place of residence, community concentration of women education, community concentration of poverty, community concentration of women's modern contraceptive use, the average distance between HF and households, the average quality of ANC at the facility and the number of health facilities per 1,000 inhabitants with the ANC indicator. PBF was not significantly associated with the ANC indicator.

Table 4 3: Variations in indicators of the use of antenatal care visits, by selected community and districts characteristics.

Characteristics	Number of women *(n)*	≥4 Antenatal care visits (%)	X^2 probability
Community Factors			
Type of place of residence			
Rural	7,538	80.43	0.003
Urban	636	85.22	
Community concentration of women education			
Low (0%)	1,863	75.58	
Medium (>25%)	5,403	82.45	0.000
High (25% and above)	908	81.72	
Community concentration of poverty			
Low (<15%)	2,245	87.04	
Medium (15%–40%)	4,134	75.06	0.000
High (40% and above)	1,795	86.24	
Community concentration of women's modern contraceptive use			
Low (<15%)	1,573	76.10	
Medium (15%–40%)	5,781	80.71	0.000
High (40% &+)	820	90.49	
Health district and HF factors			
Number of health facilities per 1,000 inhabitants			
Low (<0.15)	2,411	68.89	
Medium (0.15–0.2)	3,586	82.40	0.000
High (0.20 and above)	2,177	91.73	
Average distance between HF and households			
>1 km	1,107	88.17	
1–4 km	3,438	81.04	0.000
5 km and above	3,629	78.45	
Average quality of ANC at the facility			
Low	6,315	49.24	
Medium	1,255	86.05	0.000
High	604	92.38	

Characteristics	Number of women *(n)*	≥4 Antenatal care visits (%)	X^2 probability
PBF			
Control	1,899	80.75	0.520
Intervention	6,275	81.41	
All respondents	8,174	80.80	

Source: Authors' own calculations from endline (2017) survey data for the impact evaluation of PBF in Burkina Faso.

Multilevel models

The results presented in Table 4 show that for the ANC services utilization indicator, there was considerable heterogeneity between communities and health districts. For example, the variance at the health district level in the empty model is large and significant, indicating considerable differences in ANC use and health districts. The intraclass correlation (ICC) in the empty model indicates that 46.3% of the total variance in the ANC services utilization is attributable to the differences between the health districts.

Table 4.4 shows the results of the saturated model, which assesses the role of variables at different levels. The most significant individual characteristic of ANC services use was the mother's occupation. The odds of reporting using ANC services increase with whether the mother is working or not, so working women were five times more likely to report using ANC services than the women who were not working.

Two of the community-level variables included in the model are found to be associated with the use of ANC services. These were the community concentration of poverty and women's modern contraceptive use. Women living in areas with a low concentration of poverty have higher odds of receiving four or more ANC visits as opposed to women living in communities with a medium or high concentration of poverty. For example, women living in a community with medium poverty concentration were 33.30% less likely to use ANC services than those living in a community with a low poverty concentration. Women living in a community with a medium concentration of women's modern contraceptive use were twice more likely to use ANC services

than those in a community with a low concentration of women's modern contraceptive use.

The most significant health district and health facility level characteristic of ANC services use was the average quality of ANC at the health facility. Women living in the health area where the level of ANC quality was high were four times more likely to use ANC services than those in the health area where the ANC quality was low.

Finally, the residual ICC remains noticeably high, indicating that even after considering individual, household and community factors, there remained considerable consolidation in the ANC services utilization at the health district level.

Table 4 4: Parameter coefficients for the multilevel model of the use of antenatal care visits – assesses the role of variables at different levels

Characteristics	*n*	Model 0	Model 1 (OR CI 95%)	Model 2 (OR CI 95%)	Model 3 (OR CI 95%)
Fixed Effects					
Mother's age					
15–19	551		1.00	1.00	1.00
20–24	1,688		1.18 (0.82–1.70)	1.17 (082–1.70)	1.18 (0.82–1.70)
25–29	2,004		1.05 (0.72–1.51)	1.04 (0.73–1.52)	1.05 (0.72–1.52)
30–34	1,717		1.04 (071-1.52)	1.05 (0.71-1.54)	1.04 (0.71-1.54)
35-39	1,298		0.75 (0.51-1.12)	0.76 (0.52-1.13)	0.76 (0.52-1.130)
40-44	654		0.98 (0.64-1.52)	1.01(0.65-1.56)	1.01 (065-1.56)
45-49	262		1.29* (0.74-2.24)	1.28* (0.73-2.28)	1.27 (0.73-2.22)
Mother's modern contraceptive use					
Yes	2,434		1.00	1.00	1.00
No	5,74		0.96 (0.81-1.14)	0.95 (0.80-1.13)	0.87 (0.80-1.13)
Mother's education					
No education	7,265		1.00	1.00	1.00
Primary and above	909		1.95 (1.29-2.35)	1.54 (1.28-2.02)	1.53 (1.29-2.01)
Mother's occupation					
Not working	4,251		1.00	1.00	1.00
Working	3,923		5.50*** (4.48-6.76)	5.38*** (4.34-6.67)	5.41*** (4.36-6.70)
Birth order					
First birth	3,896		1.00	1.00	1.00
Second child	3,687		1.02 *(0.71-1.99)	1.01 (0.71-1.31)	1.01 (0.86-1.43)
Fourth child and above	591		1.03 (0.67-1.78)	1.02 (0.67-1.28)	1.02 (0.75-1.36)
Household wealth index					
Poorest	1,368		1.00	1.00	1.00
Poorer	1,475		1.048* (0.60-1.52)	1.05 (0.60-1.56)	1.06 (0.59-1.29)
Middle,	1,592		1.063* (0.73-1.54)	1.07 (0.74-1.51)	1.07 (074-1.32)
Richer	1,836		1.174* (0.64-1.47)	1.18 (0.63-1.43)	1.18 (0.62-1.49)
Richest	1,903		1.126 (0.66-1.42)	1.14 (0.66-1.46)	1.13 (0.66-1.47)
Household size					
1–3	750		1.00	1.00	1.00

Characteristics	*n*	Model 0	Model 1 (OR CI 95%)	Model 2 (OR CI 95%)	Model 3 (OR CI 95%)
4–5	1,817		1.013 (065-1.29)	1.02 (0.65-1.64)	1.025 (0.65-1.65)
6 and above	5,607		0.87 (063-1.22)	0.86 (0.62-1.45)	0.88 (0.62-01.21)
Community Factors					
Type of place of residence					
Rural	7,538			1.00	1.00
Urban	636			1.12 (0.62-1.47)	1.012 (0.61-1.56)
Community concentration of women education					
Low (0)	1,863			1.00	1.00
Medium (0%–25%)	5,403			1.93 (1.75-2.12)	1.92 (1.74-2.11)
High (25% and above)	908			1.99 (1.67-2.22)	2.04 (1.66-2.2.36)
Community concentration of poverty					
Low (<15%)	2,245			1.00	1.00
Moderate (15%–40%)	4,134			0.61*** (0.47-0.80)	0.62*** (0.46-0.81)
High (40% and above)	1,795			0.67*** (0.49-0.90)	0.68*** (0.50-0.91)
Community concentration of women modern contraceptive use					
Low (<15%)	1,573			1.00	1.00
Moderate (15%–40%)	5,781			1.88** (1.70–2.12)	1.88** (1.70–2.12)
High (40% and above)	820			2.76 (2.19–3.60)	2.41(2.20–3.60)
District and health facilities factors					
Number of health facilities per 1,000 inhabitants					
Low (<0.15)	2,411				1.00
Medium (0.15–0.2)	3,586				1.43 (1.09–2.03)
High (0.20 and above)	2,177				1.38 (1.06–2.67)
Average distance between HF and households					
Low	1,273				1.00
Medium	4,320				0.96 (0.54–1.17)
High	2,581				0.91 (0.36–2.11)
The average quality of ANC at the health facility					
Low	6,315				1.00
Medium	1,255				1.19 (1.02–2.26)
High	604				2.96** (1.46–6.12)
PBF					
Control district	1,899				*1.00*
Intervention district	6,275				1.912 (1.30–3.01)
Random Effects					
District-level variance		1.828 ***(0.540)	2.241***(0.670)	2.167***(0.671)	1.956*** (0.614
Residual intraclass correlation		0.463	0.402	0.401	0.378
Log likelihood		–2634.787	–2427.2153	–2414.8049	–2413.429
Akaike crit. (AIC)		5275.575	4894.431	4883.610	4896.251

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Source: Authors' own calculations from endline (2017) survey data for the impact evaluation of PBF in Burkina Faso.

4.4 DISCUSSION

The objective of this study was to identify the different factors that may influence the ANC services use by pregnant women in Burkina Faso, by considering the factors

related to the health care supply and demand jointly in a single analysis. The results of this study support the conceptual framework that guided this study. The findings demonstrate the influence of both health care supply and demand factors on the ANC utilization in Burkina Faso.

Regarding factors related to the demand for health care, there was a significant relationship between ANC services utilization and the mother's occupation at the individual level. The community concentration of poverty and women's modern contraceptive use were found to be associated with the use of ANC services. Regarding factors linked to the health care supply, the average quality of ANC at the health facility was found to be associated with the ANC services use.

At the individual level, ANC utilization improved with higher mother's occupation. Mother's working status appeared as one variable with a very strong influence on the ANC services utilization. The results of this study showed that the working mother was more likely to make antenatal visits many times than unemployed mothers. This finding is consistent with the finding by Tawiah and Assefa et al. (Assefa and Tadesse, 2017; Tawiah, 2011) and Sharma et al..(Sharma et al., 2007). Mother working status was related to the social environment. Pregnant women who work have a wider social environment than housewives. This allowed pregnant women to access more information related to pregnancy, including ANC. The influence of co-workers and other information that pregnant women got during work increased the knowledge of pregnancy that would eventually initiate ANC visits according to recommendations

At the community level, the lower the concentration of poverty, the higher the propensity of getting four or more antennal care visits. The community with a high concentration of women's modern contraceptive use exerted strong effects on ANC services use. The higher the average quality of ANC at the health facility, the higher the propensity of getting four or more antennal care visits.

In sum, there is evidence from this study that the use of ANC services is determined not only by the observed individual characteristics, community and health district factors but also by the unobserved individual and community-level and health district-

level effects. Estimates of the ICC in using ANC services remained considerable, even after controlling for selected individual and community-level and health district-level variables. The large residuals in the health district variance in ANC utilization suggest that there are other factors at the individual, community level, and health district level that are not accounted for in this analysis. The significant health district-level random effects that our study found demonstrate the need to contextualize efforts aimed at promoting maternal service utilization. There are obviously some unmeasured factors at the health district level that predict ANC service utilization. Possible unobserved factors could include cultures and customs in pregnancy and birthing care that were not measured in this study that may help explain part of the health district variance.

4.5 CONCLUSION

Several factors influencing the ANC services use occur at different levels: individual/household, community and health district. At the individual household level, the mother's occupation was consistently strong predictors of the ANC services utilization considered in this study. At the community level, living in a community with a low concentration of poverty or in a community with a high concentration of women using modern contraceptive methods were associated with the ANC services use. Women living in the health area where the level of ANC quality was high were four times more likely to use ANC services than those in the health area where the ANC quality was low. To be optimally effective, interventions to promote ANC service use need to consider these findings.

The study findings have important implications for the design of health policy concerning maternal health in Burkina Faso. Policies that increase the opportunity to improve the average ANC quality at the health facility, the level of women's modern contraceptive methods use and women employment would likely be effective in increasing the frequency of use of ANC services. Consequently, government policies should target women in rural areas and economically disadvantaged women so that the frequency of antenatal visits can be increased.

CHAPTER V: FACTORS ASSOCIATED WITH MOTHERS' HEALTH CARE-SEEKING BEHAVIORS FOR CHILDHOOD FEVER IN BURKINA FASO: FINDINGS FROM REPEATED CROSS-SECTIONAL HOUSEHOLD SURVEYS

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ABSTRACT

Introduction: Fever is one of the most frequent reasons for paediatric consultations in Burkina Faso, but health care-seeking behaviours and the factors associated with health care-seeking in the event of childhood fever are poorly documented. This study aims to analyse the health care-seeking behaviours and the factors associated with health care-seeking for childhood fever in Burkina Faso.

Methods: This study used the data from the baseline and endline surveys conducted to evaluate the impact of the Performance-Based Financing (PBF) program in Burkina Faso. Univariate and multivariate binary logistic regression analyses were used to identify the factors associated with appropriate healthcare-seeking for childhood fever. Odds ratios (ORs) were estimated to assess the strength of associations and 95% confidence intervals (CIs) were used for significance tests. Data were cleaned, coded and analysed using Stata software version 16.1.

Results: Among the children under five who had a fever, 75.19% and 79.76% sought appropriate health care in 2013 and 2017, respectively. Being 24–59 months old (AOR: 0.344, 95% CI: 0.182-0.649 in 2013 and AOR: 0. 208, 95% CI: 0.115-0.376 in 2017), living in a very wealthy household (AOR: 2.014, 95% CI: 1.149-3.531 in 2013 and AOR: 2.165, 95% CI: 1.223-3.834 in 2017), having a mother with a secondary or higher level of education or having made at least four antenatal care visits were significantly

associated with seeking appropriate health care for childhood fever. Living in an area where the health facility is safe was also significantly associated with seeking appropriate care for childhood fevers.

Conclusion: The findings underscore the need to concentrated efforts aimed at sensitizing the population (especially women of childbearing age) to improve sanitation and to the use of family planning (household composition), skilled antenatal care and postnatal care to help reduce the prevalence of fever in children under five and improve the use of medical healthcare for childhood fever.

Keywords: childhood fever, illness, prevalence, health care, health care-seeking, Burkina Faso

5.1 INTRODUCTION

The factors affecting children's health are both multiple and complex and come from various fields (biology, economics, sociology, cultural and environmental studies, etc.) (Boco, 2011a; Cutler et al., 2006). The most determinant causes of morbidity and mortality in children under five are diarrhoea, acute respiratory infection, fevers alone or those associated with other symptoms often overlapping with signs of malaria (Awoke, 2013; Colvin et al., 2013; Friberg et al., 2010; Kanté et al., 2015; Kinney et al., 2010; Mbonye, 2003).

Indeed, fever as a perception of high body temperature is often viewed by parents as an illness itself rather than a symptom or sign of illness (Mackowiak, 1997; Mbonye, 2003). Fever is one of the most frequent reasons for paediatric consultations (Gaudelus and Voisin, 2003), accounting for nearly 30% of paediatric consultations worldwide. Fevers, which very often mask other symptoms of malaria, have always been one of the leading causes of morbidity and mortality in childhood (40% of deaths under five) (Choge et al., 2014).

In Burkina Faso, the data on the prevalence of fever are not encouraging. The country has a high prevalence of malarial infection and fever among children under five. Indeed, according to the malaria indicators' survey (MIS) in Burkina-Faso, carried out by the National Institute of Statistics and Demography (INSD) in 2014, four out of ten children (40%) had fever during the two weeks preceding the survey (Institut National de la Statistique et de la Démographie et al., 2014). According to the same survey, in 46% of children under five who had a fever in the two weeks preceding the survey, the fever was not treated, and only 35% of children who had a fever took antimalarial drugs (Institut National de la Statistique et de la Démographie et al., 2014). Burkina Faso is one of the ten countries with the highest number of malaria cases and associated deaths (3% of cases and deaths worldwide). Malaria is responsible for 43% of health facility use and 22% of deaths (Organisation mondiale de la Santé, 2019). Fever in children can be associated with malaria; thus, late healthcare-seeking can be fatal.

Despite this burden, the observation regarding support for health care-seeking is the time taken by parents before seeking health care in health facilities. The cases generally encountered in health facilities are therefore serious cases that have been the subject of many treatment attempts with other therapists outside the national health system (Sy et al., 2010; Baume et al., 2000; Greenwood, 2000). Evidence suggests that the factors associated with the use of health services in the event of children's illness are both multiple and complex, relating to various fields and exerting their influences at the individual, household, community and national levels (Abdulkadir and Abdulkadir, 2017; Taffa and Chepngeno, 2005). Previous studies conducted elsewhere documented that factors such as parents' (especially mothers') sense of competence for detecting signs of illness (Kofoed et al., 2004), the distance between home and the health facility, long periods of waiting for medical services and direct payment for care were the main reasons for low healthcare utilization in developing countries (Baume et al., 2000; Dagnew et al., 2018; Lungu et al., 2020; Mbagaya and Odhiambo, 2005; S. Sarrassat et al., 2018; Strasser et al., 2016).

However, it is recognized that the early and adequate management of fever considerably reduces the incidence of severe cases (Chopra et al., 2013; Houéto et al., 2007; Sirima et al., 2003; Walker et al., 2015). Nevertheless, little is known about the differential prevalence of childhood fever and the factors associated with health-seeking behaviours by mothers for fever in their children in Burkina Faso. In Burkina Faso, apart from the results of demographic and health surveys (DHS) and apart from the malaria indicators' survey, which makes a distribution of the prevalence of fever according to certain socio-demographic characteristics (Institut National de la Statistique et de la Démographie et al., 2014; Institut national de la statistique et de la démographie and ICF international, 2012), the differential prevalence of this childhood illness, healthcare-seeking behaviours and the factors associated with health care-seeking in the event of children's fever are poorly documented.

Regarding the public health problem posed by fever, the analysis of the differential prevalence of infantile fever, care-seeking behaviours and factors associated with the mothers seeking care in the event of infantile fever in Burkina Faso are all needed in

order to generate knowledge that can inform program planners and policymakers working in the field of child health.

5.2 METHODS

5.2.1 Data sources

To achieve the objectives of this study, two quantitative data sources were used: baseline (2013) and endline (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso. The PBF impact assessment was a blocked-by-region cluster random trial based on a pre-post comparison design. This process of random allocation seeks to ensure that the different study groups are comparable in terms of observed and unobserved characteristics that could affect treatment outcomes, thereby allowing average differences in outcomes to be causally attributed. The aim was to compare the indicators between intervention and control areas over a period before and after the intervention. In the protocol, it was planned to trace households and health facilities from the baseline survey to the final survey. The sample was derived in a three-stage cluster sampling procedure, described in detail elsewhere (De Allegri et al., 2019).

Data from the baseline and endline surveys for the impact assessment of RBF in Burkina Faso was used for this study. The baseline and endline surveys collected data on household characteristics and household members, the health status of each household member and the use of health services, perception of the quality of services, antenatal care, postnatal care, immunization of children and use of the services of community health workers. This survey also provides information on the evaluation of the health facility, exit interviews after the consultations for children under five and for women seen in antenatal care and the distance between the home and the health facilities.

5.2.2 Study population

The target population for this study was all children aged 0-59 months who had a fever in the four weeks preceding the survey and their mothers.

5.2.3 Selected Variables

5.2.3.1 Outcome variables

In this study, there were two dependent variables. The first was constructed from information collected in the field. Reports of fever were classified into two categories: those reported to have had a fever in the last four weeks preceding the survey and those not reported to have a fever in the last four weeks preceding the survey. This outcome variable, therefore, includes two modalities: presence of fever = 1 and absence of fever = 0. The fever was self-reported, according to the mother's statement.

The second variable was appropriate healthcare-seeking. Seeking appropriate healthcare has been defined as seeking healthcare from all public or private health facilities, private doctors and community health workers but excluding non-medical care, pharmacies, shops and traditional healers (Rutebemberwa et al., 2009).

5.2.3.2 Explanatory variables

The description of the differential prevalence of fever in children under five was made, not with the classic variables (sex of the child, birth order, place of residence, region of residence, mothers' level of education, wealth status, etc.) (Abdulkadir and Abdulkadir, 2017), widely studied by DHS and MIS, but with additional variables such as household composition, child immunization status, antenatal and postnatal care, the methods of garbage disposal, the sources of drinking water and the method of evacuating human excreta (Bouba Djourdebbé, 2016).

Regarding the analysis of the factors associated with appropriate health care-seeking behaviours, several groups of variables were considered. The variables describing the socio-demographic characteristics of the child, their mother and their household is as follows: child's sex, child's age, child's vaccination status, mother's age, mother's

marital status, mother's level of education, mother's occupation, mother's use of antenatal and postnatal care, and wealth status. The group of variables describing the morphological characteristics of the household includes the following: the size of the household, the number of children under five and the presence of elderly persons. The group of variables characterizing the health facilities includes the waiting time before receiving care and the safety and confidence in the health facility.

5.2.4 Statistical analysis

Several statistical methods were used to answer the research questions. The analytical strategy is based on two successive stages that are linked together to provide additional knowledge. The first analytical phase consists mainly of a description of the differential prevalence of fever in children under five years of age. To describe the differential prevalence of fever, cross-tables and their statistical associations were used (95%).

Univariate and multivariate binary logistic regression analyses were used to identify factors associated with appropriate health care-seeking behaviours for childhood fever. Odds ratios (ORs) and adjusted odds ratios (AORs) were estimated to assess the strength of associations and used 95% confidence intervals for significance tests. The proportion test was used to examine the differences in prevalence of fever among children under five and healthcare utilization for fever among child in Burkina Faso. Authors' do their own calculations from the baseline (2013) and endline (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso, to build all the table. Data were cleaned, coded and analysed using Stata software version 16.1.

5.2.5 Ethics and consent considerations

The Ethics Committee of the Medical Faculty of the University of Heidelberg (Protocol number S-272/2013) and Burkina Faso National Ethics Committee (Protocol number 2013-7-06) have approved the study and the verbal informed-consent form. All household members and parents/guardians for children were informed about all

relevant aspects of the study including its aim, procedures, potential risks and hazards. Since the subjects of this study were women aged 15-49 and children under 5 years of age, the informed consent of the women and the authorization of parents or guardians and the informed assent of the children was requested to participate in the study. The participants gave their verbal consent and decided to participate in the study voluntarily. All information would remain confidential and anonymized. No constraints or restrictions weigh on the autonomy and independence of the study or the publication of its results.

5.3 RESULTS

5.3.1 Descriptive results of the differential prevalence of fever in children under five

Of all the children under five included in this study (1,029 and 1,863, respectively, in 2013 and 2017), 814 and 1,067 children, respectively, had a fever in the last four weeks preceding the survey.

Table 1 shows the distribution of children under five who had a fever in the last four weeks preceding the survey according to their household characteristics and the health practices of their mothers. Overall, the results show that, respectively, in 2013 and 2017, about eight in ten children and six in ten children (79.11% and 57.27%) had a fever in the four weeks preceding the survey.

This prevalence was high among children living in large households (81.94% in 2013 and 59.21% in 2017), among those living in households with three or more children (85.64% in 2013 and 59.29% in 2017)) and among those living in households with at least two elderly persons (92.00% in 2013 and 62.96% in 2017).

Also noted was a particularly high prevalence among children living in households where household garbage was dumped in the street (81.76% in 2013 and 63.99% in 2017) and among those living in households that continued to defecate in nature (81.89% in 2013 and 59.63% in 2017). This prevalence was also high among children

whose mothers did not attend postnatal consultations (80.32% in 2013 and 60.34 in 2017).

Whatever the year, a significant relationship was noted between variables such as household composition (household size, number of children under five, number of elderly persons), methods of garbage disposal, sources of drinking water, method of disposal of human excreta and the occurrence of fever in children under five. Regarding antenatal and postnatal care, there was no significant relationship between these variables and the occurrence of fever in children under five in 2013, but this relationship became significant in 2017.

Table 5. 1: Descriptive results of differential prevalence of fever among children under five from the baseline (2013) and endline (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

	2013			2017			Statistically significant of decrease
Characteristics	N	Fever in 4 last week (%)	P-value	N	Fever in 4 last week (%)	P-value	
Household size							
1–3	333	74.47		1,189	52.61		0.000***
4–5	480	81.04	0.024**	425	54.59	0.071*	0.000***
6 & +	216	81.94		249	59.21		0.000***
Number of children under five							
1 infant	353	84.14		678	54.69		0.000***
2 infants	488	72.95	0.000***	801	56.80	0.325	0.000***
3 infants & +	188	85.64		384	59.29		0.000***
Number of elderly persons in the household							
No elderly	915	79.13		1,648	55.95	0.005***	0.000***
An elderly person	89	75.28	0.237	188	68.09		0.002***
2 Elderly & +	25	92.00		27	62.96		0.000***
Method of garbage disposal							
In the street	510	81.76		711	63.99	0.000***	0.000***
Pile of filth	445	77.53	0.022**	996	53.61		0.000***
Garbage collection	74	70.27		156	50.00		0.000***
Mode of disposal of human excreta							
In nature	657	81.89		1,023	59.63	0.000***	0.000***
Ordinary latrines	337	75.07	0.000***	776	56.06		0.000***
Improved latrines	35	65.71		64	34.38		0.000***
Source of drinking water							
Unprotected sources	188	80.32		364	60.99		0.000***
Protected well	99	82.83	0.003***	285	52.28	0.079*	0.000***
Drilling	631	80.67		1,112	57.91		0.000***
Household Tap	111	64.86		102	50.98		0.003***
Children fully immunized							
No	434	81.86	0.099*	80	55.81	0.860	0.000***
Yes	595	77.22		1,783	57.17		0.000***

Characteristics	2013 N	2013 Fever in 4 last week (%)	2013 P-value	2017 N	2017 Fever in 4 last week (%)	2017 P-value	Statistically significant of decrease
Received four skilled antenatal visits							
< 4	499	79.36	0.197	643	61.74	0.005**	0.000***
>= 4	530	78.87		1220	54.92		0.000***
Received postnatal care							
No postnatal visits	315	80.32	0.938	383	60.34	0.000***	0.000***
At least one postnatal visit	714	78.57		1,480	45.43		0.000***
All Respondents	1,029	79.11		1,863	57.27		0.00***

*** p < .01, ** p < .05, * p < .1

5.3.2 Descriptive results of the use of medical care for childhood fever

Table 2 shows the percentage of children under five whose fever was treated at all public or private health facilities by private doctors and community health workers. For over 75.19% and 70.76% of children with fever, respectively, in 2013 and 2017, medical health care was sought from a healthcare facility or healthcare provider.

This health care-seeking was more frequently carried out for the youngest children (less than one year) (82.35% in 2013 and 86.22% in 2017) and those living in households without elderly persons (77.27% in 2013 and 85.19% in 2017). It was also noted that children with fever tended to be deprived of medical care in the poorest households (71.96% in 2013 and 77.97% in 2017), while more than eight in ten children from the richest households benefited from appropriate care (80.47% in 2013 and 81.76% in 2017). In addition, among households with at least three children under five years old, nearly eight in ten children with fever (77.05% in 2013 and 79.95% in 2017) sought medical health care.

It was also noticed that the frequency of the use of appropriate healthcare increased with the level of education of the mother (only 70.48% of children of mothers with no education in 2013 and 79.19% in 2017). However, 87.27% of those whose mothers had a secondary level or higher education in 2013 and 86.03% in 2017 received appropriate health care.

Table 5. 2: Descriptive results of healthcare utilization for fever among child, maternal, household and health facility-level characteristics from the baseline (2013) and endline (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

	2013		2017		Statistically significant of increase
Characteristics	N	Sought appropriate health care (%)	N	Sought appropriate health care (%)	
Sex of child					
Male	442	75.31	558	80.10	0.0695*
Female	374	75.05	509	79.39	0.1267
Child's age					
0–11 months	269	82.35	436	86.22	0.1651
12–23 months	335	72.10	366	77.78	0.0825*
24–35 months	213	71.00	265	71.86	0.8360
Children full immunized					
No	339	73.53	520	77.49	0.1845
Yes	477	79.29	547	81.40	0.3960
Mother's age					
15–24	333	78.38	347	78.35	0.9924
25–34	370	72.22	515	82.31	0.0003***
35 & +	113	75.52	206	75.77	0.9603
Mother's marital status					
Unmarried	21	75.00	45	78.48	0.7530
Monogamous marriage	576	76.92	664	81.10	0.0707*
Polygamous marriage	220	75.54	352	78.50	0.4105
Mother's education level					
No education	690	70.48	848	79.19	0.0001***
Primary education	83	75.00	141	79.76	0.4706
Secondary & +	44	87.27	78	86.03	0.8485
Mother's occupation					
Not working	519	75.15	637	81.21	0.0126**
Working	290	74.66	423	78.62	0.2170
Household size					
1–3	263	75.90	681	79.14	0.2795
4–5	378	75.52	243	84.00	0.0116**
6 & +	176	73.42	143	75.50	0.6722
Number of elderly persons in the household					
None	731	77.27	944	85.19	0.0000***
One	68	68.60	108	71.81	0.6491
2 & +	17	75.76	15	80.58	0.7425
Number of children under five					
1	292	73.98	388	76.25	0.4970
2	380	75.42	459	82.65	0.0100**
3 & +	145	77.05	220	79.95	0.5071
Household wealth index					
Poorest	150	71.96	198	77.97	0.1975
Poorer	150	73.02	207	78.67	0.2153
Middle	140	73.45	182	76.73	0.4987
Richer	175	75.11	214	82.57	0.0713*
Richest	203	80.47	267	81.76	0.7229
Received four skilled antenatal visits					
< 4	413	71.51	368	78.23	0.0311*
>= 4	403	78.88	699	80.57	0.4997
Received postnatal visits					

Characteristics	2013 N	2013 Sought appropriate health care (%)	2017 N	2017 Sought appropriate health care (%)	Statistically significant of increase
No postnatal visits	242	72.55	219	73.63	0.7941
At least one postnatal visit	574	76.31	848	81.35	0.0213*
Waiting time in the health facility					
Not acceptable	87	68.18	193	78.04	0.0779*
Acceptable	714	75.86	859	80.33	0.0322*
Safety in the health facility					
Not safe	350	69.81	434	59.73	0.0034 ***
Safe	453	81.67	633	89.66	0.0002***
Confidence in the health facility					
No	32	74.97	75	77.86	0.7450
Yes	771	82.50	983	79.85	0.1601
All Respondents	814	75.19	1067	79.76	0.0182*

*** p < .01, ** p < .05, * p < .1

5.3.3 Factors associated with the use of medical healthcare for fever

The results of the bivariate and multivariate logistic regression are presented in Table 3. The results of the saturated model show that being aged 12–23 months and 24–59 months, living in a very wealthy household, having within the household one elderly person and several children under five were significantly associated with seeking appropriate healthcare for childhood fever in Burkina Faso. Likewise, having a mother with a secondary or higher level education or who made at least four antenatal care visits or at least one postnatal care visit was significantly associated with seeking appropriate healthcare for childhood fever. In addition, living in an area where the health facility was safe was significantly associated with seeking appropriate care for childhood fever.

The odds of appropriate health care use for fever in children aged between 24 and 59 months was 66.1% (AOR: 0.339, 95% CI: 0.179–0.640 in 2013) and 79% (AOR: 0.21, CI at 95%: 0.116–0.381 in 2017) lower than in children between 0 and 11 months. Furthermore, mothers from the richest households were twice as likely to seek health care for childhood fever than mothers from the poorest households (AOR: 2.002, 95% CI: 1.142–3.510 in 2013 and AOR: 2.144, 95% CI: 1.211–3.796 in 2017). In 2013 and 2017, respectively, mothers with secondary or higher level education were 1.6 times (AOR:

1.604, 95% CI: 0.618–3.116) and 2.5 times (AOR: 2.480, 95% CI: 1.102–4.584) more likely to request medical healthcare for childhood fever than mothers who had no education.

Table 5. 3: Factors associated with healthcare utilization for fever from the baseline (2013) and endline (2017) survey data on the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

	2013			2017		
Characteristics	N	OR (CI 95%)	AOR (CI 95%)	N	OR (CI 95%)	AOR (CI 95%)
Sex of child						
Male	559	1.00	1.00	975	1.00	1.00
Female	473	0.986 (0.743–1.309)	1.014 (0.706–1.458)	888	0.957 (0.763–1.2)	0.984 (0.705–1.375)
Child's age						
0–11 months	340	1.00	1.00	762	1.00	1.00
12–23 months	423	0.554*** (0.39–0.786)	0.457*** (0.265–0.789)	639	0.559*** (0.424–0.739)	0.356*** (0.203–0.624)
24–59 months	269	0.525*** (0.358–0.770)	0.339*** (0.179–0.640)	462	0.408*** (0.306–0.545)	0.21*** (0.116–0.381)
Children fully immunized						
No	429	1.00	1.00	43	1.00	1.00
Yes	603	1.726* (1.52–2.012)	1.1 (0.676–1.791)	955	1.787 (1.36–2.721)	1.701 (1.302–2.629)
Mother's age						
15–24	421	1.00	1.00	605	1.00	1.00
25–34	468	1.717** (1.527–1.975)	1.678 (1.440–2.044)	899	1.286* (0.993–1.666)	2.085*** (1.392–3.124)
35–49	143	0.851 (0.545–1.330	0.673 (0.365–1.241)	359	0.864 (0.634–1.177)	1.585* (0.956–2.629)
Mother's marital status						
Unmarried	26	1.00	1.00	79	1.00	1.00
Monogamous marriage	728	1.90 (1.356–2.276)	1.715 (1.239–2.140)	1159	1.177 (0.675–2.053)	1.519 (0.676–3.412)
Polygamous marriage	278	0.926 (0.357–2.276)	1.138 (0.318–2.068)	614	1.001 (0.566–1.771)	0.94 (0.395–2.235)
Mother's education level						
No education	872	1.00	1.00	1480	1.00	1.00
Primary education	105	1.796 (1.509–2.243)	1.153 (0.636–2.090)	247	1.035 (0.741–1.1447)	1.203 (0.754–2.921)
Secondary +	55	2.286** (1.019–4.126)	1.604* (0.618–3.116)	136	1.618* (0.981–2.67)	2.48** (1.102–4.584)
Mother's occupation						
Not working	656	1.00	1.00	1112	1.00	1.00
Working	367	0.974 (0.726–1.308)	0.975 (0.665–1.430)	739	0.851 (0.675–1.073)	1.064 (0.757–1.493)
Household size						
1–3	332	1.00	1.00	1189	1.00	1.00
4–5	478	0.98 (0.707–1.358)	0.814 (0.495–1.339)	425	1.384** (1.031–1.858)	0.997 (607–1.640)
6 +	222	0.877 (0.594–1.295)	0.444*** (0.241–0.820)	249	0.812 (0.589–1.120)	0.23 (0.6–1.52)
Number of elderly persons in the household						
None	924	1.00	1.00	1648	1.00	1.00
1	86	0.699 (0.433–1.130)	0.492** (0.267–0.905)	188	0.614*** (0.437–0.863)	0.506** (0.297–0.863)
2 & +	22	0.688 (0.397–1.982)	0.341* (0.107–1.091)	27	0.386 (0,046–2.034)	0.748* (0.187–2.989)
Number of children under five						
1	369	1.00	1.00	678	1.00	1.00
2	480	1.079 (0.790–1.474)	1.046 (0.637–1.715)	801	1.483*** (1.150–1.913)	1.319 (0.878–1.982)
3 & +	183	1.181 (0.779–1.789)	1.155 *(0.494–2.701)	384	1.242 (0.914–1.686)	1.827** (1.103–23.027)
Household's wealth index						

Characteristics	2013			2017		
	N	OR (CI 95%)	AOR (CI 95%)	N	OR (CI 95%)	AOR (CI 95%)
Poorest	189	1.00	1.00	345	1.00	1.00
Poorer	189	1.054 (0.671–1.656)	1.565 (0.871–2.812)	361	1.042 (0.728–1.491)	1.215 (0.718–2.059)
Middle	177	1.078 (0.680–1.708)	1.4 (0.802–2.44)	318	0.932 (0.647–1.1341)	1.428 (0.808–2.522)
Richer	221	1.176 (0.757–1.827)	1.219 (0.707–2.103)	373	1.339 (0.925–1.937)	1.431 (0.829–2.471)
Richest	256	1.606** (1.031–2.500)	2.002** (1.142–3.510)	466	1.266 (0.895–1.791)	2.144*** (1.211–3.796)
Received four skilled antenatal visits						
< 4	522	1.00	1.00	643	1.00	1.00
>= 4	510	1.488*** (1.119–1.978)	1.444** (1.014–2.057)	1220	3.593*** (2.979–4.333)	1.892 ***(1,628–2.265)
Received postnatal care						
No postnatal visits	306	1.00	1.00	383	1.00	1.00
At least one postnatal visit	726	1.219 (0.899–1.651)	1.808 *(1.538–2.215)	1480	2.792*** (2.224–3.505)	1.922*** (1.329–2.778)
Waiting time in the health facility						
Not acceptable	110	1.00	1.00	337	1.00	1.00
Acceptable	903	1.466* (0.955–2.252)	1.746 (1.392–2.423)	1500	3.554*** (2.746–4.6)	1.456* (0.968–2.191)
Safety in the health facility						
No safe	442	1.00	1.00	735	1.00	1.00
Safe	573	1.519*** (1.384–1.700)	1.484** (1.335–1.701)	1106	3.933*** (3.286–4.708)	1.725* (1.516–2.018
Confidence in the health facility						
No	40	1.00	1.00	131	1.00	1.00
Yes	975	1.635 (1.278–2.455)	1.276* (1.062–2.235)	1717	1.127 (0.734–1.730)	1.408 (0.766–2.588)

*** p < .01, ** p < .05, * p < .1

Source: Authors' own calculations from the baseline (2013) and endline (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

5.4 DISCUSSION

The present study was conducted to determine the differential prevalence of fever and to identify the factors associated with appropriate health care-seeking behaviours for childhood fever in Burkina Faso.

The results of this study show that 79.11% and 57.27% of children had a fever in the four weeks before the survey in 2013 and 2017, respectively. We noted a decrease in the prevalence of self-reported fever between 2013 and 2017. This may be explained by the PBF and interventions in the field of malaria. Our finding is higher than previous studies conducted in Burkina Faso (Bouba Djourdebbe et al., 2015; Institut National de la Statistique et de la Démographie et al., 2014; Institut national de la statistique et de la démographie and ICF international, 2012; Kiemde et al., 2018). This

may be due to the four-week reference period chosen to collect the data for this study as compared to the two-week reference period of other studies.,

Our finding showed an increase in health care-seeking behaviours for childhood fever between 2013 and 2017. This could be explained by the PBF and interventions in the field of malaria and the policy of free care for children under five and for pregnant women for whom the financial barriers to access to health care have been removed. The study also showed that health care-seeking behaviours for childhood fever in Burkina Faso was higher than that showed in studies conducted in Nigeria (Abdulkadir and Abdulkadir, 2017) and Ethiopia (Alene et al., 2019). However, it was lower than the level of health care-seeking for childhood fever in Tanzania (Kanté et al., 2015) and in Gabon (Ahinkorah et al., 2021). Because a population's standard of living is a vital factor in health and disease (Alene et al., 2019; Aremu et al., 2011), the above inconsistent results could be due to the difference in the socio-economic status of the study participants (Alene et al., 2019; Makoge et al., 2017).

The child's age, wealth of the household, household composition, mother's educational level, use of antenatal and postnatal care and safety in health facilities were factors significantly associated with appropriate health care-seeking behaviours for childhood fever.

In the present study, mothers were less likely to seek appropriate healthcare for children one year and older with fever. This is consistent with similar studies in Ethiopia, Tanzania and Kenya that assessed health-seeking behaviours in children under five with fever (Alene et al., 2019; Bishai et al., 2003; Taffa et al., 2005; Taffa and Chepngeno, 2005).

Mothers from the richest households were more likely to seek appropriate health care for children's fever than mothers from households with the poorest wealth status. This finding is consistent with previous studies reported in Nepal, Ethiopia, Tanzania and Nigeria (Adedokun et al., 2017; Ahinkorah et al., 2021; Alene et al., 2019; Ayalneh et al., 2017; Kanté et al., 2015; Mälqvist et al., 2017).

Mothers who had formal education (secondary and above) were more likely to seek appropriate health care for children with fever than mothers who had no formal education. This finding is consistent with previous studies conducted in Ethiopia, Bangladesh and Tanzania (Adedokun et al., 2017; Alene et al., 2019; Amin et al., 2010; Kanté et al., 2015). It is known that education influences health care-seeking behaviours in communities. Educated mothers can better understand the symptoms and severity of fever and thus seek health care in a shorter period than those mothers who are less-educated.

Our study also found that children residing in households with two or more children under the age of five were more likely to receive appropriate health care for fever than children residing in households with only one child under five. This fact is probably explained by the experiences acquired with the other children of the household. Indeed, in the Burkinabè context, all adult members of a household potentially have to take care of the child. This person could therefore acquire experience in caring for a child under 5 years, if there are several in this household. Therefore, a mother or guardian of a child living in a household with several children under 5 years could have this experience in terms of health care seeking. However, this finding is not consistent with another study in Tanzania (Kanté et al., 2015). These inconsistent results could be due to the difference in the socio-cultural context of study participants.

Limitations of the study

As the study was cross-sectional and data were collected in a short period, we could not capture changes in the health care-seeking behaviours of mothers between seasons. Moreover, in this study, we did not analyse the health care-seeking behaviours of mothers in terms of the duration and severity of the fever.

Furthermore, although our study's focus was a sample of randomly selected households in the regions, the generalizability of our results may be limited given that study regions and districts of the study were purposely selected.

5.5 CONCLUSION

This study found that the occurrence of fever in children under five was associated with variables relating to household composition and sanitation and those relating to the mothers' use of antenatal and postnatal care. This study also found that important factors related to the individual household composition and health facility are associated with seeking appropriate health care for childhood fever in Burkina Faso. These findings underscore the need for interventions that would improve mothers' pursuit of appropriate medical care for their children. These interventions should take into account individual, household and health facility characteristics and could include, but are not limited to, increasing girls' education; improving household living conditions, including sanitation; improving the level of use of prenatal and postnatal care; and improving the quality of care as well as safety in health structures. Further studies should focus on longitudinal and experimental exploration.

CHAPTER VI: CHILDREN'S HEALTH STATUS: EXAMINING THE EFFECT OF MOTHERS' PREVENTIVE HEALTH CARE USE

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Abstract

Introduction: Several mechanisms come into play for the child to have good health. This study aimed to examine the effect of mothers' preventive health care use for themselves and their children on their children's health status.

Methods: For this study, data come from the end-line survey conducted to evaluate the impact of Performance-Based Financing program in Burkina Faso. Multivariate Ordered logistic regression analysis was used to identify factors associated with children health status. Odds ratios (ORs) and adjusted odds ratios (AORs) were estimated to assess the strength of associations and used 95% confidence intervals for significance tests. A multivariate multinomial logistic regression analysis was also used to calculate the predicted probability of being each children health status at each level of coverge of preventive health care. Data were cleaned, coded and analysed using Stata software in version 16.1.

Results: Skilled attendant at birth was a favorable factor for being in the good health (OR 1.16; 95% CI 1.10-1.31). Received skilled antenatal care and received skilled postnatal care (OR 1.09; 95% CI 0.99-1.18 and OR 1.88; 95% CI 1.80-1.97) were positively correlated with children health status. children vaccination against measles (MSL), was positively correlated with children health status (OR 1.85; 95% CI 1.73-1.99). Modern contraceptive methods use, vaccination for children against diphtheria-pertussis-tetanus and tuberculosis did not affect children health status.

Conclusion: activities aimed to increase knowledge and awareness of the importance of skilled antenatal care, skilled attendant at birth, child immunization, skilled postnatal care and other preventive measures for child health should be conducted with women of childbearing age.

Keywords: Health care use, Preventive health care, Children's health, Burkina Faso

6.1 INTRODUCTION

Several mechanisms come into play for a child to have good health. Previous studies have shown that the mother's education and high household socioeconomic status are associated with healthy behaviours for their children. High socioeconomic status of the household positively influences most health behaviours (Baya, 1999). For example, a mother living in a household with a high socioeconomic status would perform at least one antenatal consultation and her children would be vaccinated within a timeframe consistent with the vaccination schedule (Mamodraza, 2013; Minkovitz et al., 2002). Many authors have shown that most educated mothers are less likely to give birth to underweight new-borns and there is less chance of their losing their child in the first year after birth (Currie and Moretti, 2003; Cutler and Lleras-Muney, 2012, 2006; Mamodraza, 2013).

One of the ways in which the mothers' education could improve their children's health is the use of preventive health care such as prenatal care, skilled birth attendants at delivery, immunisation, well-child visits, etc. (Nevin and Witt, 2002). For example, the more educated a woman is, the more aware she will be of the importance of monitoring her pregnancy (Currie and Moretti, 2003; Minkovitz et al., 2002). These results confirm Karlsen et al.'s (2011) finding, according to which educated mothers derive greater benefit from the advantages of modern medicine than their illiterate counterparts (Karlsen et al., 2011).

The efficient use of health resources is recognised as one of the factors influencing children's health (Baya, 1999; Chopra et al., 2013; Walker et al., 2015). Previous studies have used indicators such as antenatal care visit, immunisation, place of delivery, well-child visits, breastfeeding practices and health care seeking practices in case of child illness to highlight the means adopted by mothers to preserve their children's health (Baya, 1999; Minkovitz et al., 2002).

Indeed, maternal antenatal care use has been shown to be associated with the place of delivery, well-child visits, children's immunisation within a timeframe consistent with the immunisation schedule and healthy children (Freed et al., 1999; Kools et al., 2005;

Minkovitz et al., 2002; Nevin and Witt, 2002). We could admit that mothers whose first visit took place during the first three months are better informed about the requirement of antenatal care visits and that they are more open to modern health care, whereas those whose first antenatal care visit has taken place later may have been forced to do so by the difficulties associated with their pregnancy (Baya, 1999).

Regarding well-child visits, most of the preventive health care steps for children are administered during these visits. Well-child visits are important for children's health, as they can track children's growth, diagnose disease, ensure vaccine administration, and provide education on nutrition, safety and other important health issues (Freed et al., 1999; Jhanjee et al., 2004).

New-borns are endowed with passive immunity against several diseases which they inherit from the mother. However, due to the transience of this passive immunity, it is important for the child to acquire active immunity through immunisation in order to cope with the most common infectious diseases (Baya, 1999; Whitney et al., 2014). Previous findings have shown that a large number of illnesses, hospitalisations and deaths have been prevented through childhood immunisation (Hinman et al., 2011; Schuchat and Bell, 2008; Whitney et al., 2014).

As for breastfeeding, it should be remembered that it provides several advantages for survival in childhood. Breastfeeding strengthens and prolongs the immunological protection that the infant obtains from its mother (Baya, 1999; Girma and Berhane, 2011; Howie, 2002; Oddy et al., 2003). Longer breastfeeding is generally beneficial for child survival (Girma and Berhane, 2011; Howie, 2002; Locoh, 2003; Samuel and Attané, 2005).

The main objective of this study was to examine the effect of mothers using preventive and curative health care for themselves and their children, on their children's health status. Beyond the importance of maternal health care use and its impact on maternal morbidity and mortality, analysing the associations between children's health status and mothers' preventive or curative health care use is likely to have implications for

programs and policies aimed at improving appropriate health care services' use for children.

6.2 METHODS

6.2.1 Data sources

To achieve the objectives of this study, the end-line survey data for the impact evaluation of Performance-Based Financing (PBF) conducted in Burkina Faso in 2017 was used. The PBF impact assessment was a blocked-by-region cluster random trial based on a pre–post comparison design. This process of random allocation seeks to ensure that the different study groups are comparable in terms of observed and unobserved characteristics that could affect treatment outcomes, thereby allowing average differences in outcomes to be causally attributed. The aim was to compare the indicators between intervention and control areas over a period before and after the intervention. The sample was derived through a three-stage cluster sampling procedure, described in detail elsewhere (De Allegri et al., 2019).

The end-line survey collected data on household characteristics and household members, the health status of each household member and the use of health services, perception of the quality of services, antenatal care, postnatal care, immunisation of children and use of the services of community health workers. This survey also provides information on the evaluation of the health facility, the interviews at the exit of the consultation for children under 5 years and women seen in antenatal care and the distance between the home and the health facilities.

6.2.2 Study population and sample size

The source populations for the study were all permanently resident women of the study area who had given live birth at least once in the two years immediately preceding the end-line survey, and their children. Women of childbearing age who had not given live birth at least once in the two years prior to this survey and/or had been residing in the study area for less than six months were excluded from this study.

The analysis focuses on responses from 14,407 women who had given birth at least once in the two years preceding the survey, irrespective of the outcome of the delivery.

6.2.3 Selected variables

6.2.3.1 Outcome variable

In this study, the outcome variable was children's health status. During the end-line survey, the following question was asked of the mothers: "How has your health / the health of your child been during the past 12 months?" to gather their perception of their own and their children's health status. The information collected was coded as follows: 1 = Excellent, 2 = Good, 3= Fair, 4 =Poor and 5 = Very poor. This variable was re-coded in three categories with values of 1=Good, 2=Fair and 3=Poor.

6.2.3.2 Explanatory variables

The independent variables are those that report on mothers' practices in preventive health care. Based on the prior literature and the database used in this study, we selected six preventive health care measures which have been shown to reduce child mortality from the major causes of under-five deaths (Barros and Victora, 2013; Victora et al., 2005). The preventive health care measures included were family planning needs satisfied (FPS), skilled birth attendants at delivery (SBA), at least one antenatal care visit with a skilled provider before the three first months (ANCS), well-child visits (WCV), breastfeeding and vaccination for children against diphtheria-pertussis-tetanus (DPT3, three doses), measles (MSL) vaccination and tuberculosis (BCG) vaccination.

The coverage of these preventive health care measures was summarised using the composite concentrated index (CCI), which is based on the weighted average of the six preventive health care measures, calculated as follows:

$$\mathrm{CCI} = \frac{1}{3}\left(\mathrm{FPS} + \frac{\mathrm{SBA+ANCS}}{2} + \frac{\mathrm{2DPT3+MSL+BCG}}{4}\right) \quad (1)$$

The CCI is a composite measure. The CCI gives equal weight to family planning as well as maternal and new-born care and immunisation, and has been proposed as an effective way to summarise and compare coverage of preventive health care across HDs and over time (Barros and Victora, 2013; Corsi and Subramanian, 2014).

With regard to the individual characteristics of the mother's social identification, this study retained maternal age at childbirth, parity, educational level and occupation (Corsi and Subramanian, 2014; Vilms et al., 2017). To better determine the impact of the social and household environment, we used the household wealth index and place of residence.

6.2.4 Statistical analysis

Most of the information collected on children's health status focused on events that occurred in the two years immediately prior to the date of the end-line survey. Variables that operationalise mothers' preventive health-care practices (contraceptive methods used, vaccination, antenatal care, place of delivery and an attendant at delivery) were captured only for women who had had a live birth in the two years immediately preceding the survey.

For this study we conducted two sets of analyses. The first analytical phase consists mainly of the multivariate ordered logistic regression analysis used to identify factors associated with children's health status. Ordered logistic regression model is used to model ordered outcome variables. Odds ratios (ORs) and adjusted odds ratios (AORs) were estimated to assess the strength of associations and 95% confidence interval was used for significance tests. A second set of analyses was implemented using the multivariate multinomial logistic regression analysis. The predicted probability of the children being of a particular health status at each level of coverge of preventive health care was calculated. Data were cleaned, coded and analysed using Stata software version 16.1.

6.3 RESULTS

The analyses included data for 14,407 women who had given live birth at least once in the two years immediately preceding the end-line survey, and their children. Overall, 77.63%, 20.03% and 2.34% of the children were in good, fair and poor health, respectively.

The bivariate analysis shows that the variables skilled attendant at birth and received skilled antenatal care may be associated with children's health status ($p<0.05$). Modern contraceptive methods use, vaccination for children against diphtheria-pertussis-tetanus, measles and tuberculosis (BCG) may not be correlated with children's health status ($p>0.05$) (Table 6.1).

Table 6. 1: Sample size, percentage of children health status according to preventive health care, Burkina Faso

		Children health status			
Characteristics	N	Good (%)	Fair (%)	Poor (%)	P-value
Modern contraceptive methods use					
No	8,880	77.83	20.02	2.15	
Yes	5,527	77.31	20.05	2.64	0.163
Skilled attendant at birth					
No	3,304	77.42	19.40	3.18	
Yes	11,103	77.69	20.22	2.09	0.001
Received skilled antenatal care					
No	6,006	78.69	19.35	1.96	
Yes	8,401	76.87	20.52	2.61	0.007
BCG					
No	8,191	77.39	20.28	2.33	
Yes	6,216	77.94	19.71	2.35	0.698
DTP3					
No	9,075	77.49	20.15	2.36	
Yes	5,332	77.87	19.82	2.31	0.868
MSL					
No	10,139	77.30	20.29	2.42	
Yes	4,268	78.42	19.42	2.16	0,289
All Respondents	14,407	77.63	20.03	2.34	

Source: Authors' own calculations from end-line survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

Table 6.2 shows the results as to the influence of mother's preventive health care use, other maternal and household factors on the children's health status and models good to poor child health as the dependent variable. Skilled attendant at birth was a favourable factor for being in good health (OR 1.16; 95% CI 1.10-1.31). Received skilled antenatal care and received skilled postnatal care (OR 1.09; 95% CI 0.99-1.18 and OR 1.88; 95% CI 1.80-1.97) were positively correlated with children's health status. Children's vaccination against measles (MSL) was positively correlated with children's health status (OR 1.85; 95% CI 1.73-1.99). Duration of breastfeeding (OR 0.88; 95% CI 0.77-1.00), mother's age (20-24 and 25-29, OR 0.87; 95% CI 0.74-1.01 and OR

0.87 95% CI 0.74-1.01 respectively) and parity (six children and above OR 0.83; 95% CI 0.74-0.94) were negatively correlated with children's health status. Mothers who worked (OR 1.48; 95% CI 1.37-1.61) and mothers who had primary and above education level (OR 1.22; 95% CI 1.01-1.50) were likely to have their children in good health. In addition, household wealth index was positively correlated with children's health status. Nevertheless, Modern contraceptive methods use, vaccination for children against diphtheria-pertussis-tetanus and tuberculosis did not affect children's health status (Table 6.2).

Table 6. 2: Odds ratios (OR) and 95% Confidence Intervals of children health status according to preventive health care, maternal and household-level covariates

Characteristics	N	Children health status, OR (95% CI)
Modern contraceptive methods use		
No	8880	1.00
Yes	5527	1.02 (0.93-1.11)
Skilled attendant at birth		
No	3304	1.00
Yes	11103	1.16** (1.10-1.31)
Received skilled antenatal care		
No	6006	1.00
Yes	8401	1.09** (0.99-1.18)
BCG		
No	8191	1.00
Yes	6216	1.01 (0.86-1.19)
DTP3		
No	9075	1.00
Yes	5332	1.10 (0.90-1.33)
MSL		
No	10139	1.00
Yes	4268	1.85** (1.73-1.99)
Received skilled postnatal care		
No	4416	1.00
Yes	9991	1.88** (1.80-1.97)
Duration of breastfeeding		
Less than 6 months	3318	1.00
6 months or more	11089	0.88** (0.77-1.00)
Mother's age		
15-19	1357	1.00
20-24	3167	0.87** (0.74-1.01)
25-29	3640	0.87** (0.74-1.01)
30-34	2986	0.89 (0.76-1.04)
35-39	1952	0.94 (0.79-1.12)
40-44	908	1.06 (0.86-1.31)
45-49	397	0.91 (0.70-0.94)
Mother's occupation		
No working	9238	1.00
Working	5169	1.48*** (1.37-1.61)
Mother's education level		
No education	13869	1.00
Primary &+	538	1.22** (1.01-1.50)
Parity		
1+3	5891	1.00

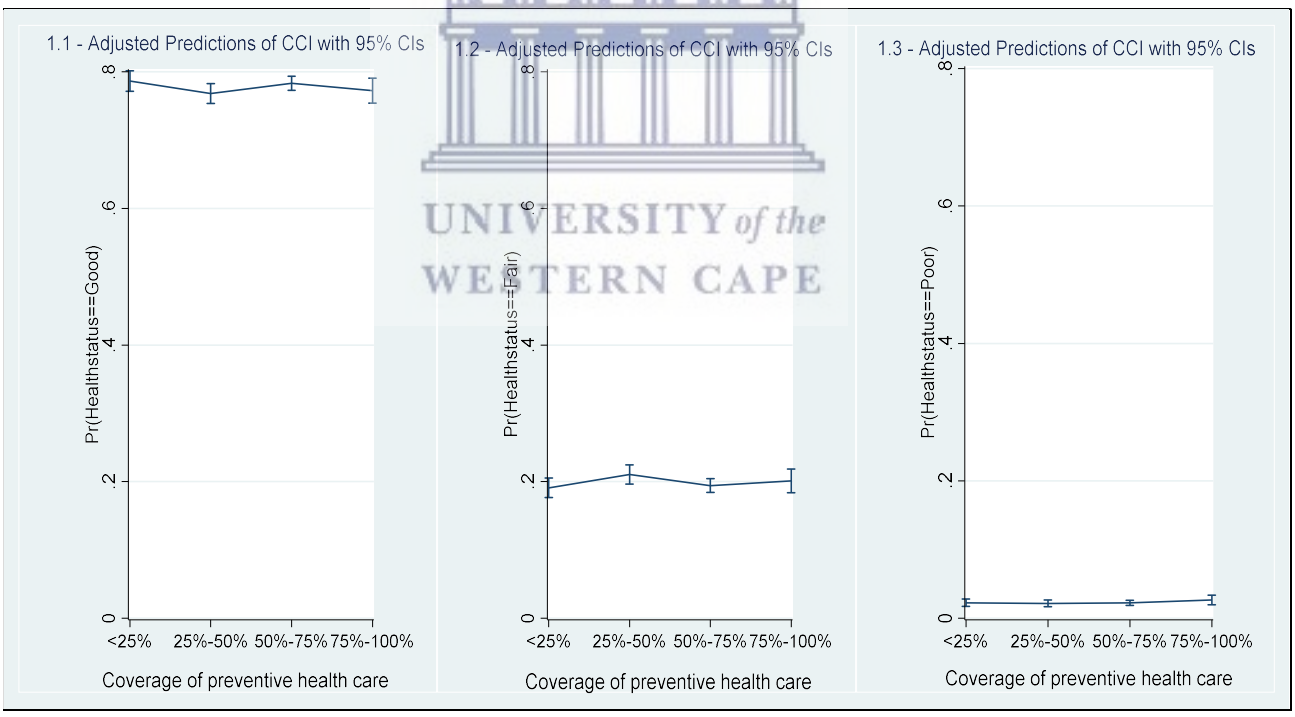
Characteristics	N	Children health status, OR (95% CI)
4-5	4121	0.94 (0.84-1.05)
6 & +	4395	0.83*** (0.74-0.94)
Household wealth index		
Poorest	2539	1.00
Poorer	2743	0.95 (0.84-1.07)
Middle	2853	1.90* (1.79-2.08)
Richer	3179	1.79*** (1.70-1.90)
Richest	3093	1.80*** (1.70-1.90)

*** p<0.001, ** p<0.01, * p<0.05, OR: Odds Ratios, CI: confidence interval, N = number of observations

Source: Authors' own calculations from end-line survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

The predicted probability of children being at a particular health status at each level of CCI was calculated by multinomial logistic regression, based on the probabilities that were saved for each case record, as presented in Figure 6.1. The results show that CCI is a good predictor of children's health status.

Figure 6. 1: Predicted probability of being each children health status at each level of coverge of preventive health care



Source: Authors' own calculations from end-line survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

6.4 DISCUSSION

This study demonstrates relationships between maternal preventive health care use and children's health status in Burkina Faso. Preventive health care factors and the variables related to the household and the mother were associated with children's health.

On average, an increase in the level of CCI was associated with an increase in the probability of predicting each child's health status, but this trend was not consistent. These results suggest that other factors not taken into account here may also influence the health status of children. Further, the CCI is a composite measure, and a low level of the CCI may reflect a low level of one of the components, while other components may have high levels. We were not able to assess the predicted probability of the influence of each component of the CCI on children's health status, but it is likely that some components are more strongly associated than others. For example, the results of the analysis presented in Table 2 show that modern contraceptive methods' use was not associated with children's health.

This study shows that several of the preventive health care factors linked to the mother are associated with their children's health status. The variables skilled attendant at birth and received skilled antenatal care were positively correlated with children's health status. This result was consistent with the study conducted by Ghimire et al. (2019) in Nepal in 2019, which showed that family planning interventions as well as the promotion of universal skilled antenatal care (at least two doses of the tetanus vaccine) are essential in helping improve child survival in Nepal (Ghimire et al., 2019). Skilled attendant at birth was also found to be associated with children's health status. This finding is consistent with previous studies conducted by Walker et al. (2013) in 71 countries on the patterns of maternal, new-born and child health coverage, showing that substantial reduction in child deaths is possible, but only if intensified intervention efforts, e.g. for SBA, are implemented successfully in every country (Walker et al., 2013).

It appears that improvement in mothers' preventive health care practices, including having a skilled attendant at birth and receiving skilled antenatal care interventions, is key to improving children's health in sub-Saharan Africa (Masanja et al., 2008). It has been suggested that effective implementation of cost-effective preventive health care interventions for mothers (skilled antenatal care, SBA and child vaccination) can improve children's health status in low-income countries (Black et al., 2003; Bryce et al., 2006; Ghimire et al., 2019; Rockli et al., 2018; Victora et al., 2005).

6.5 CONCLUSION

This study found that children who had received vaccination against measles, whose mothers had received a skilled attendant at birth of the child, those who had received skilled antenatal care and received skilled postnatal care had greater odds of being in good health in Burkina Faso. This finding indicates that activities should be conducted among women of childbearing age, aimed at increasing knowledge and awareness of the importance of skilled antenatal care, skilled attendant at birth, child immunisation, skilled postnatal care and other preventive measures for child health.

CHAPTER VII: MOTHERS' PREVENTIVE HEALTH CARE PRACTICES AND CHILDREN'S SURVIVAL IN BURKINA FASO: FINDINGS FROM REPEATED CROSS-SECTIONAL HOUSEHOLD SURVEYS

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ABSTRACT

The significant reduction in the level of child mortality in both developed and developing countries over recent decades has led to an improvement in children's health. The implementation, monitoring, and evaluation of the health programs needed to reduce child mortality require determination and an understanding of the factors responsible for this reduction. This study investigated factors that have contributed to the recent improvement in the survival of children under five, focusing on the contribution of preventive health care in improving children's survival rates in Burkina Faso.

The data used come from baseline and end-line surveys designed to evaluate the impact of performance-based financing (PBF) on health programs in Burkina Faso. Using time-series for health districts and child-level logistic regression models, we estimated the effect of preventive health care, as summarized by the changes in the composite coverage index (CCI), on under-five child survival of temporal trends and covariates at the household, maternal, and child levels. At the health district level, a unit increase in standardized CCI was associated with an improvement in under-five child survival after adjustment for survey period effects. The linear regression analysis showed that a standardized unit increase in CCI was associated with an increase in the percentage of children under five who survive. At the child level, the logistic regression showed that a skilled attendant at birth (SBA), wealth index, and mother's parity were associated with under-five children's survival, after adjustment for the survey period effects and a set of households, maternal, and child-level covariates.

Preventive health care is important in improving under-five children's survival, whereas the effects of economic growth in Burkina Faso remain weak and inconsistent. Improved coverage of preventive health care interventions is likely to contribute to further reductions in under-five mortality in Burkina Faso.

Key words: child mortality, preventive health care, maternal and child health interventions, Burkina Faso

7.1 INTRODUCTION

The health of children under the age of five is a major priority for developing countries (Rockli et al. 2018). According to recent studies, a significant reduction in the levels of child mortality over the last decades in both developed and developing countries has led to an improvement in children's health (Houweling et al. 2006; Houweling/Kunst 2009; McKinnon et al. 2014; United Nations 2013; You et al. 2015). Despite the overall decline in child mortality in developing countries, there are still unacceptably high levels in sub-Saharan African countries (Adedini 2013; Harttgen/Misselhorn 2006; Rajaratnam et al. 2010).

Like other African countries, Burkina Faso has a high level of under-five mortality (Liu et al. 2015; Munos et al. 2016). According to the results of the demographic module of the continuous multi-sector survey conducted in 2015, for every 1,000 live births 82 children die before their fifth birthday, and 43 do not reach their first birthday (INSD 2015). The results of this survey show that the mortality level of children under 5 declined between 1998 and 2014: from 177 to 82 deaths per 1000 births, respectively. The 2018 United Nations Development Program (UNDP) Human Development Index ranks it 182nd of 189 countries and territories with comparable data. The vast majority of the population (77%) lives in rural areas and is afflicted by a high illiteracy level (65.5% in 2014). In 2014, the poverty headcount ratio at the national poverty line was estimated at 40.10% of the total population (INSD 2015).

Previous studies have revealed considerable disparities in Burkina Faso in terms of health service delivery, quality of care and use of obstetric and neonatal care (Amnesty International 2009; De Allegri et al. 2011; Dong et al. 2008; Gnawali et al. 2009). Differences were thus observed between various socioeconomic groups in terms of health coverage and results, the differences being particularly marked among indicators relating to maternal and child health at the national level. Progress has been made in recent years to improve these indicators. Apart from inequalities in the risk of

death, children are also exposed to inequalities in health care access (Say/Raine 2007; Vilms et al. 2017). These inequalities result from various institutional, economic, cultural, and individual factors (Adedini et al. 2014; Adedini 2013; Boco 2011; Braveman et al. 2004; Corsi/Subramanian 2014; Liwin/Houle 2019; Pedersen 2015; Susuman 2015; Tsawe/Susuman 2014). One of the direct determinants is the set of mothers' preventive health care practices (Garenne/Vimard 1984; Ghimire et al. 2019; Houweling/Kunst 2009; Masuy-Stroobant 2002a, 2002b; Mosley/Chen 1984).

First, mothers are the primary caregivers for children. They are responsible for maintaining children's health by providing them with adequate food and training in personal hygiene, both of which are preconditions for preventing illness. They may also be responsible for taking the children to health-care centers when they are ill (Masuy-Stroobant 2002a; Mishra et al. 2019; Ouedraogo 1994).

Second, within explanatory frameworks for child mortality, maternal health-care behaviors represent intermediate variables through which socioeconomic and cultural factors can influence child survival (Garenne/Vimard 1984; Houweling/Kunst 2009; Masuy-Stroobant 2002a, 2002b; Mosley/Chen 1984).

In the context of institutional change and the fight against poverty including improvement of the health system, mothers' behaviors have a major impact on their children's survival (Garenne/Vimard 1984; Houweling/Kunst 2009; Masuy-Stroobant 2002a, 2002b; Mosley/Chen 1984). The best strategies for improving child survival occur at the individual level (Corsi/Subramanian 2014; Owais et al. 2011; Oyefara 2014; Pedersen 2015; Tsawe/Susuman 2014). They involve mobilizing women to adopt behaviors conducive to child survival. Their ability to make better use of the health services available to them and to take responsibility for managing health problems is important for improving children's survival (Susuman 2015; Tsawe/Susuman 2014; World Health Organization 2011).

The implementation, monitoring, and evaluation of the health programs needed to reduce children's mortality require determination and a clear understanding of the factors responsible for making this phenomenon so prevalent (Barbieri 1991).

Awareness of the contributory factors to this phenomenon is therefore crucial in order to identify or inform the existing health actions, with the aim of further improving the situation and reducing the persistent health inequalities among children from different social strata.

Analyzing the factors associated with child mortality is a particularly complex undertaking. This complexity results from the large number of factors likely to impact on child mortality: demographic, epidemiological, medical, sociological, environmental and genetic. In practice, not all of these data are always available for analysis in a single piece of research, which limited the scope of the previous studies.

The analytical framework adopted for this study is based on that established by Garenne and Vimard (1984). It distinguishes five levels of variables specific to the analysis: discriminating, independent, intermediate, determining and dependent variables. These correspond to the different levels of analysis and thus to the different levels of explanation. This analytical framework has been adapted in this study to take into account independent (place of residence, household income, mother's education, mother's work) and intermediate (situation of birth, behavior in matters of health, immunity) variables.

In this paper we therefore investigated factors that have contributed to the recent improvement in under-five children's survival in Burkina Faso using data from the baseline (2013) and end-line (2017) surveys for the impact evaluation of performance-based financing (PBF)[1] in Burkina Faso. Specifically, we focus on the contributions of the main preventive factors associated with under-five children's survival in Burkina Faso. In other words, we seek to determine whether antenatal care visits, family planning needs satisfied (FPS), skilled birth attendants at delivery (SBA), and vaccination best practices have contributed to improving the under-five children's survival rate in Burkina Faso.

[1] **Performance-based financing** (PBF) or pay-for-**performance** (P4P) is a form of incentive where health providers are, at least partially, funded on the basis of their **performance** to meet targets or undertake specific actions. It is **defined** as fee-for-service-conditional-on-quality (WHO).

7.2 MATERIALS AND METHODS

7.2.1 Data source

To achieve the objectives of this study, two quantitative data sources were used: baseline survey data (2013) and end-line survey data (2017) for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso. The PBF impact assessment was a blocked-by-region cluster random trial based on a pre-post comparison design. This process of random allocation seeks to ensure that the different study groups are comparable in terms of observed and unobserved characteristics that could affect treatment outcomes, thereby allowing average differences in outcomes to be causally attributed. The aim was to compare the indicators between intervention and control areas over a period before and after the intervention. In the protocol, it was planned to trace households and health facilities from the baseline survey to the final survey.

The choice of health regions was guided by the low level of maternal and child health indicators there. In each region (Center North, Center West, North, South West, Boucle du Mouhoun and Center Est), two health districts (HD) of intervention were selected by the Ministry of Health and two control districts in the same or in a neighboring region based on their relative proximity and similarity to the intervention districts in the targeted regions (Map 1). Within each HD of intervention, all the health facilities (HFs) – Centre de santé et de promotion sociale (CSPS), or Centers for Health and Social Promotion, and Centre médical avec antenne chirurgicale (CMA), a medical center with surgical satellite services, and a district hospital – were included. In each HD control, the number of selected HFs was proportional to the size of the health district.

A simple random draw of the number of HFs was performed in each health district based on one HF control for four HFs of intervention. A total of 529 HFs were investigated, including 428 rural CSPS. To be exact, 413 were visited in the intervention zones, and 116 in the control zones.

Each rural CSPS was associated with a village in its health area in which 15 households were selected for the survey. Fifteen households were randomly drawn from each

village. Data collection for the baseline and end-line survey included a household and a facility-based survey. The household survey applied a two-stage sampling procedure (15 households per selected village). The questionnaire was administered to the head of household and women aged 15-49 years. The facility-based survey comprised different tools for data collection with different data sources and respondents: health facility records, providers' questionnaire, direct observations (curative consultations of under-5 and antenatal consultations), exit interviews (curative and antenatal consultations), Community Health Workers (CHW) (questionnaire). All health facilities and all households included in this study responded to the questionnaires. This paper is based on the household survey.

7.2.2 Study population and sample sizes

Two study populations were used in this study. First, we examined the study population based on an ecological time-series design, with health districts repeatedly observed over time. In this design, the lowest level of analysis was the health district, and 48 survey-period observations were available for analysis, covering 24 health districts observed in two periods (2013 and 2017).

Second, we used a repeated cross-sectional design, with children under five at the lowest unit of analysis. One of the main advantages of this second approach is its ability to take into account the factors that can influence both child mortality and economic development indicators. In this second level of analysis, children from both surveys were grouped together, and the child's likelihood of death was examined in the five years immediately preceding the survey. In total, 37,244 children were involved in this analysis, after exclusion of missing covariate data.

7.2.3 Selected Variables

7.2.3.1 Dependent variables

This study used two dependent variables, corresponding to the two study populations. In the ecological time-series design, the dependent variable is the proportion of under-five surviving children for the five-year reference period in each survey. In the child-level design, the dependent is the probability of child death

occurring within five years prior to the survey. These are children born during the five years preceding the date of each survey used in this study. The question of the survival status of each live-born child made it possible to distinguish between surviving and deceased children. The age at death was recorded for each child who died.

7.2.3.2 Intermediate variables

The independent variables are those that report on mothers' practices in preventive health care. Based on prior literature and the database used in this study, we selected six preventive health care measures that have been shown to reduce child mortality from the major causes of under-five deaths, and that can be summarized as a composite concentrated index for comparability (CCI) between HDs and within HDs over time (Aaby et al. 1996; Barros/Victora 2013; Victora et al. 2005, 1997). The preventive health care measures included were family planning needs satisfied (FPS), skilled birth attendants at delivery (SBA), at least one antenatal care visit with a skilled provider (ANCS), and vaccination for children against diphtheria-pertussis-tetanus (DPT3, three doses), measles (MSL), and tuberculosis (BCG) vaccination. The coverage of these preventive health care measures at health district (HD) level was summarized using the CCI, which is based on the following weighted average of the six preventive health care measures:

$$\mathrm{CCI} = \frac{1}{3}\left(\mathrm{FPS} + \frac{\mathrm{SBA+ANCS}}{2} + \frac{\mathrm{2DPT3+MSL+BC}}{4}\right) \quad (1)$$

The CCI is a composite measure. The CCI gives equal weight to family planning and maternal and newborn care and immunization and has been proposed as an effective way to summarize and compare coverage of preventive health care across HDs and over time (Barros/Victora 2013; Corsi/Subramanian 2014).

7.2.3.3 Independent variables

At the child level, we used a variety of theoretically important household, maternal and child characteristics as covariates (Victora et al. 1997). With regard to the individual characteristics of the mother's social identification, this study retained maternal age at childbirth, parity, educational level, and occupation. Regarding

children's characteristics, we used sex of the child, childbirth order, and child preceding birth intervals (Corsi/Subramanian 2014; Vilms et al. 2017). To better determine the impact of the social and household environment, we used the household wealth index and place of residence.

7.2.4 Statistical analysis

Most of the information collected on child survival focused on events that occurred in the five years prior to the date of each survey. Variables that operationalize mothers' preventive health-care practices (contraceptive methods used, vaccination, antenatal care, place of delivery and an attendance at delivery) were captured only for women who had had a live birth in the five years preceding both surveys.

Due to the nature of the data (collected from the retrospective surveys) and the objectives of our study, we adopted a longitudinal analysis approach. Longitudinal analysis reports on the evolution of the risk of death of a generation or a group of generations. The basic assumption is that children born in the same period are deemed to experience the same conditions that expose them to the risk of an indiscriminate death.

For this study we conducted two separate sets of analyses based on the two study populations described above. For the ecological time-series analysis, we apply linear regression models of form (Corsi/Subramanian 2014):

$$y_{ij} = \beta_0 + BC_j + BS_{ij} + \beta_1 CCI_{ij} + e_{0ij} \quad (2)$$

where y_{ij} represents the percentage of surviving children for survey time i in HD j; β_0 represents the constant or the average percentage of surviving children holding CCI constant, and after accounting for HD differences (BC_j); BC_j represents the HD specific dummy variables estimating percentage differences of surviving children between HD; BS_{ij} represents the effects associated with dummies for survey years; $\beta_1 CCI_{ij}$ represents the percentage change of surviving children for a unit change in CCI; and e_{0ij} represents the residuals at the survey-year level i in HD j.

A second set of analyses was implemented using the child-level dataset. In these analyses, the basic model is a logistic regression model with a binary response (y=1 for child is alive during the reference period, y=0 for child death). The outcome of child survival, $Pr(y_{ij}=1)$, is assumed to be binomially distributed y_{ij} ~Binomial (1, π_{ij}) with probability π_{ij} related to the set of independent variables X and a random effect for each level by a logit link function:

$$\text{Logit}(\pi_{ij} = \beta_0 + BC_j + BS_{ij} + \beta_1 CCI_{ij} + BX_{ij} \quad (3)$$

The intercept, $\beta 0$, represents the log odds of child survival for the reference group, BS_{ij} is a vector of coefficients for dummy variables for survey years, $\beta 1 CCI_{ij}$ represents the log odds of child survival for a one-unit increase in CCI, and the BX represents a vector of coefficients for the log odds of child survival for a one-unit increase for each independent variable. Coefficients were estimated and presented as odds ratios with 95% confidence intervals. Odds ratios (ORs), adjusted odds ratios (aORs) and p-value were estimated to capture the association between each independent and covariate variable and child survival (Harrell Jr 2015). The data analysis was performed primarily using version 13 of the Stata software.

7.3 RESULTS

A total of 20,483 (55.0%) and 16,757 (45.0%) under-five children from the 2013 baseline and 2017 end-line survey, respectively, were included in the analyses for the impact evaluation of PBF in Burkina Faso. Between 2013 and 2017, the percentage of under-five surviving children increased in a majority (17 of 24) of HDs included in this study, although the rate of change varied across the HDs (Table 1). During this period, the CCI increased in all HDs from an average of 62.7% among all health districts in the baseline survey to 69.2% in the end-line survey (Table 7.1). During the period, the CCI increased in all HDs, but the percentage of under-five surviving children fell. Indeed, the percentage of under-five surviving children decreased in 7 of 24 HDs (Manga, Boussé, Yako, Réo, Gaoua, Batié, Boromo), while the CCI increased in these same HDs during the same period.

In both the baseline and end-line surveys, a positive association was seen between HD levels of under-five surviving children and CCI coverage, indicating higher rates of under-five surviving children in HDs with greater preventive health care coverage (Pearson correlation +0.30 [baseline] and +0.74 [end line], p<0.001, Fig. 7.1.1 and 7.1.2). This association held when the average changes in the percentage of under-five surviving children and CCI over time were examined (Pearson correlation 0.36, p<0.001, Fig.7.1.3).

Table 7. 1: Sample size, percentage of under-5 children surviving and CCI for baseline and endline survey in 24 health districts, Burkina Faso

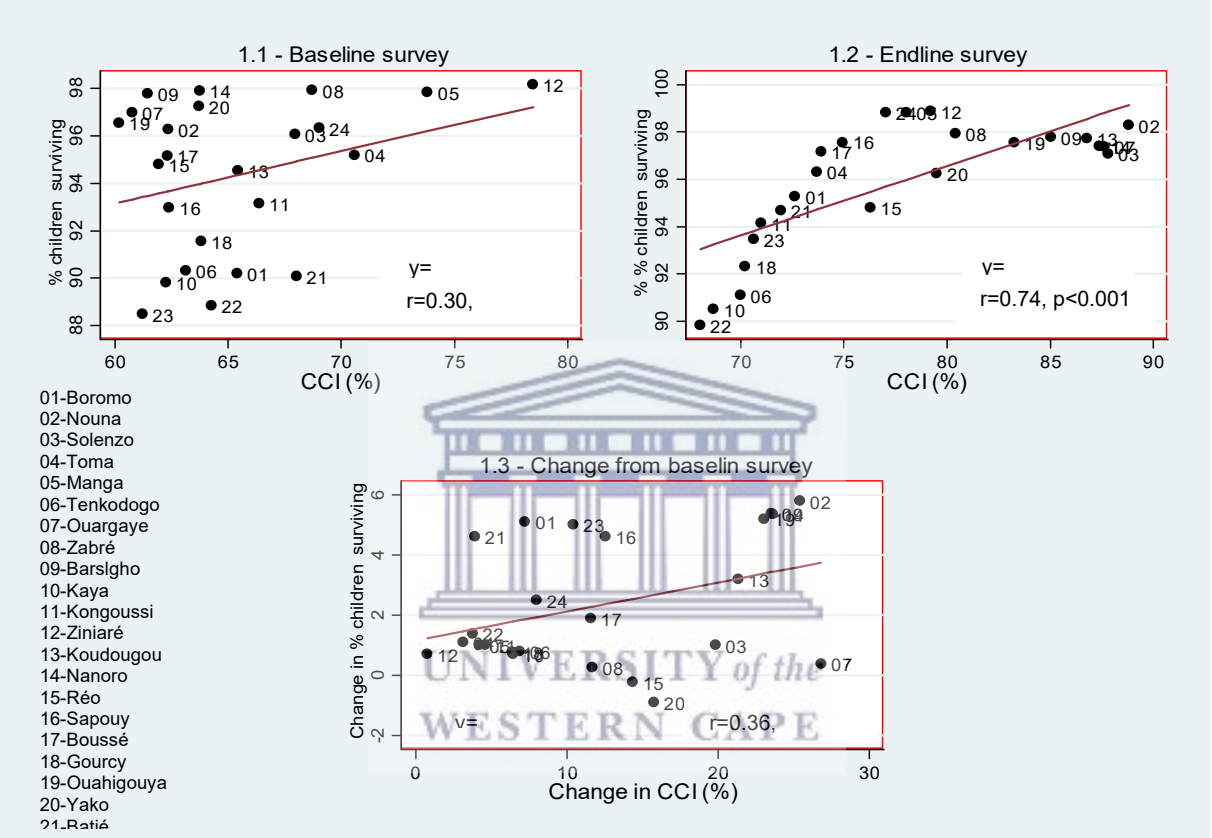
N°	Health District	Baseline survey (2013)			End line survey (2017)		
		N	% Surviving children	CCI	N	% Surviving children	CCI
03	Solenzo	1,166	93.1	62.0	1,080	99.1	70.8
09	Barsalgho	163	98.3	62.7	118	98.8	62.7
14	Nanoro	185	98.3	60.8	175	98.4	66.4
18	Gourcy	1,232	96.3	64.2	1,081	98.3	69.8
02	Nouna	1,678	87.1	62.2	1,484	98.3	69.7
04	Toma	410	94.8	63.6	326	98.3	72.6
08	Zabré	144	97.7	69.3	128	97.9	75.0
05	Manga	367	98.9	64.5	370	97.8	69.0
16	Sapouy	736	96.9	62.6	544	97.6	64.7
10	Kaya	2,001	96.0	63.1	1,680	97.5	68.6
19	Ouahigouya	2,361	96.8	60.5	1,952	97.5	72.5
17	Boussé	562	98.7	60.1	371	97.2	72.5
11	Kongoussi	1,225	91.4	66.9	1,219	97.1	71.9
07	Ouargaye	1,061	97.4	63.4	921	97.1	68.6
12	Ziniaré	707	94.8	62.7	492	97.0	69.2
13	Koudougou	2,289	95.0	62.4	1,601	96.7	65.9
06	Tenkodogo	961	94.9	60.9	732	96.4	67.5
20	Yako	690	97.0	61.1	503	96.2	69.8
15	Réo	691	98.2	62.0	508	94.8	66.0
24	Gaoua	181	94.1	57.5	152	92.8	65.5
21	Batié	354	98.1	58.6	324	92.7	66.9
01	Boromo	427	94.0	65.5	318	92.3	73.8
23	Diébougou	726	88.7	61.3	552	91.5	66.0
22	Dano	167	89.3	64.3	121	89.8	67.4
	Total	20,483	94.8	62.7	16,757	97.0	69.2

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

At an ecological level (model 1), the linear regression analysis showed that a standardized unit increase in CCI was associated with an increase of 10.0% in under-

five surviving children after accounting for secular increases in the percentage of under-five surviving children as captured by the survey period's fixed effects (Table 7.2). In these analyses, CCI was associated with an increase in under-five surviving children, indicating a multiplier effect of under-five surviving children independent of survey period effects.

Figure 7. 1 : Correlation between under-five children surviving and CCI at baseline (panel 3.1, n=24 surveys) and end-line (panel 3.2, n=24 surveys) surveys and correlation between the change in under-fi ve children surviving and change in CCI from baseline (panel 3.3, n=24 surveys)



Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

In a second model (model 2), a child-level analysis was conducted that included all preventive health care associated with under-five children's survival. Table 3 shows the sample sizes and unadjusted (OR) and adjusted (aOR) odds ratio by preventive health care variable: ANCS ($p<0.05$), SBA ($p<0.001$), and full immunization ($p<0.05$) were associated with under-five children's survival. Indeed, children whose mothers had no access to skilled antenatal care or a skilled attendant at birth are less likely to

survive. The children under five who did not receive full immunization are less likely to survive.

Table 7. 2: Coefficients of the health district model (ecological model) predicting under-5 children surviving across 48 survey periods in 24 Health Districts, Burkina Faso (model 1)

Variables	Model 1	
	Beta	Standard Error (SE)
Survey period		
Baseline (reference)		
End line	0.33	1.26
Composite coverage index (per Standard deviation (SD) increase)	0.10	0.15
Constant	88.77	8.69

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

Model 3 includes, in addition to the variables of preventive health care, covariates related to the household, the mother, and the child in the child-level analysis.

Table 7.4 presents the results of the bivariate analysis of child survival and the covariates related to the household, the mother, and the child. The wealth index, place of residence, mother's age at birth, maternal occupation, sex of the child, birth interval and birth order were significantly associated with the survival of the child. For multivariate analysis, the results of this model presented in Table 7.4 show that household wealth quintile (rich, richest) and received skilled attendant at birth (SBA)) were associated with better under-five child survival. Indeed, it is noted that maternal age at childbirth (25–29 years, aOR=0.73) and high parity is associated with a low chance of under-five child survival (aOR=0.59 for 4-6 parity and aOR=0.42 for 7&+).

Table 7. 3: Bivariate odds ratios (OR), and multivariable adjusted odds ratios (aOR) of child survival according to preventive health care (Model 2)

Variables	Children, n	%	Odds Ratio	95% CI	P-value	Adjusted Odds Ratio	95% CI	P-value
Family planning needs satisfied (FPS)								
Yes	9,135	24.53	1.00			1.00		
No	28,112	75.47	1.05	(0.91 - 1.21)		0.94	(0.71 - 1.26)	

Received skilled antenatal care (ANCs)								
Yes	30,238	81.19	1.00			1.00		
No	7,006	18.81	0.93	(0.81 - 1.06)	*	0.46	(0.23 - 0.95)	*
Skilled attendant at birth (SBA)								
Yes	27,403	73.58	1.00			1.00		
No	9,841	26.42	0.74	(0.63 - 0.87)	***	0.69	(0.51 - 0.93)	*
Full immunization								
Yes	22,175	59.54	1.00			1.00		
No	15,069	40.46	0.83	(0.68 - 1.00)	*	0.80	(0.65 - 0.98)	*

*** p<0.001, ** p<0.01, * p<0.05, OR: Odds Ratios, CI: confidence interval, n = number of observations
Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

Children from rich and richest households (aOR = 1.4 for richest, aOR=1.23 for rich, were less likely to die before their 5th birthday than those from the poorest households.

Table 7. 4: Bivariate odds ratios (OR), and multivariable adjusted odds ratios (aOR) of child survival according to preventive health care, child, maternal and household-level covariates (Model 3)

Variables	Childre n, N	%	Odds Ratio	95% CI	P-value	Adjusted Odds Ratio	95% CI	P-value
Survey period								
Baseline	20,483	55.00	1.00			1.00		
Endline	16,757	45.00	1.57	(1.52 - 1.64)	***	1.47	(1.37 - 1.62)	***
Household wealth quintile								
Poorest	6,464	17.36	1.00			1.00		
Poorer	6,935	18.62	1.17	(0.99 - 1.39)	*	1.22	(1.00 - 1.50)	
Middle	7,36	19.77	1.13	(0.96 - 1.34)		1.21	(0.99 - 1.47)	
Rich	8,197	22.01	1.16	(0.99 - 1.36)		1.23	(1.01 - 1.49)	*
Richest	8,279	22.23	1.35	(1.14 - 1.59)	***	1.40	(1.14 - 1.72)	***
Area of residence								
Urban	16,958	45.54	1.00			1.00		
Rural	20,277	54.46	1.63	(1.47 - 1.81)	***	0.93		
Maternal age at child birth								
15-19	3,200	8.60	1.00			1.00		
20-24	8,328	22.37	1.12	(0.94 - 1.33)		0.79	(0.58 - 1.07)	
25-29	10,293	27.65	1.37	(1.13 - 1.67)	**	0.73	(0.54 - 0.99)	*
30-34	7,906	21.24	1.32	(1.05 - 1.65)	*	1.11	(0.80 - 1.53)	
35-39	4,855	13.04	1.35	(0.99 - 1.82)		1.29	(0.90 - 1.83)	
40-44	2,011	5.40	1.82	(1.02 -3.28)	*	1.25	(0.83 - 1.89)	
45-49	651	1.75	0.66	(0.24 - 1.83)		1.22	(0.70 - 2.11)	
Maternal education								
No education	35,041	94.08	1.00			1.00		
Primary &+	2,205	5.92	1.16	(0.92 - 1.47)		1.27	(0.92 - 1.75)	
Maternal occupation								
No working	17,592	47.23	1.00			1.00		
Working	11,887	31.92	0.87	(0.78 - 0.97)	**	0.92	(0.81 - 1.05)	
Parity								
1-3	17,443	46.83	1.00			1.00		

Variables	Childre n, N	%	Odds Ratio	95% CI	P-value	Adjusted Odds Ratio	95% CI	P-value
4-6	14,231	38.21	0.67	(0.60 - 0.76)	***	0.59	(0.50 - 0.70)	***
7 & +	5,570	14.96	0.57	(0.49 - 0.67)	***	0.42	(0.33 - 0.54)	***
Sex of child								
Male	18,935	50.84	1.00			1.00		
Female	18,309	49.16	1.14	(1.03 - 1.27)	*	1.13	(1.00 - 1.29)	
Birth order								
1st child	7,526	20.31	1.00			1.00		
2-3	8,938	24.12	1.46	(1.26 - 1.69)	***	1.23	(0.71 - 2.13)	
4-5	3,366	9.08	1.45	(1.18 - 1.78)	***	1.64	(0.91 - 2.92)	
>= 6	17,234	46.50	1.46	(1.28 - 1.66)	***	1.38	(0.79 - 2.42)	
Birth interval								
1st chid	7,915	21.25	1.00			1.00		
<=24 months	2,617	7.03	0.90	(0.75 - 1.09)		0.67	(0.38 - 1.18)	
24-47 months	15,592	41.86	1.66	(1.45 - 1.90)	***	1.61	(0.94 - 2.76)	
>=48 months	11,120	29.86	1.70	(1.47 - 1.96)	***	1.43	(0.82 - 2.48)	
Family planning needs satisfied								
Yes	9,135	24.53	1.00			1.00		
No	28,112	75.47	1.05	(0.91 - 1.21)		1.03	(0.89 - 1.20)	
Received skilled antenatal care								
Yes	30,238	81.19	1.00			1.00		
No	7,006	18.81	0.93	(0.81 - 1.06)	*	0.89	(0.58 - 1.37)	
Skilled attendant at birth								
Yes	27,403	73.58	1.00			1.00		
No	9,841	26.42	0.74	(0.63 - 0.87)	***	0.77	(0.58 - 1.37)	**
Full immunization								
Yes	22,175	59.54	1.00			1.00		
No	15,069	40.46	0.83	(0.68 - 1.00)	*	0.84	(0.67 - 1.05)	

*** p<0.001, ** p<0.01, * p<0.05, OR: Odds Ratios, CI: confidence interval, N = number of observations
Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

7.4 DISCUSSION

This study aimed to investigate the main preventive health-care factors associated with under-five children's survival in Burkina Faso. The results of this study support the conceptual framework that guided this study, namely, that the intermediate variables related to preventive health-care factors and the independent variables related to the household, mother and child were associated with under-five children's survival in Burkina Faso. Improvement in preventive health care coverage (use of family planning, skilled antenatal care, SBA, and full immunization) was associated

with an increase in under-five children's survival in Burkina Faso. This association was significant for the two types of populations considered in this study.

On average, the increases in CCI correlated with increases in the percentage of under-five surviving children, however not all HDs fit this trend. These findings suggest that other factors not considered here may also be influencing changes in the percentage of under-five surviving children. Further, the CCI is a composite measure, and a decline in CCI may reflect one of the components decreasing over time while other components may have increased. We were not able to assess the association of each component of the CCI with the percentage of under-five surviving children, but it is likely that some components are more strongly associated than others. For example, the results of the analysis presented in Table 4 suggest that a skilled attendant at birth is particularly important in increasing the percentage of under-five surviving children. It is therefore possible that increases in coverage of certain interventions (but not others) may result in an improvement in the percentage of under-five surviving children without a corresponding improvement in CCI.

This paper shows that several preventive health care factors are associated with children's survival. A study conducted in 35 sub-Saharan countries in 2014 (Corsi/Subramanian 2014) on DHS data showed that under-five children's mortality was related to the coverage of skilled antenatal care, SBA, vaccinations, and so on. Also, Ghimire et al. (2019) conducted a study in Nepal in 2019 that showed that family planning intervention as well as the promotion of universal skilled antenatal care (at least two doses of the tetanus vaccine) are essential in helping improve child survival in Nepal.

Another study conducted by Walker et al. (2013) in 71 Countdown to 2015 priority countries[2] on the patterns of maternal, newborn, and child health coverage showed that substantial reductions in child deaths are possible but only if intensified

[2] The Countdown to 2015 for Maternal, Newborn, and Child Survival initiative monitors coverage of priority interventions to achieve the Millennium Development Goals (MDG) for reduction of maternal and child mortality

intervention efforts, e.g. for SBA, are implemented successfully within each of the Countdown countries.

It appears that health system improvements, including the scaling up of key maternal, newborn and child health (MNCH) interventions, are a key explanation for reductions in U5MR in sub-Saharan Africa. For example, in Tanzania between 1999 and 2004-05, the coverage of interventions relevant to child survival improved substantially (Masanja et al. 2008).

It has been suggested that effective implementation of cost-effective preventive health-care interventions can prevent much of the current under-five mortality in low-income settings (Black et al. 2003; Bryce et al. 2006; Victora et al. 2005). Based on our child-level analyses, it appears that the coverage of health interventions has played a relatively important role in reducing child mortality. However, it is not clear whether these improvements are being driven by supply side increases in the national or regional availability and coverage of health services and interventions, or through increased demand and access at an individual level.

Based on the results of this study, concentrated efforts aimed at sensitizing the population (especially women of childbearing age) to the use of family planning, skilled antenatal care, SBA, and child vaccination will help improve the survival of children (Corsi/Subramanian 2014; Ghimire et al. 2019; Rockli et al. 2018; Walker et al. 2013). This indicates that activities aimed at increasing knowledge and awareness of the importance of family planning, skilled antenatal care, SBA, child immunization, and other preventive measures for child survival should be conducted with women of childbearing age.

In this study, it was not possible to explore certain important variables revealed in studies of factors associated with child survival, such as those related to the quality of the pregnant woman's diet, to children's nutrition in general, and to breast-feeding in particular. These variables were not taken into account in the analysis because of the quality of the information about these variables in the database. Recommendations for future research include qualitative studies to provide a much deeper understanding

of the factors that contribute to child survival. Future research on this topic should explore the quality of pregnant women's nutrition, child nutrition, the beliefs of women and their partners, and the influence of partners and the extended family on issues surrounding the adoption of preventive health care with the aim of improving child survival.

7.5 CONCLUSION

This study found that children whose mothers had not received SBA at the birth of the child, those with high parity, and children who had lived in poorer and the poorest households were at greater risk of experiencing under-five mortality in Burkina Faso. Hence, to achieve Sustainable Development Goal (SDG) child survival targets, the present findings indicate the need for family planning interventions such as the promotion of contraception as well as universal SBA coverage. In addition, these interventions should target women from socioeconomically marginalized groups as well as those who have lived in poorer and the poorest households.

Burkina Faso could attain child survival Sustainable Development Goal targets if this trend of improved child survival were to be sustained. Investing in health systems and scaling up key maternal, newborn and child health (MNCH) interventions can produce a rapid improvement in child survival.

CHAPTER VIII: DISCUSSION AND CONCLUSION

8.1 DISCUSSION

The objective of this thesis is to gain a better understanding of the determinants of the health services used by mothers in sub-Saharan African countries in general and in Burkina Faso in particular, and an analysis of the related effects on their children's health and survival. This new scientific evidence adds to the corpus of knowledge that supports the development of evidence-based health programs and policies. Such interventions are necessary to improve maternal and child health indicators in sub-Saharan African countries. The progress made in maternal and child health since the 1990s is certainly laudable, but remains insufficient for the attainment by the end of 2030 of the third Sustainable Development Goal in the area of maternal and child health (WHO et al., 2015; Zere et al., 2012). Given the little improvement in reproductive health indicators, WHO, for example, has qualified Burkina Faso's efforts to reduce maternal mortality as "insufficient" (WHO et al., 2015).

8.1.1 Factors associated of mother's preventive and curative health care use in Burkina Faso

With a fertility rate of 6.0 children per woman in Burkina Faso (Institut national de la Statistique et de la démographie and IFC international, 2012), pregnancies play an important role in the lives of most Burkinabè women. Even today, many women do not make the four visits recommended by the Reproductive health policy and standards of the Ministry of the health of Burkina Faso as per the new model of antenatal care for women without complications in pregnancies (Ministère de la santé, 2010). Thus, in this study, we chose to analyze the factors associated with the use of health services through the analysis of factors associated with ANC use.

Based on the data from the baseline and final survey for the final assessment of the PBF in Burkina Faso, our study underlines that ANC use appears, according to our analysis, to be essentially determined by economic factors such as the community level

of poverty and women's occupation, in addition to the factors such as the use of modern contraceptive methods and quality of healthcare in health facilities.

At the individual level, ANC utilization improved with a better occupation of mothers. Mother's working status appeared as one variable that has a very strong influence on the ANC services utilization. Mothers' working status was related to the social environment. Pregnant women who work have a wider social environment than housewives. This allowed pregnant women to access more information related to pregnancy, including ANC. The influence of co-workers and other information that pregnant women got during work increases the knowledge of pregnancy that would eventually initiate ANC visits according to recommendations (Rahman et al., 2017). The positive effect of maternal occupation suggests that through information campaigns, Burkinabè women could be made more aware of the contribution of ANC to their health and that of their newborns. Increased attention should be paid to women with the experience of many previous pregnancies, who tend to make insufficient antenatal visits. To increase efficiency in the provision of antenatal care and to avoid unnecessary antenatal care visits, Burkina Faso will align its antenatal care guidelines with new standards promoted by WHO.

At the community level, the lower the concentration of poverty, the higher the propensity of getting four or more antennal care visits. The community with a high concentration of women's modern contraceptive use exerted strong effects on ANC services use. The higher the average quality of ANC at the health facility, the higher the propensity of getting four or more antennal care visits. The effect of the community level of poverty and the modern contraceptive methods use on the use of ANC is very strong, according to the results of our study. Guliani et al. (2012), for example, highlight the strong influence of the community level of poverty on the incidence of institutional deliveries, and the need for further research to this effect (Guliani et al., 2012). This implies that improved subsidizing of antenatal care visits could be the most effective policy to increase the uptake of antenatal care, as it has already been done in Burkina Faso since 2016. This suggests that economic growth will boost significantly with sufficient antenatal care coverage for pregnant women. Given the continued

rapid population growth, the importance of the beneficial effects of using modern contraceptive methods should not be underestimated (Langlois, 2015). Regarding the effect of health care quality on ANC use, the Government could opt for additional training of health workers in rural areas as a part of the provision of ANC. The use of antenatal care can be promoted through improved health, transport and communication infrastructures, as demonstrated in rural Uganda (Musoke, 2002).

Burkina Faso is one of the ten countries with the highest number of malaria cases and associated deaths (3% of cases and deaths worldwide). Malaria is responsible for 43% of health facility use and 22% of deaths (Organisation Mondiale de la Santé, 2019). Fever in children can be associated with malaria and late health care seeking can be fatal for the child's survival. The underutilization of health services by mothers of children during their children's fever remains a serious public health concern that requires further analysis of the associated factors. Thus, in this study, we chose to analyze the factors associated with curative health services use through the analysis factors associated with the mother's curative health care seeking behavior in the event of fever in their children. The use of healthcare services is therefore not systematic in cases of fever in children, it only occurs after the failure of home care (Fourn et al., 2001).

Child age, wealth status of a household, household composition, mothers' educational level, use of antenatal and postnatal care, safety in a health facility were factors significantly associated with the appropriate health care seeking for children's fever.

In the present study, mothers with formal education (primary and higher) were more likely to attend health training facilities to receive medical care for a child with fever than mothers with no formal education. It is well known that education affects the use of health care by the community. Therefore, educated mothers/guardians can easily understand the signs and severity of illnesses and seek health care in a short period (Alene et al., 2019). Our study also found that mothers in households with wealthier wealth status were more likely to seek medical treatment for their children's fever compared to their counterparts in poorer households. Studies have shown that

financial capacity is one of the determining factors that strongly influence the use of healthcare for childhood illnesses (Alene et al., 2019; Amin et al., 2010; Kolola et al., 2016). The present study also indicated that mothers who used antenatal care were more likely to seek health care for their children's fever than mothers who did not use antenatal care. The possible explanation for this finding could be that antenatal care enables mothers to realize the benefits of seeking health care at the time of the child's illness (Alene et al., 2019).

There is evidence from this study that the use of ANC services is determined not only by the observed individual characteristics, community and health district factors but also by the unobserved individual and community-level and health district-level effects. Estimates of the ICC in using ANC services remained considerable, even after controlling for selected individual and community-level and health district-level variables. The large residuals in the health district variance in ANC utilization suggest that there are other factors at the individual, community level, and health district level that are not accounted for in this analysis. The significant health district-level random effects that our study found to demonstrate the need to contextualize efforts aimed at promoting maternal service utilization. There are some unmeasured factors at the health district level that predict ANC service utilization. The other potential unobserved factors could include cultures and customs in pregnancy and birthing care that were not measured in this study but may help explain the health district variance.

Further quantitative and qualitative research should also address the contextual barriers that persist in the use of health services. The additional evidence would feed into the development and implementation of contextualized policies and programs working towards better maternal and child health outcomes in Burkina Faso. There appears to be a contextual socioeconomic effect in maternal and child healthcare-seeking behavior associated with various health indicators (Pickett and Pearl, 2001). Pickett and Pearl (2001) carried out a systematic review on this subject presented as a "reconciliation between two divergent epidemiological paradigms, namely the epidemiology of individual risk factors and the ecological approach" (Pickett and Pearl, 2001). Dzakpasu et al. (2013) underline that contextual analysis is necessary to

"infer health impacts from the phenomenon of the use of health services" (Dzakpasu et al., 2014b, 2012; Nketiah-Amponsah et al., 2013). Reflection on contextual factors is added to the effects of health policies and other determinants of the use of health services, thus placing the debate at the heart of the concerns of social epidemiology. The study of the determinants of the use of health services, therefore, fits into this conception, which "uses scientific evidence to structure interventions whose objective is to reduce social exposure that is harmful to health, and to 'increase exposure to social factors that promote the health of populations " (Harper and Strumpf, 2012).

8.1.2 Mothers' preventive and curative health care practices and children's health status and survival in Burkina

One of the objectives of this thesis was to evaluate the effect of the use of health care by mothers on the health and survival of their children in Burkina Faso. This study found that children who received vaccination against measles, whose mothers had received skilled attendant at the birth of the child, and those who had received skilled antenatal care and postnatal care were at greater odds to be in good health in Burkina Faso. This study also found that children whose mothers had not received SBA at the birth of the child, those with high parity, and children who had lived in poorer and the poorest households were at a greater risk of experiencing under-five mortality in Burkina Faso. Hence, to achieve Sustainable Development Goal (SDG) child survival targets, the present findings indicate the need for family planning interventions such as the promotion of contraception as well as universal SBA coverage. In addition, these interventions should target women from socioeconomically marginalized groups as well as those who have lived in poorer and the poorest households.

Improvement in preventive health care coverage (use of family planning, skilled antenatal care, SBA, and full immunization) was associated with an increase in under-five children's survival in Burkina Faso.

This finding suggests that strengthening and sustaining preventive public health strategies such as antenatal care and childhood immunizations are highly needed in improving the children under five health and survival in many countries sub-Saharan

African countries (Boco, 2011b). For example, in Tanzania between 1999 and 2004-05, the coverage of key maternal, newborn, and child health interventions relevant to child survival improved substantially (Masanja et al., 2008).

Our study provides a fresh perspective that consolidates the issue of contextual influences on women's use of health services and child survival in developing countries, and suggests, among other things, that policies and programs to improve health. The use of health services and children's health should include a community dimension. Our analyses also show that individual factors remain crucial in explaining differences in the use of health services. Certain individual characteristics of the mother, such as the occupation of the mother, financial status, appeared to be important predictors of the use of health services, in the presence of contextual factors.

8.2 CONCLUSION

A major public health problem in Africa sub-Saharan Africa is the ability of low-income rural women to access and use health care resources. However, empirical studies on factors associated with women's use of services are still fragmented due to a lack of or inadequate data. The present research constitutes a contribution by analyzing the factors associated with the use of health services by women by considering the factors linked to the supply and demand of health care from the survey data along with baseline and final for PBF assessment. In undertaking this research, the overall objective was to help explore the factors associated with the use of preventive and curative health care by mothers and the effect on their children's health status and survival in Burkina Faso. This study aims to overcome the limits of previous research on the explanation of the use of care by combining the analysis of the factors affecting the supply and demand of care in the analysis of the factors associated with the use of services. health. The specific objectives of the research were: (1) to determine the factors associated with the use of preventive health care by considering in a single analysis the factors affecting the supply and demand for health care in Burkina Faso; (2) determine the factors associated with the use of curative health care by considering in a single analysis the factors affecting the supply of and demand for health care in

Burkina Faso; (3) Identify the contextual and individual factors associated with the use of health facilities by mothers in Burkina Faso; and (4) to assess the effect of the use of health care by mothers on the health and survival of their children in Burkina Faso.

The results of the thesis were presented in the form of four articles, taking into account the four objectives specifically pursued. The results of this thesis would thus provide research results that are likely to guide public policies in reducing the morbidity and mortality of women and children in sub-Saharan countries. Several studies have used bivariate analyzes to look for factors associated with the use of health services, paying less attention not only to analyzes that take into account factors linked to the demand and supply of health care but also the factors associated with the use of health services, contextual and individual factors in the same analysis. To fill these gaps in previous studies on the subject, the first and second articles sought to determine the factors associated with the use of preventive and curative care by mothers, all other things being equal.

Considering the importance of the use of preventive and curative health care by mothers on the health of their children, the third and the fourth article examined the effects of the use of preventive and curative health services on the health and child survival from logit models. These effects were controlled by the variables of the social identity of the mother (age, level of education, occupation, marital status), the standard of living of the household, and variables linked to the context (place of residence, health district, quality of care, …).

Much effort has been made to identify interventions that are safe, affordable and acceptable and can be scaled up to improve access and use of health services in general and maternal and child health services in particular.

The evidence from this thesis will therefore fuel reflection on the development of policies and programs that promote better access and use of maternal and child health services.

As Julio Frenk, former Mexican health minister, said, "maternal and child health remains the best entry point for an overall goal of improving health systems in low- and middle-income countries" (Stanton, 2008).

It remains to be seen, whether the movement towards universal health coverage will promote greater equity in the access and use of maternal and child health services in Burkina Faso.

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APPENDICES

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ORIGINAL RESEARCH
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Determinants of Antenatal Care Utilization Among Childbearing Women in Burkina Faso

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Introduction: Antenatal care (ANC) is one of the pillars of maternal and child health programs aimed at preventing and reducing maternal and child morbidity and mortality. This study aims to identify the factors associated with ANC use, considering both health care demand and supply factors in the single analysis.

Methods: We used data from the endline survey conducted to evaluate the impact of the performance-based financing (PBF) program in Burkina Faso in 2017. This study was a blocked-by-region cluster random trial using a pre–post comparison design. The sample was derived in a three-stage cluster sampling procedure. Data collection for the endline surveys included a household survey and a facility-based survey. Women of childbearing age who gave birth at least once in the past 2 years prior to this survey and residing in the study area for more than 6 months were included in this study. Multilevel statistical techniques were used to examine individual and contextual effects related to health care demand and supply simultaneously and thus measure the relative contribution of the different levels to explaining factors associated with ANC use.

Results: The working women were five times [odd ratio (OR): 5.41, 95% confidence intervals (CI) 4.36–6.70] more likely to report using ANC services than the women who were not working (OR: 5.41, 95% CI 4.36–6.70). Women living in a community with high poverty concentration were 32.0% (OR: 0.68, 95% CI 0.50–0.91) less likely to use ANC services than those in a community with low poverty concentration. Women living in a community with a medium concentration of women's modern contraceptive use were almost two times (OR: 1.88, 95% CI 1.70–2.12) more likely to use ANC services than those living in a community with a low concentration of women's modern contraceptive use. Women living in the health area where the level of ANC quality was high were three times (OR: 2.96, 95% CI 1.46–6.12) more likely to use ANC services than those in the health area where the ANC quality was low.

Conclusion: Policies that increase the opportunity for improving the average ANC quality at the health facility (HF), the level of women's modern contraceptive use and women employment would likely be effective in increasing the frequency of use of antenatal services.

Keywords: antenatal care, multilevel analysis, determinants, health services utilization, Burkina Faso

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INTRODUCTION

To achieve the sustainable development goals (SDGs), about two-thirds of sub-Saharan African countries will need to accelerate the reduction in maternal and under-five deaths (1, 2). In these countries, although much effort toward achieving the SDGs has focused on health systems and the supply side, including community case management of childhood illnesses (3–5), less attention has been paid to increasing demand for health care in general and antenatal care (ANC) in particular (1).

Antenatal care is one of the pillars of maternal and child health programs aimed at preventing and reducing maternal and child morbidity and mortality (6–9). The recognition of this fact has made ANC one of the main objectives of health programs, concerning the health needs of women during pregnancy (9–11). ANC has been shown to provide opportunities for the early detection of potential obstetric risks and, through counseling and education, motivates women to seek skilled assistance at birth (12–14). Thus, access to and adequate use of ANC services are essential to reduce maternal and neonatal mortality (6, 8). Improved maternal and neonatal outcomes have been associated with the utilization of ANC services (7, 12, 15, 16).

Like other African countries, Burkina Faso has a low utilization level of health care services in general and ANC services in particular (17). Indeed, despite considerable efforts by the government and its development partners to promote the use of health care services, the rate of utilization of ANC does not seem to be increasing significantly. Indeed, recent data showed that only a third of women (38.0%) received at least four ANC services in Burkina Faso, and 39.1% received it in their first trimester (17).

The causes of low use of health services in general and of ANCs in particular have been studied by several authors in Burkina Faso and elsewhere, often solely from the point of view of health care demand (18–25) or supply (11, 26–30). The effect of health care supply and demand, taken together in a single analysis, on the use of ANC services should be documented. This type of analysis would contribute to the explanation of the use of ANC by identifying the factors associated with the use of ANC among childbearing women, taking into account the effect of health care supply and demand. This would contribute to identifying relevant variables related to health supply or demand, necessary for better planning of future interventions.

This study aims to contribute to the results of previous studies by considering in a single analysis the factors affecting the supply and demand of health care in the analysis of the factors associated with the use of ANC.

MATERIALS AND METHODS

Study Setting

The study was conducted in six administrative regions (Boucle du Mouhoun, Center-Est, Center-Nord, Center-Ouest, Nord, and Sud-Ouest) of Burkina Faso. The preliminary results of the fifth general population and housing census of Burkina Faso, carried out in 2019, indicated the total resident population of 20,487,979 inhabitants (31). According to the same source, the vast majority of the population (73.7%) lives in rural areas in 2019 (31).

According to the results of the demographic module of the continuous multisectoral survey carried out in 2019 in Burkina Faso, the vast majority of the population was affected by illiteracy (65.5% in 2014), and the poverty coverage rate at the national poverty line was estimated at 40.10% of the total population (32). The 2018 Human Development Index of the United Nations Development Program ranks Burkina Faso 182 out of 189 countries and territories with comparable data. According to the 2010 demography and health survey results for Burkina Faso, fewer than six in 10 women (58.4%) make two to three antenatal visits during pregnancy, and only three in 10 women (33.1%) make four or more visits during pregnancy (33).

Data Source

To achieve the objectives of this study, two quantitative data sources were used: endline survey data (2017) for the impact evaluation of performance-based financing (PBF) in Burkina Faso and routine health facility (HF) data.

Endline Survey Data for the Impact Evaluation of PBF

The PBF impact evaluation was a blocked-by-region cluster random trial using a pre–post comparison design. The aim was to compare indicators between intervention areas (12 PBF intervention districts) and control areas (12 districts selected as controls) over a period before and after the intervention within the framework of the PBF impact evaluation. The sample was derived using a three-stage cluster sampling procedure, described in detail elsewhere (34).

Data collection for the endline surveys included a household survey and a facility-based survey. The household survey collected data on household characteristics and members: the health status of each member of the household and the use of health services, perception of the quality of services, ANC, postnatal care, immunization of children, and the use of the services of community health workers (CHW). The facility-based survey comprised different data collection tools with different data sources and respondents: HF records, providers' questionnaire, direct observations (curative consultations of under-five and antenatal consultations), exit interviews (curative consultations and antenatal consultations), and the CHW questionnaire. All HFs and all households included in this study responded to the questionnaires. This paper is based on the HF and household surveys.

Routine HF Data

Routine data from HFs (2017) were obtained from the General Directorate of Studies and Sector Statistics of the Ministry of Health. For health districts, numbers of resident population and HFs were provided. Data from the 24 health districts included in the performance-based financing (RBF) were extracted for analysis.

Study Population and Sample Sizes

The source populations for this study were all permanent women residents in the study area who gave birth at least once in the last

2 years preceding the endline survey, irrespective of the outcome of delivery. Women of childbearing age who did not give birth at least once in the past 2 years prior to this survey and/or who resided in the study area for <6 months were excluded from this study. The analysis focuses on the responses from 8,174 women.

Selected Variables

Outcome Variable

In this study, the dependent variable was the utilization of ANC services. This is a dichotomous variable (Yes/No), defined by whether or not the respondent used ANC services. This study classified the users of ANC services as women who have had at least four ANC visits for their pregnancies ($<4 = 0$ and $\geq 4 = 1$). This classification was based on the reproductive health policy and standards of the Ministry of Health of Burkina Faso of a new model of ANC for women without complicated pregnancies (35).

Explanatory Variables

Analyzing the determinants of health care utilization is particularly challenging. This complexity comes first from a large number of factors that may affect the utilization of health care. In practice, all these data are never available for analysis, which limits the scope of the studies. With the multitude of studies describing the patterns of utilization in different health care settings, several scholars have developed explanatory frameworks that identify the predictors of health care utilization (36).

The variables used in the study are informed by the previous literature on the determinants of the utilization of ANC (13, 37–40). At individual and household levels, this study used mothers' age, the use of modern contraceptives, education, occupation, and household wealth index and size (**Table 1**).

At the community level, variables often cited in the literature (37, 38, 42) capture characteristics such as accessibility, economic status, and other health system factors: community concentration of female education, community concentration of poverty, community concentration of modern contraceptive prevalence, and the type of place of residence.

For the health district/HF level, this study used HF density (number of HFs per 1,000 people), the average quality of ANC at the facility, and the average distance between HF and households and PBF.

In this study, the supply side is proxied by the density of HFs in the health district, the average distance between HF and households, and the average quality of ANC at the reference facility and PBF. The uptake of ANC indicates demand and distance to the nearest facility and captures the interaction between supply and demand.

Statistical Analysis

Statistical analysis begun with cross-tabulations, and their statistical associations were used. The bivariate relationships indicated by the bivariate analysis may be due to interrelationships between the different characteristics measured as well as unmeasured characteristics at the community and health district level. Therefore, we used multilevel modeling to find the determinants of the use of ANC and analyze the variance of the use of ANC in its fixed and random components.

In the endline survey data for the impact evaluation of PBF in Burkina Faso, individual-level data followed a three-level hierarchical structure with the individual (women and household) at level 1 (i), nested within communities [or enumeration section (village)] at level 2 (j), and districts at level 3 (k). Multilevel statistical techniques provide a technically robust and efficient framework to account for the complex survey design and to assess variation in outcomes by multiple levels (43, 44). As suggested by its name, multilevel modeling enables simultaneous examination of the circumstances of individuals at one level in the context of multiple higher geographic, administrative, and social levels and thereby discerns the relative contribution of different levels to the scientific question of interest (43, 44).

For the binary outcome variable [ANC use ($<4 = 0$ and $\geq 4 = 1$)], a series of three-level random intercept multilevel logistic regression models were estimated based on a logit link function.

The multilevel analysis began with an empty model to test the null hypothesis that the variance at the community and health district level in the use of ANC services is zero and to assess whether our data justify the decision to assess random effects at the community and health district level.

The null model with no predictor variable was run to serve as a baseline to compare changes in variance estimates in subsequent models (Model 0):

$$\text{Model 0}: \text{logit}\left(\pi_{ijk}\right) = \beta_0 + \left(f_{0k} + v_{0jk}\right), \quad (1)$$

where β_0 represents the median log odds of antenatal use across all study areas, and the bracketed terms in Model 0 represent the random effects associated with districts and communities, respectively. The term f_{0k} is a district-specific residual that represents a departure of each district from the national median log odds of antenatal use; v_{0jk} is a community-specific residual conditional on the district.

In subsequent models, all the individual-level covariates (X_{ijk}) were included first in Model 1:

$$\text{Model 1}: \text{logit}\left(\pi_{ijk}\right) = \beta_0 + \beta X_{ijk} + (v_{0k} + u_{0jk} + e_{ijk}) \quad (2)$$

Then, the variables related to community (Model 2) and district (Model 3) were added to evaluate the relative importance of the individual effect of the use of ANC versus contextual effect:

$$\text{Model2}: \text{logit}\left(\pi_{ijk}\right) = \beta_0 + \beta X_{ijk} + \beta Y_{jk} + (v_{0k} + u_{0jk} + e_{ijk}) \quad (3)$$

$$\text{Model3}: \text{logit}\left(\pi_{ijk}\right) = \beta_0 + \beta X_{ijk} + \beta Y_{jk} + \beta Z_k + (v_{0k} + u_{0jk} + e_{ijk}) \quad (4)$$

For each successive model, the proportion of variance in the log odds of the use of ANC explained by additional factors was computed by subtracting the variance of the model with the most terms from the variance of the simplest model and converting it to a percentage. Data were prepared, and all multilevel models were estimated using STATA 16.1. For interpretation, we report odd ratios (OR) and 95% confidence intervals (CI).

TABLE 1 | Measurement of explanatory variables included in the estimated models.

Characteristics	Measurement
Mother's age at last birth	The questionnaire did not include a direct question on the age at last birth; we computed this indicator by subtracting the child's age from the woman's current age and rounding the result to the nearest whole number.
Mother's use of modern contraceptive	We measure this indicator through reported use of modern contraceptive (Yes/No).
Mother's education	The highest level of education attained is divided into two categories: none and primary and above (combining primary and higher education categories together).
Mother's occupation	It has been re-coded in two categories: not working [Employee, employee, piecework (daily work), self-employed/self-employed worker, member of a producers' cooperative, family worker, apprentice] and working [looking for a job (unemployed), pupils/students, housewife].
Last birth order	We distinguish between mothers whose most recent birth is rank 1 and 2 and those whose most recent birth is of a higher rank. It has been re-coded first-order birth, second-order birth, third-order birth and above
Household wealth index*	We constructed a scale for household wealth index from information on possession of specific household items and utilities. The resulting scale was divided into five quintiles, coded poorest, poorer, middle, richer and richest.
Household size	It has been re-coded in 1–3, 4–5 and 6 and above.
Community concentration of female education	Aggregate values of community level of female education are measured by the proportion of women with a minimum of primary level of education derived from data on respondent's level of education categorized as: "0% = Low", "<25% = Medium" and "25% and above = High"
Community concentration of poverty	Aggregate values of community-level poverty are measured by the proportion of households in the poorest wealth quintile derived from data on wealth index categorized as: "<15% = Low", "15–40% = Medium" and ">40% = High".
Community concentration of modern contraceptive prevalence	Aggregate values of community level of modern contraceptive prevalence are measured by the proportion of women who are currently using modern contraceptive categorized as: "≤15% = Low", "15–40% = Medium" and ">40% = High".
Type of place of residence	This variable was derived from the question on the type of place of residence. The variable place of residence recorded as rural and urban in the data set was retained without change.
Number of health facilities per 1,000 people	This information came from the routine health facility data.
The average quality of ANC at the facility	Data are captured by the facility survey from the exit interviews. The average quality of ANC at the facility, a composite quality index is constructed. The components considered, and demarcated as true/false, include the following: attendance by skilled health worker, weight and height measured, blood pressure checked, urine and blood sample taken, told about complications, given or bought iron tablets, and took fansidar as prophylaxis for malaria prevention (categorized as: "0% = Low", "0–25% = Medium" and ">25% = High".
Average distance between HF and households	It is computed from the geographic coordinates of households and health facilities (categorized as 1 = <1 km, 2 = 1–4 km and 3 = 5 km and above).
Performance-based financing**	It is categorized as 0 = control district and 1 = intervention district.

*Described in more detail elsewhere (41).
**Described in more detail elsewhere (34).

Ethical Aspects

No constraints or restrictions are placed on the autonomy and independence of the study or the publication of its results. The Ethics Committee of the Medical Faculty of the University of Heidelberg (Protocol No. S-272/2013) and the Burkina Faso ethics committee for health research (Protocol No. 2013-7-06) have approved the study. Written consent was obtained from all respondents prior to the survey. The database was anonymized to ensure respondents' confidentiality.

RESULTS

Overall, among the respondents included in this study, it is noted that the proportion of women who used at least four ANC services during their last pregnancy was 80.80% in 2017.

Bivariate Analysis

Tables 2, **3** present the variations in the indicator of the use of ANC services according to certain sociodemographic, household, community, HF, and health district factors. **Table 1** shows the distribution of women who paid at least four ANC visits during their last pregnancy according to the individual and household's sociodemographic characteristics. There was a significant relationship ($p < 0.01$) between mother's age, mother's use of modern contraceptives, and the ANC utilization indicator. There was also a significant relationship between the ANC indicator and household size. The relationship between the ANC indicator and birth order, as well as the household wealth index and size, were not significant at the bivariate level.

Regarding the characteristics of the community, the HF, and the health district (**Table 2**), there was a significant relationship between the type of place of residence, community concentration of women education, community concentration of poverty, community concentration of women's use of modern contraceptives, the average distance between HF and households, the average quality of ANC at the facility, and the number of HFs per 1,000 inhabitants with the ANC indicator. PBF was not significantly associated with the ANC indicator.

TABLE 2 | Variations in indicators of the use of antenatal care (ANC) services, by selected individual and household characteristics.

Characteristics	*n*	≥4 Antenatal care visits (%)	X^2 probability
Mothers' age at last birth			
15–19	551	80.94	0.03
20–24	1,688	80.15	
25–29	2,004	81.89	
30–34	1,717	80.84	
35–39	1,298	79.51	
40–44	654	76.91	
45–49	262	73.28	
Mother's modern contraceptive use			
Yes	2,434	81.88	0.039
No	5,740	80.35	
Mother's education			
No education	7,265	80.56	0.035
Primary and above	909	82.73	
Mother's occupation			
Not working	4,231	72.52	0.000
Working	3,943	89.78	
Birth order			
First birth	3,848	80.57	0.311
Second birth	3,704	80.74	
Third birth and above	622	82.74	
Household wealth index			
Poorest	1,368	82.09	0.581
Poorer	1,475	79.25	
Middle	1,592	80.15	
Richer	1,836	78.92	
Richest	1,903	80.82	
Household size			
1–3	750	61.07	0.114
4–5	1,817	55.75	
6 and above	5,607	43.64	
All respondents	8,174	80.80	

Source: Authors' own calculations from endline (2017) survey data for the impact evaluation of performance-based financing (PBF) in Burkina Faso.

TABLE 3 | Variations in indicators of the use of ANC visits, by selected community and districts characteristics.

Characteristics	*N*	≥4 Antenatal care visits (%)	X^2 probability
Community factors			
Type of place of residence			
Rural	7,538	80.43	0.003
Urban	636	85.22	
Community concentration of women education			
Low (0%)	1,863	75.58	0.000
Medium (>25%)	5,403	82.45	
High (25% and above)	908	81.72	
Community concentration of poverty			
Low (<15%)	2,245	87.04	0.000
Medium (15–40%)	4,134	75.06	
High (40% and above)	1,795	86.24	
Community concentration of women's modern contraceptive use			
Low (<15%)	1,573	76.10	0.000
Medium (15–40%)	5,781	80.71	
High (40% &+)	820	90.49	
Health district and HF factors			
Number of health facilities per 1,000 inhabitants			
Low (<0.15)	2,411	68.89	0.000
Medium (0.15–0.2)	3,586	82.40	
High (0.20 and above)	2,177	91.73	
Average distance between HF and households			
>1 km	1,107	88.17	0.000
1–4 km	3,438	81.04	
5 km and above	3,629	78.45	
Average quality of ANC at the facility			
Low	6,315	49.24	0.000
Medium	1,255	86.05	
High	604	92.38	
PBF			
Control	1,899	80.75	0.520
Intervention	6,275	81.41	
All respondents	8,174	80.80	

Source: Authors' own calculations from endline (2017) survey data for the impact evaluation of PBF in Burkina Faso.

Multilevel Models

The results presented in **Table 4** show that for the ANC service utilization indicator, there was considerable heterogeneity between communities and health districts. For example, the variance at the health district level in the empty model is large and significant, indicating considerable differences in the use of ANC and health districts. The intraclass correlation (ICC) in the empty model indicates that 46.3% of the total variance in the use of ANC services is attributable to the differences between the health districts.

Table 4 shows the results of the saturated model, which assesses the role of variables at different levels. The most significant individual characteristic of the use of ANC services was the mother's occupation. The odds of reporting the use of ANC services increase with whether the mother is working or not, such that working women were five times more likely to report the use of ANC services than women who were not working.

Two of the community-level variables included in the model are found to be associated with the use of ANC services. These were the community concentration of poverty and women's use of modern contraceptives. Women living in areas with a low concentration of poverty have higher odds of receiving four or more ANC visits as opposed to women living in communities with a medium or high concentration of poverty. For example, women living in a community with medium poverty concentration were 33.30% less likely to use ANC services than those living in a community with a low poverty concentration. Women living in a community with a medium

TABLE 4 | Parameter coefficients for the multilevel model of the use of ANC visits—assesses the role of variables at different levels.

Characteristics	*n*	Model 0	Model 1 (OR CI 95%)	Model 2 (OR CI 95%)	Model 3 (OR CI 95%)
Fixed effects					
Mother's age					
15–19	551		1.00	1.00	1.00
20–24	1,688		1.18 (0.82–1.70)	1.17 (082–1.70)	1.18 (0.82–1.70)
25–29	2,004		1.05 (0.72–1.51)	1.04 (0.73–1.52)	1.05 (0.72–1.52)
30–34	1,717		1.04 (071–1.52)	1.05 (0.71–1.54)	1.04 (0.71–1.54)
35–39	1,298		0.75 (0.51–1.12)	0.76 (0.52–1.13)	0.76 (0.52–1.130)
40–44	654		0.98 (0.64–1.52)	1.01(0.65–1.56)	1.01 (065–1.56)
45–49	262		1.29* (0.74–2.24)	1.28* (0.73–2.28)	1.27 (0.73–2.22)
Mother's modern contraceptive use					
Yes	2,434		1.00	1.00	1.00
No	5,74		0.96 (0.81–1.14)	0.95 (0.80–1.13)	0.87 (0.80–1.13)
Mother's education					
No education	7,265		1.00	1.00	1.00
Primary and above	909		1.95 (1.29–2.35)	1.54 (1.28–2.02)	1.53 (1.29–2.01)
Mother's occupation					
Not working	4,251		1.00	1.00	1.00
Working	3,923		5.50*** (4.48–6.76)	5.38*** (4.34–6.67)	5.41*** (4.36–6.70)
Birth order					
First birth	3,896		1.00	1.00	1.00
Second child	3,687		1.02* (0.71–1.99)	1.01 (0.71–1.31)	1.01 (0.86–1.43)
Fourth child and above	591		1.08 (0.67–1.78)	1.02 (0.67–1.28)	1.02 (0.75–1.36)
Household wealth index					
Poorest	1,368		1.00	1.00	1.00
Poorer	1,475		1.048* (0.60–1.52)	1.05 (0.60–1.56)	1.06 (0.59–1.29)
Middle,	1,592		1.063* (0.78–1.54)	1.07 (0.74–1.51)	1.07 (074–1.32)
Richer	1,836		1.174* (0.64–1.47)	1.18 (0.63–1.43)	1.18 (0.62–1.49)
Richest	1,903		1.126 (0.66–1.42)	1.14 (0.66–1.46)	1.13 (0.66–1.47)
Household size					
1–3	750		1.00	1.00	1.00
4–5	1,817		1.013 (065–1.29)	1.02 (0.65–1.64)	1.025 (0.65–1.65)
6 and above	5,607		0.87 (063–1.22)	0.86 (0.62–1.45)	0.88 (0.62–01.21)
Community factors					
Type of place of residence					
Rural	7,538			1.00	1.00
Urban	636			1.12 (0.62–1.47)	1.012 (0.61–1.56)
Community concentration of women education					
Low (0)	1,863			1.00	1.00
Medium (0–25%)	5,403			1.93 (1.75–2.12)	1.92 (1.74–2.11)
High (25% and above)	908			1.99 (1.67–2.22)	2.04 (1.66–2.2.36)
Community concentration of poverty					
Low (<15%)	2,245			1.00	1.00
Moderate (15–40%)	4,134			0.61*** (0.47–0.80)	0.62*** (0.46–0.81)
High (40% and above)	1,795			0.67*** (0.49–0.90)	0.68*** (0.50–0.91)
Community concentration of women modern contraceptive use					
Low (<15%)	1,573			1.00	1.00
Moderate (15–40%)	5,781			1.88** (1.70–2.12)	1.88** (1.70–2.12)
High (40% and above)	820			2.76 (2.19–3.60)	2.41(2.20–3.60)
District and health facilities factors					
Number of health facilities per 1,000 inhabitants					

(Continued)

TABLE 4 | Continued

Characteristics	*n*	Model 0	Model 1 (OR CI 95%)	Model 2 (OR CI 95%)	Model 3 (OR CI 95%)
Low (<0.15)	2,411				1.00
Medium (0.15–0.2)	3,586				1.43 (1.09–2.03)
High (0.20 and above)	2,177				1.38 (1.06–2.67)
Average distance between HF and households					
Low	1,273				1.00
Medium	4,320				0.96 (0.54–1.17)
High	2,581				0.91 (0.36–2.11)
The average quality of ANC at the health facility					
Low	6,315				1.00
Medium	1,255				1.19 (1.02–2.26)
High	604				2.96** (1.46–6.12)
PBF					
Control district	1,899				*1.00*
Intervention district	6,275				1.912 (1.30–3.01)
Random effects					
District-level variance		1.828*** (0.540)	2.241*** (0.670)	2.167*** (0.671)	1.956*** (0.614)
Residual intraclass correlation		0.463	0.402	0.401	0.378
Log likelihood		−2,634.787	−2,427.2153	−2,414.8049	−2,413.429
Akaike crit. (AIC)		5,275.575	4,894.431	4,883.610	4,896.251

****p < 0.01, **p < 0.05, *p < 0.1.*

Source: Authors' own calculations from endline (2017) survey data for the impact evaluation of PBF in Burkina Faso.

concentration of women's use of modern contraceptives were two times more likely to use ANC services than those living in a community with a low concentration of women's use of modern contraceptives.

The most significant health district and HF level characteristic of the use of ANC services was the average quality of ANC at the HF. Women living in the health area where the level of ANC quality was high were four times more likely to use ANC services than those living in the health area where the ANC quality was low.

Finally, the residual ICC remains noticeably high, indicating that even after considering individual, household and community factors, there remained considerable consolidation in the use of ANC services at the health district level.

DISCUSSION

The objective of this study was to identify the different factors that may influence the use of ANC services by pregnant women in Burkina Faso, by considering factors related to the health care supply and demand jointly in a single analysis. The results of this study support the conceptual framework that guided this study. The findings demonstrate the influence of health care supply and demand factors on the use of ANC in Burkina Faso.

Regarding factors related to health care demand, there was a significant relationship between the use of ANC services and the mother's occupation at the individual level. The community concentration of poverty and women's use of modern contraceptives were found to be associated with the use of ANC services. Regarding factors linked to health care supply, the average quality of ANC at the HF was found to be associated with the use of ANC services.

At the individual level, the use of ANC improved with higher mother's occupation. Mother's working status appeared as one variable with a very strong influence on the use of ANC services. The results of this study showed that the working mother was more likely to make antenatal visits many times than unemployed mothers. This finding is consistent with that by Assefa and Tadesse (45), Tawiah (46), and Sharma et al. (47). Mothers' working status was related to the social environment. Working pregnant women have a wider social environment than housewives. This allowed pregnant women to access more information related to pregnancy, including ANC. The influence of information from co-workers and other information that pregnant women got during work increased pregnancy knowledge that would eventually initiate ANC visits according to recommendations (48).

At the community level, the lower the concentration of poverty, the higher the propensity of getting four or more antennal care visits. This finding is consistent with the outcomes of studies conducted in Nigeria (49, 50). The community with a high concentration of women's use of modern contraceptives exerted strong effects on the use of ANC services. This finding is consistent with the finding from studies conducted elsewhere (51, 52). The higher the average quality of ANC at the HF, the higher the propensity

of getting four or more antennal care visits. This finding is consistent with that from the two studies conducted in Zambia by Chama-Chiliba and Koch (38) and Kyei et al. (53).

In summary, there is evidence from this study that the use of ANC services is determined not only by the observed factors related to individual characteristics, community, and health district but also by the unobserved effects at the individual, community, and health district level. Estimates of the ICC in using ANC services remained considerable, even after controlling for selected variables at the individual, community, and health district level. Large residuals in the health district variance in the use of ANC suggest that there are other factors at the individual, community, and health district level that are not accounted for in this analysis. The significant health district-level random effects that our study found demonstrate the need to contextualize efforts aimed at promoting the use of maternal services. There are obviously some unmeasured factors at the health district level that predict the use of ANC services. Possible unobserved factors could include cultures and customs in pregnancy and birthing care that were not measured in this study that may help explain part of the health district variance.

Limitations of This Study

This study used data from the endline survey for the PBF impact evaluation, which uses three-stage cluster sampling procedures to ensure reliability and a multistage probability sampling methodology to select clusters and households from geographic sampling frames that cover the study area. However, there are some limitations to this study. The first limitation is the cross-sectional nature of the data collected, which means the outcome and explanatory variables were measured simultaneously, and therefore cannot guarantee any causality of associations. The second limitation is the recall and self-reporting bias of the information collected by the endline survey for the PBF impact evaluation. However, to reduce as much as possible various limitations and possible biases of this study, descriptive and multivariate analysis methods were combined.

CONCLUSION

Several factors influencing the use of ANC services occur at different levels: individual/household, community, and health district. At the individual household level, the mother's occupation was consistently a strong predictor of the use of ANC services considered in this study. At the community level, living in a community with a low concentration of poverty or in a community with a high concentration of women using modern contraceptive methods were associated with the use of ANC services. Women living in the health area where the level of ANC quality was high were four times more likely to use ANC services than those living in the health area where the ANC quality was low. To be optimally effective, interventions to promote the use of ANC services need to consider these findings.

The study findings have important implications for the design of health policy concerning maternal health in Burkina Faso. Policies that increase the opportunity to improve the average ANC quality at the HF, the level of women's use of modern contraceptive methods, and women employment would likely be effective in increasing the frequency of use of ANC services. Consequently, government policies should target economically disadvantaged women so that the frequency of antenatal visits can be increased.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the Medical Faculty of the University of Heidelberg (Protocol Number S-272/2013); Burkina Faso National Ethics Committee (Protocol Number 2013-7-06). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

HB, AB, HH, and MD developed the detailed plans for the fieldwork, designed the data collection instruments, implemented, and supervised the fieldwork. HB and AS conceived and designed this paper and developed the analysis strategy. HB analyzed the data and wrote the first draft. AS is the overall guarantor author. All authors reviewed, provided inputs, and approved the final paper.

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Children's health status: examining the effect of mothers' preventive health care use

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ABSTRACT

Introduction: Several mechanisms come into play for the child to have good health. This study aimed to examine the effect of mothers' preventive health care use for themselves and their children on their children's health status.

Methods: For this study, data come from the end-line survey conducted to evaluate the impact of Performance-Based Financing program in Burkina Faso. Multivariate Ordered logistic regression analysis was used to identify factors associated with children health status. Odds ratios (ORs) and adjusted odds ratios (AORs) were estimated to assess the strength of associations and used 95% confidence intervals for significance tests. A multivariate multinomial logistic regression analysis was also used to calculate the predicted probability of

being each children health status at each level of coverge of preventive health care. Data were cleaned, coded and analysed using Stata software in version 16.1.

Results: Skilled attendant at birth was a favorable factor for being in the good health (OR 1.16; 95% CI 1.10-1.31). Received skilled antenatal care and received skilled postnatal care (OR 1.09; 95% CI 0.99-1.18 and OR 1.88; 95% CI 1.80-1.97) were positively correlated with children health status. children vaccination against measles (MSL), was positively correlated with children health status (OR 1.85; 95% CI 1.73-1.99). Modern contraceptive methods use, vaccination for children against diphtheria-pertussis-tetanus and tuberculosis did not affect children health status.

Conclusion: activities aimed to increase knowledge and awareness of the importance of skilled antenatal care, skilled attendant at birth, child immunization, skilled postnatal care and other preventive measures for child health should be conducted with women of childbearing age.

KEYWORDS: Health care use, Preventive health care, Children's health, Burkina Faso

INTRODUCTION

Several mechanisms come into play for a child to have good health. Previous studies have shown that the mother's education and high household socioeconomic status are associated with healthy behaviours for their children. High socioeconomic status of the household positively influences most health behaviours [1]. For example, a mother living in a household with a high socioeconomic status would perform at least one antenatal consultation and her children would be vaccinated within a timeframe consistent with the vaccination schedule [2,3]. Many authors have shown that most educated mothers are less likely to give birth to underweight new-borns and there is less chance of their losing their child in the first year after birth [2,4–6].

One of the ways in which the mothers' education could improve their children's health is the use of preventive health care such as prenatal care, skilled birth attendants at delivery, immunisation, well-child visits, etc. [7]. For example, the more educated a woman is, the more

aware she will be of the importance of monitoring her pregnancy [3,4]. These results confirm Karlsen et al.'s (2011) finding, according to which educated mothers derive greater benefit from the advantages of modern medicine than their illiterate counterparts [8].

The efficient use of health resources is recognised as one of the factors influencing children's health [1,9,10]. Previous studies have used indicators such as antenatal care visit, immunisation, place of delivery, well-child visits, breastfeeding practices and health care seeking practices in case of child illness to highlight the means adopted by mothers to preserve their children's health [1,3].

Indeed, maternal antenatal care use has been shown to be associated with the place of delivery, well-child visits, children's immunisation within a timeframe consistent with the immunisation schedule and healthy children [3,7,11,12]. We could admit that mothers whose first visit took place during the first three months are better informed about the requirement of antenatal care visits and that they are more open to modern health care, whereas those whose first antenatal care visit has taken place later may have been forced to do so by the difficulties associated with their pregnancy [1].

Regarding well-child visits, most of the preventive health care steps for children are administered during these visits. Well-child visits are important for children's health, as they can track children's growth, diagnose disease, ensure vaccine administration, and provide education on nutrition, safety and other important health issues [11,13].

New-borns are endowed with passive immunity against several diseases which they inherit from the mother. However, due to the transience of this passive immunity, it is important for the child to acquire active immunity through immunisation in order to cope with the most common infectious diseases [1,14]. Previous findings have shown that a large number of illnesses, hospitalisations and deaths have been prevented through childhood immunisation [14–16].

As for breastfeeding, it should be remembered that it provides several advantages for survival in childhood. Breastfeeding strengthens and prolongs the immunological protection that the infant obtains from its mother [1,17–19]. Longer breastfeeding is generally beneficial for child survival [17,18,20,21].

The main objective of this study was to examine the effect of mothers using preventive and curative health care for themselves and their children, on their children's health status. Beyond the importance of maternal health care use and its impact on maternal morbidity and mortality, analysing the associations between children's health status and mothers' preventive or curative health care use is likely to have implications for programs and policies aimed at improving appropriate health care services' use for children.

METHODS

Data sources

To achieve the objectives of this study, the end-line survey data for the impact evaluation of Performance-Based Financing (PBF) conducted in Burkina Faso in 2017 was used. The PBF impact assessment was a blocked-by-region cluster random trial based on a pre–post comparison design. This process of random allocation seeks to ensure that the different study groups are comparable in terms of observed and unobserved characteristics that could affect treatment outcomes, thereby allowing average differences in outcomes to be causally attributed. The aim was to compare the indicators between intervention and control areas over a period before and after the intervention. The sample was derived through a three-stage cluster sampling procedure, described in detail elsewhere [22].

The end-line survey collected data on household characteristics and household members, the health status of each household member and the use of health services, perception of the quality of services, antenatal care, postnatal care, immunisation of children and use of the services of community health workers. This survey also provides information on the evaluation of the health facility, the interviews at the exit of the consultation for children under 5 years and women seen in antenatal care and the distance between the home and the health facilities.

Study population and sample size

The source populations for the study were all permanently resident women of the study area who had given live birth at least once in the two years immediately preceding the end-line survey, and their children. Women of childbearing age who had not given live birth at least once in the two years prior to this survey and/or had been residing in the study area for less

than six months were excluded from this study. The analysis focuses on responses from 14,407 women who had given birth at least once in the two years preceding the survey, irrespective of the outcome of the delivery.

Selected variables

Outcome variable

In this study, the outcome variable was children's health status. During the end-line survey, the following question was asked of the mothers: "How has your health / the health of your child been during the past 12 months?" to gather their perception of their own and their children's health status. The information collected was coded as follows: 1 = Excellent, 2 = Good, 3= Fair, 4 =Poor and 5 = Very poor. This variable was re-coded in three categories with values of 1=Good, 2=Fair and 3=Poor.

Explanatory variables

The independent variables are those that report on mothers' practices in preventive health care. Based on the prior literature and the database used in this study, we selected six preventive health care measures which have been shown to reduce child mortality from the major causes of under-five deaths [23,24]. The preventive health care measures included were family planning needs satisfied (FPS), skilled birth attendants at delivery (SBA), at least one antenatal care visit with a skilled provider before the three first months (ANCS), well-child visits (WCV), breastfeeding and vaccination for children against diphtheria-pertussis-tetanus (DPT3, three doses), measles (MSL) vaccination and tuberculosis (BCG) vaccination.

The coverage of these preventive health care measures was summarised using the CCI, which is based on the weighted average of the six preventive health care measures, calculated as follows:

$$\mathrm{CCI} = \frac{1}{3}\left(\mathrm{FPS} + \frac{\mathrm{SBA}+\mathrm{ANCS}}{2} + \frac{2\mathrm{DPT3}+\mathrm{MSL}+\mathrm{BCG}}{4}\right) \quad (1)$$

The CCI is a composite measure. The CCI gives equal weight to family planning as well as maternal and new-born care and immunisation, and has been proposed as an effective way to summarise and compare coverage of preventive health care across HDs and over time [23,25].

With regard to the individual characteristics of the mother's social identification, this study retained maternal age at childbirth, parity, educational level and occupation [25,26]. To better

determine the impact of the social and household environment, we used the household wealth index and place of residence.

Statistical analysis

Most of the information collected on children's health status focused on events that occurred in the two years immediately prior to the date of the end-line survey. Variables that operationalise mothers' preventive health-care practices (contraceptive methods used, vaccination, antenatal care, place of delivery and an attendant at delivery) were captured only for women who had had a live birth in the two years immediately preceding the survey.

For this study we conducted two sets of analyses. The first analytical phase consists mainly of the multivariate ordered logistic regression analysis used to identify factors associated with children's health status. Ordered logistic regression model is used to model ordered outcome variables. Odds ratios (ORs) and adjusted odds ratios (AORs) were estimated to assess the strength of associations and 95% confidence interval was used for significance tests. A second set of analyses was implemented using the multivariate multinomial logistic regression analysis. The predicted probability of the children being of a particular health status at each level of coverge of preventive health care was calculated. Data were cleaned, coded and analysed using Stata software version 16.1.

RESULTS

The analyses included data for 14,407 women who had given live birth at least once in the two years immediately preceding the end-line survey, and their children. Overall, 77.63%, 20.03% and 2.34% of the children were in good, fair and poor health, respectively.

The bivariate analysis shows that the variables skilled attendant at birth and received skilled antenatal care may be associated with children's health status ($p<0.05$). Modern contraceptive methods use, vaccination for children against diphtheria-pertussis-tetanus, measles and tuberculosis (BCG) may not be correlated with children's health status ($p>0.05$) (Table 1).

Table 1: Sample size, percentage of children health status according to preventive health care, Burkina Faso

Characteristics	N	Children health status			P-value
		Good (%)	Fair (%)	Poor (%)	
Modern contraceptive methods use					
No	8,880	77.83	20.02	2.15	0.163
Yes	5,527	77.31	20.05	2.64	
Skilled attendant at birth					
No	3,304	77.42	19.40	3.18	0.001
Yes	11,103	77.69	20.22	2.09	
Received skilled antenatal care					
No	6,006	78.69	19.35	1.96	0.007
Yes	8,401	76.87	20.52	2.61	
BCG					
No	8,191	77.39	20.28	2.33	0.698
Yes	6,216	77.94	19.71	2.35	
DTP3					
No	9,075	77.49	20.15	2.36	0.868
Yes	5,332	77.87	19.82	2.31	
MSL					
No	10,139	77.30	20.29	2.42	0,289
Yes	4,268	78.42	19.42	2.16	
All Respondents	14,407	77.63	20.03	2.34	

Source: Authors' own calculations from end-line survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

Table 2 shows the results as to the influence of mother's preventive health care use, other maternal and household factors on the children's health status and models good to poor child health as the dependent variable. Skilled attendant at birth was a favourable factor for being in good health (OR 1.16; 95% CI 1.10-1.31). Received skilled antenatal care and received skilled postnatal care (OR 1.09; 95% CI 0.99-1.18 and OR 1.88; 95% CI 1.80-1.97) were positively

correlated with children's health status. Children's vaccination against measles (MSL) was positively correlated with children's health status (OR 1.85; 95% CI 1.73-1.99). Duration of breastfeeding (OR 0.88; 95% CI 0.77-1.00), mother's age (20-24 and 25-29, OR 0.87; 95% CI 0.74-1.01 and OR 0.87 95% CI 0.74-1.01 respectively) and parity (six children and above OR 0.83; 95% CI 0.74-0.94) were negatively correlated with children's health status. Mothers who worked (OR 1.48; 95% CI 1.37-1.61) and mothers who had primary and above education level (OR 1.22; 95% CI 1.01-1.50) were likely to have their children in good health. In addition, household wealth index was positively correlated with children's health status. Nevertheless, Modern contraceptive methods use, vaccination for children against diphtheria-pertussis-tetanus and tuberculosis did not affect children's health status (Table 2).

Table 2: Odds ratios (OR) and 95% Confidence Intervals of children health status according to preventive health care, maternal and household-level covariates

Characteristics	N	Children health status, OR (95% CI)
Modern contraceptive methods use		
No	8880	1.00
Yes	5527	1.02 (0.93-1.11)
Skilled attendant at birth		
No	3304	1.00
Yes	11103	1.16** (1.10-1.31)
Received skilled antenatal care		
No	6006	1.00
Yes	8401	1.09** (0.99-1.18)
BCG		
No	8191	1.00
Yes	6216	1.01 (0.86-1.19)
DTP3		
No	9075	1.00
Yes	5332	1.10 (0.90-1.33)
MSL		
No	10139	1.00

Characteristics	N	Children health status, OR (95% CI)
Yes	4268	1.85** (1.73-1.99)
Received skilled postnatal care		
No	4416	1.00
Yes	9991	1.88** (1.80-1.97)
Duration of breastfeeding		
Less than 6 months	3318	1.00
6 months or more	11089	0.88** (0.77-1.00)
Mother's age		
15-19	1357	1.00
20-24	3167	0.87** (0.74-1.01)
25-29	3640	0.87** (0.74-1.01)
30-34	2986	0.89 (0.76-1.04)
35-39	1952	0.94 (0.79-1.12)
40-44	908	1.06 (0.86-1.31)
45-49	397	0.91 (0.70-0.94)
Mother's occupation		
No working	9238	1.00
Working	5169	1.48*** (1.37-1.61)
Mother's education level		
No education	13869	1.00
Primary &+	538	1.22** (1.01-1.50)
Parity		
1+3	5891	1.00
4-5	4121	0.94 (0.84-1.05)
6 & +	4395	0.83*** (0.74-0.94)
Household wealth index		
Poorest	2539	1.00
Poorer	2743	0.95 (0.84-1.07)
Middle	2853	1.90* (1.79-2.08)

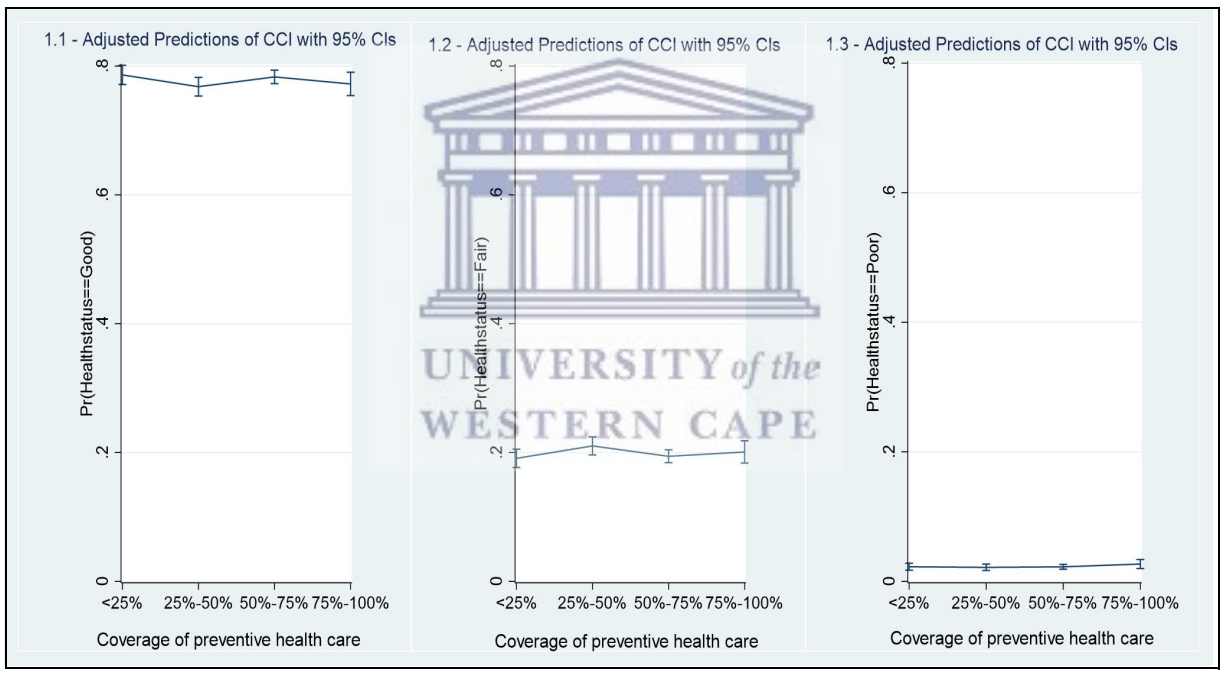
Characteristics	N	Children health status, OR (95% CI)
Richer	3179	1.79*** (1.70-1.90)
Richest	3093	1.80*** (1.70-1.90)

*** p<0.001, ** p<0.01, * p<0.05, OR: Odds Ratios, CI: confidence interval, N = number of observations

Source: Authors' own calculations from end-line survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

The predicted probability of children being at a particular health status at each level of CCI was calculated by multinomial logistic regression, based on the probabilities that were saved for each case record, as presented in Figure 1. The results show that CCI is a good predictor of children's health status.

Figure 1. Predicted probability of being each children health status at each level of coverge of preventive health care



Source: Authors' own calculations from end-line survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

DISCUSSION

This study demonstrates relationships between maternal preventive health care use and children's health status in Burkina Faso. Preventive health care factors and the variables related to the household and the mother were associated with children's health.

On average, an increase in the level of CCI was associated with an increase in the probability of predicting each child's health status, but this trend was not consistent. These results suggest that other factors not taken into account here may also influence the health status of children. Further, the CCI is a composite measure, and a low level of the CCI may reflect a low level of one of the components, while other components may have high levels. We were not able to assess the predicted probability of the influence of each component of the CCI on children's health status, but it is likely that some components are more strongly associated than others. For example, the results of the analysis presented in Table 2 show that modern contraceptive methods' use was not associated with children's health.

This study shows that several of the preventive health care factors linked to the mother are associated with their children's health status. The variables skilled attendant at birth and received skilled antenatal care were positively correlated with children's health status. This result was consistent with the study conducted by Ghimire et al. (2019) in Nepal in 2019, which showed that family planning interventions as well as the promotion of universal skilled antenatal care (at least two doses of the tetanus vaccine) are essential in helping improve child survival in Nepal [27]. Skilled attendant at birth was also found to be associated with children's health status. This finding is consistent with previous studies conducted by Walker et al. (2013) in 71 countries on the patterns of maternal, newborn and child health coverage, showing that substantial reduction in child deaths is possible, but only if intensified intervention efforts, e.g. for SBA, are implemented successfully in every country [28].

It appears that improvement in mothers' preventive health care practices, including having a skilled attendant at birth and receiving skilled antenatal care interventions, is key to improving children's health in sub-Saharan Africa [29]. It has been suggested that effective implementation of cost-effective preventive health care interventions for mothers (skilled antenatal care, SBA and child vaccination) can improve children's health status in low-income countries [24,27,30–32].

CONCLUSION

This study found that children who had received vaccination against measles, whose mothers had received a skilled attendant at birth of the child, those who had received skilled antenatal care and received skilled postnatal care had greater odds of being in good health in Burkina Faso. This finding indicates that activities should be conducted among women of childbearing age, aimed at increasing knowledge and awareness of the importance of skilled antenatal care, skilled attendant at birth, child immunisation, skilled postnatal care and other preventive measures for child health.

Authors' contributions: HB developed the detailed plans for the fieldwork, designed the data collection instruments, implemented and supervised the fieldwork. HB and AS conceived and designed the paper and developed the analysis strategy. HB analysed the data and wrote the first draft. All authors reviewed, provided input to and approved the final paper. AS is the overall guarantor and the corresponding author.

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Ethics and consent: There are no constraints or restrictions weighing on the autonomy and independence of the study or the publication of its results. The Ethics Committee of the Medical Faculty of the University of Heidelberg (Protocol number S-272/2013) and Burkina Faso National Ethics Committee (Protocol number 2013-7-06) have approved the study.

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Mothers' Preventive Health Care Practices and Children's Survival in Burkina Faso: Findings from Repeated Cross-sectional Household Surveys

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Abstract: The significant reduction in the level of child mortality in both developed and developing countries over recent decades has led to an improvement in children's health. The implementation, monitoring, and evaluation of the health programs needed to reduce child mortality require determination and an understanding of the factors responsible for this reduction. This study investigated factors that have contributed to the recent improvement in the survival of children under five, focusing on the contribution of preventive health care in improving children's survival rates in Burkina Faso.

The data used come from baseline and end-line surveys designed to evaluate the impact of performance-based financing (PBF) on health programs in Burkina Faso. Using time-series for health districts and child-level logistic regression models, we estimated the effect of preventive health care, as summarized by the changes in the composite coverage index (CCI), on under-five child survival of temporal trends and covariates at the household, maternal, and child levels.

At the health district level, a unit increase in standardized CCI was associated with an improvement in under-five child survival after adjustment for survey period effects. The linear regression analysis showed that a standardized unit increase in CCI was associated with an increase in the percentage of children under five who survive. At the child level, the logistic regression showed that a skilled attendant at birth (SBA), wealth index, and mother's parity were associated with under-five children's survival, after adjustment for the survey period effects and a set of household, maternal, and child-level covariates.

Preventive health care is important in improving under-five children's survival, whereas the effects of economic growth in Burkina Faso remain weak and inconsistent. Improved coverage of preventive health care interventions are likely to contribute to further reductions in under-five mortality in Burkina Faso.

Keywords: Child mortality · Preventive health care · Maternal and child health interventions · Burkina Faso

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1 Introduction and literature review

The health of children under the age of five is a major priority for developing countries (*Rockli et al.* 2018). According to recent studies, a significant reduction in the levels of child mortality over the last decades in both developed and developing countries has led to an improvement in children's health (*Houweling et al.* 2006; *Houweling/Kunst* 2009; *McKinnon et al.* 2014; *United Nations* 2013; *You et al.* 2015). Despite the overall decline in child mortality in developing countries, there are still unacceptably high levels in sub-Saharan African countries (*Adedini* 2013; *Harttgen/Misselhorn* 2006; *Rajaratnam et al.* 2010).

Like other African countries, Burkina Faso has a high level of under-five mortality (*Liu et al.* 2015; *Munos et al.* 2016). According to the results of the demographic module of the continuous multi-sector survey conducted in 2015, for every 1,000 live births 82 children die before their fifth birthday, and 43 do not reach their first birthday (*INSD* 2015). The results of this survey show that the mortality level of children under 5 declined between 1998 and 2014: from 177 to 82 deaths per 1000 births, respectively. The 2018 United Nations Development Program (UNDP) Human Development Index ranks it 182nd of 189 countries and territories with comparable data. The vast majority of the population (77 percent) lives in rural areas and is afflicted by a high illiteracy level (65.5 percent in 2014). In 2014, the poverty headcount ratio at the national poverty line was estimated at 40.10 percent of the total population (*INSD* 2015).

Previous studies have revealed considerable disparities in Burkina Faso in terms of health service delivery, quality of care and use of obstetric and neonatal care (*Amnesty International* 2009; *De Allegri et al.* 2011; *Dong et al.* 2008; *Gnawali et al.* 2009). Differences were thus observed between various socioeconomic groups in terms of health coverage and results, the differences being particularly marked among indicators relating to maternal and child health at the national level. Progress has been made in recent years to improve these indicators. Apart from inequalities in the risk of death, children are also exposed to inequalities in health care access (*Say/Raine* 2007; *Vilms et al.* 2017). These inequalities result from various institutional, economic, cultural, and individual factors (*Adedini et al*. 2014; *Adedini* 2013; *Boco* 2011; *Braveman et al.* 2004; *Corsi/Subramanian* 2014; *Liwin/Houle* 2019; *Pedersen* 2015; *Susuman* 2015; *Tsawe/Susuman* 2014). One of the direct determinants is the set of mothers' preventive health care practices (*Garenne/Vimard* 1984; *Ghimire et al.* 2019; *Houweling/Kunst* 2009; *Masuy-Stroobant* 2002a/b; *Mosley/Chen* 1984).

First, mothers are the primary caregivers for children. They are responsible for maintaining children's health by providing them with adequate food and training in personal hygiene, both of which are preconditions for preventing illness. They may also be responsible for taking the children to health-care centers when they are ill (*Masuy-Stroobant* 2002a; *Mishra et al.* 2019; *Ouedraogo* 1994).

Second, within explanatory frameworks for child mortality, maternal health-care behaviors represent intermediate variables through which socioeconomic and cultural factors can influence child survival (*Garenne/Vimard* 1984; *Houweling/Kunst* 2009; *Masuy-Stroobant* 2002a/b; *Mosley/Chen* 1984).

In the context of institutional change and the fight against poverty including improvement of the health system, mothers' behaviors have a major impact on their children's survival (*Garenne/Vimard* 1984; *Houweling/Kunst* 2009; *Masuy-Stroobant* 2002a,/b; *Mosley/Chen* 1984). The best strategies for improving child survival occur at the individual level (*Corsi/Subramanian* 2014; *Owais et al.* 2011; *Oyefara* 2014; *Pedersen* 2015; *Tsawe/Susuman* 2014). They involve mobilizing women to adopt behaviors conducive to child survival. Their ability to make better use of the health services available to them and to take responsibility for managing health problems is important for improving children's survival (*Susuman* 2015; *Tsawe/Susuman* 2014; *World Health Organization* 2011).

The implementation, monitoring, and evaluation of the health programs needed to reduce children's mortality require determination and a clear understanding of the factors responsible for making this phenomenon so prevalent (*Barbieri* 1991). Awareness of the contributory factors to this phenomenon is therefore crucial in order to identify or inform the existing health actions, with the aim of further improving the situation and reducing the persistent health inequalities among children from different social strata.

Analyzing the factors associated with child mortality is a particularly complex undertaking. This complexity results from the large number of factors likely to impact on child mortality: demographic, epidemiological, medical, sociological, environmental and genetic. In practice, not all of these data are always available for analysis in a single piece of research, which limited the scope of the previous studies.

The analytical framework adopted for this study is based on that established by *Garenne* and *Vimard* (1984). It distinguishes five levels of variables specific to the analysis: discriminating, independent, intermediate, determining and dependent variables. These correspond to the different levels of analysis and thus to the different levels of explanation. This analytical framework has been adapted in this study to take into account independent (place of residence, household income, mother's education, mother's work) and intermediate (situation of birth, behavior in matters of health, immunity) variables.

In this paper we therefore investigated factors that have contributed to the recent improvement in under-five children's survival in Burkina Faso using data from the baseline (2013) and end-line (2017) surveys for the impact evaluation of performance-based financing (PBF)[1] in Burkina Faso. Specifically, we focus on the contributions of the main preventive factors associated with under-five children's survival in Burkina Faso. In other words, we seek to determine whether antenatal care visits, family planning needs satisfied (FPS), skilled birth attendants at delivery (SBA), and vaccination best practices have contributed to improving the under-five children's survival rate in Burkina Faso.

[1] Performance-based financing (PBF) or pay-for-performance (P4P) is a form of incentive where health providers are, at least partially, funded on the basis of their performance to meet targets or undertake specific actions. It is defined as fee-for-service-conditional-on-quality (WHO).

2 Materials and Methods

2.1 Data source

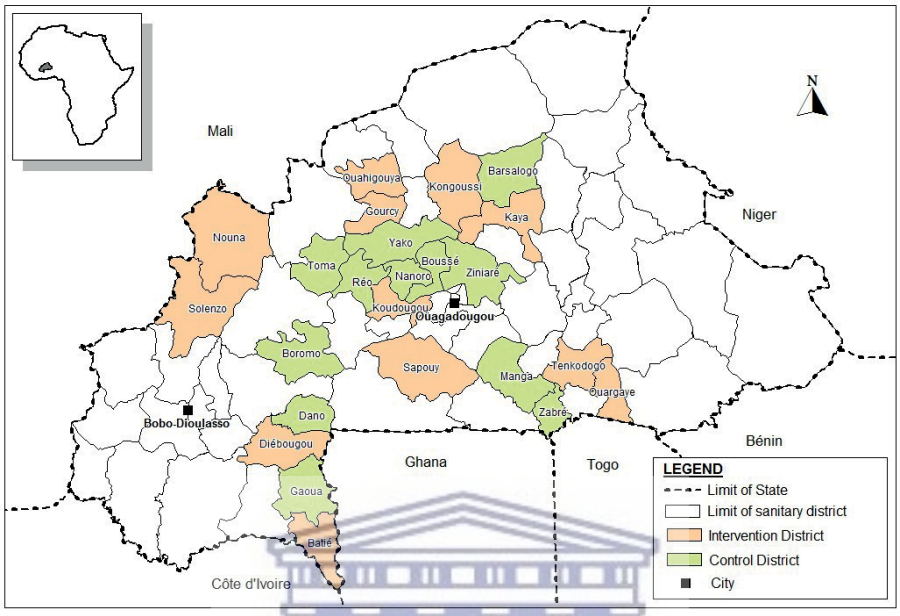
To achieve the objectives of this study, two quantitative data sources were used: baseline survey data (2013) and end-line survey data (2017) for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso. The PBF impact assessment was a blocked-by-region cluster random trial based on a pre-post comparison design. This process of random allocation seeks to ensure that the different study groups are comparable in terms of observed and unobserved characteristics that could affect treatment outcomes, thereby allowing average differences in outcomes to be causally attributed. The aim was to compare the indicators between intervention and control areas over a period before and after the intervention. In the protocol, it was planned to trace households and health facilities from the baseline survey to the final survey.

The choice of health regions was guided by the low level of maternal and child health indicators there. In each region (Center North, Center West, North, South West, Boucle du Mouhoun and Center Est), two health districts (HD) of intervention were selected by the Ministry of Health and two control districts in the same or in a neighboring region based on their relative proximity and similarity to the intervention districts in the targeted regions (Fig. 1). Within each HD of intervention, all the health facilities (HFs) – Centre de santé et de promotion sociale (CSPS), or Centers for Health and Social Promotion, and Centre médical avec antenne chirurgicale (CMA), a medical center with surgical satellite services, and a district hospital – were included. In each HD control, the number of selected HFs was proportional to the size of the health district.

A simple random draw of the number of HFs was performed in each health district based on one HF control for four HFs of intervention. A total of 529 HFs were investigated, including 428 rural CSPS. To be exact, 413 were visited in the intervention zones, and 116 in the control zones.

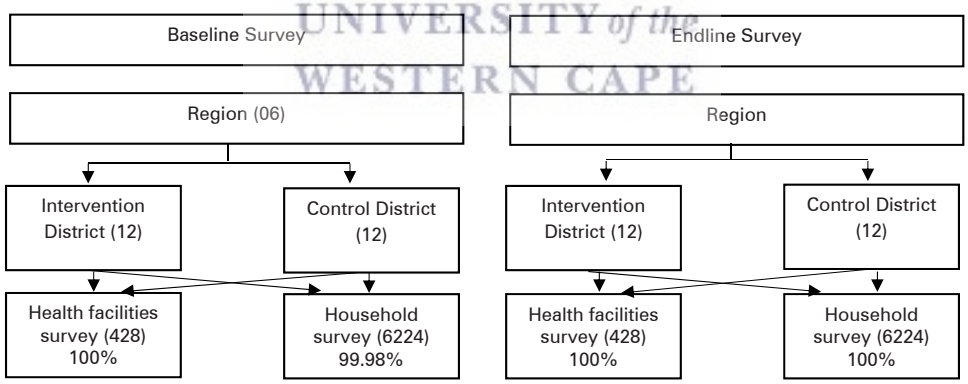
Each rural CSPS was associated with a village in its health area in which 15 households were selected for the survey. Fifteen households were randomly drawn from each village. Data collection for the baseline and end-line survey included a household and a facility-based survey. The household survey applied a two-stage sampling procedure (15 households per selected village). The questionnaire was administered to the head of household and women aged 15-49 years. The facility-based survey comprised different tools for data collection with different data sources and respondents: health facility records, providers' questionnaire, direct observations (curative consultations of under-5 and antenatal consultations), exit interviews (curative and antenatal consultations), Community Health Workers (CHW) (questionnaire). All health facilities and all households included in this study responded to the questionnaires. This paper is based on the household survey.

Fig. 1: Study area – Control and intervention health districts for baseline and endline survey, Burkina Faso



Source: Author's own production from base maps of the Geographic Institute of Burkina Faso

Fig. 2: Survey design diagram



Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

2.2 Study population and sample sizes

Two study populations were used in this study. First, we examined the study population based on an ecological time-series design, with health districts repeatedly observed over time. In this design, the lowest level of analysis was the health district, and 48 survey-period observations were available for analysis, covering 24 health districts observed in two periods (2013 and 2017).

Second, we used a repeated cross-sectional design, with children under five at the lowest unit of analysis. One of the main advantages of this second approach is its ability to take into account the factors that can influence both child mortality and economic development indicators. In this second level of analysis, children from both surveys were grouped together, and the child's likelihood of death was examined in the five years immediately preceding the survey. In total, 37,244 children were involved in this analysis, after exclusion of missing covariate data.

2.3 Selected Variables

Dependent variables

This study used two dependent variables, corresponding to the two study populations. In the ecological time-series design, the dependent variable is the proportion of under-five surviving children for the five-year reference period in each survey. In the child-level design, the dependent is the probability of child death occurring within five years prior to the survey. These are children born during the five years preceding the date of each survey used in this study. The question of the survival status of each live-born child made it possible to distinguish between surviving and deceased children. The age at death was recorded for each child who died.

Intermediate variables

The independent variables are those that report on mothers' practices in preventive health care. Based on prior literature and the database used in this study, we selected six preventive health care measures that have been shown to reduce child mortality from the major causes of under-five deaths, and that can be summarized as a composite index for comparability (CCI) between HDs and within HDs over time (*Aaby et al.* 1996; *Barros/Victora* 2013; *Victora et al.* 2005, 1997). The preventive health care measures included were family planning needs satisfied (FPS), skilled birth attendants at delivery (SBA), at least one antenatal care visit with a skilled provider (ANCS), and vaccination for children against diphtheria-pertussis-tetanus (DPT3, three doses), measles (MSL), and tuberculosis (BCG) vaccination. The coverage of these preventive health care measures at health district (HD) level was summarized using the CCI, which is based on the following weighted average of the six preventive health care measures:

$$\mathrm{CCI} = \frac{1}{3}(\mathrm{FPS} + \frac{\mathrm{SBA} + \mathrm{ANCS}}{2} + \frac{2\mathrm{DPT3} + \mathrm{MSL} + \mathrm{BCG}}{4}) \quad (1)$$

The CCI is a composite measure. The CCI gives equal weight to family planning and maternal and newborn care and immunization and has been proposed as an effective way to summarize and compare coverage of preventive health care across HDs and over time (*Barros/Victora* 2013; *Corsi/Subramanian* 2014).

Independent variables

At the child level, we used a variety of theoretically important household, maternal and child characteristics as covariates (*Victora et al.* 1997). With regard to the individual characteristics of the mother's social identification, this study retained maternal age at childbirth, parity, educational level, and occupation. Regarding children's characteristics, we used sex of the child, childbirth order, and child preceding birth intervals (*Corsi/Subramanian* 2014; *Vilms et al.* 2017). To better determine the impact of the social and household environment, we used the household wealth index and place of residence.

Statistical analysis

Most of the information collected on child survival focused on events that occurred in the five years prior to the date of each survey. Variables that operationalize mothers' preventive health-care practices (contraceptive methods used, vaccination, antenatal care, place of delivery and an attendance at delivery) were captured only for women who had had a live birth in the five years preceding both surveys.

Due to the nature of the data (collected from the retrospective surveys) and the objectives of our study, we adopted a longitudinal analysis approach. Longitudinal analysis reports on the evolution of the risk of death of a generation or a group of generations. The basic assumption is that children born in the same period are deemed to experience the same conditions that expose them to the risk of an indiscriminate death.

For this study we conducted two separate sets of analyses based on the two study populations described above. For the ecological time-series analysis, we apply linear regression models of form (*Corsi/Subramanian* 2014):

$$y_{ij} = \beta_0 + \mathrm{BC_j} + \mathrm{BS_{ij}} + \beta_1 \mathrm{CCI_{ij}} + e_{0ij} \quad (2)$$

where y_{ij} represents the percentage of surviving children for survey time i in HD j; β_0 represents the constant or the average percentage of surviving children holding CCI constant, and after accounting for HD differences ($\mathrm{BC_j}$); $\mathrm{BC_j}$ represents the HD specific dummy variables estimating percentage differences of surviving children between HD; $\mathrm{BS_{ij}}$ represents the effects associated with dummies for survey years;

$\beta_1 CCI_{ij}$ represents the percentage change of surviving children for a unit change in CCI; and e_{0ij} represents the residuals at the survey-year level i in HD j.

A second set of analyses was implemented using the child-level dataset. In these analyses, the basic model is a logistic regression model with a binary response (y=1 for child is alive during the reference period, y=0 for child death). The outcome of child survival, $Pr(y_{ij}=1)$, is assumed to be binomially distributed $y_{ij} \sim$ Binomial $(1, \pi_{ij})$ with probability π_{ij} related to the set of independent variables X and a random effect for each level by a logit link function:

$$\text{Logit}(\pi_{ij} = \beta_0 + BC_j + BS_{ij} + \beta_1 CCI_{ij} + BX_{ij}) \quad (3)$$

The intercept, β0, represents the log odds of child survival for the reference group, BS_{ij} is a vector of coefficients for dummy variables for survey years, $\beta 1 CCI_{ij}$ represents the log odds of child survival for a one-unit increase in CCI, and the BX represents a vector of coefficients for the log odds of child survival for a one-unit increase for each independent variable. Coefficients were estimated and presented as odds ratios with 95 percent confidence intervals. Odds ratios (ORs), adjusted odds ratios (aORs) and p-value were estimated to capture the association between each independent and covariate variable and child survival (*Harrell Jr.* 2015). The data analysis was performed primarily using version 13 of the Stata software.

3 Results

A total of 20,483 (55.0 percent) and 16,757 (45.0 percent) under-five children from the 2013 baseline and 2017 end-line survey, respectively, were included in the analyses for the impact evaluation of PBF in Burkina Faso. Between 2013 and 2017, the percentage of under-five surviving children increased in a majority (17 of 24) of HDs included in this study, although the rate of change varied across the HDs (Table 1). During this period, the CCI increased in all HDs from an average of 62.7 percent among all health districts in the baseline survey to 69.2 percent in the end-line survey (Table 1). During the period, the CCI increased in all HDs, but the percentage of under-five surviving children fell. Indeed, the percentage of under-five surviving children decreased in 7 of 24 HDs (Manga, Boussé, Yako, Réo, Gaoua, Batié, Boromo), while the CCI increased in these same HDs during the same period.

In both the baseline and end-line surveys, a positive association was seen between HD levels of under-five surviving children and CCI coverage, indicating higher rates of under-five surviving children in HDs with greater preventive health care coverage (Pearson correlation +0.30 [baseline] and +0.74 [end line], $p<0.001$, Fig. 3.1 and 3.2). This association held when the average changes in the percentage of under-five surviving children and CCI over time were examined (Pearson correlation 0.36, $p<0.001$, Fig. 3.3).

At an ecological level (model 1), the linear regression analysis showed that a standardized unit increase in CCI was associated with an increase of 10.0 percent in under-five surviving children after accounting for secular increases in the per-

Tab. 1: Sample size, percentage of under-5 children surviving and CCI for baseline and endline survey in 24 health districts, Burkina Faso

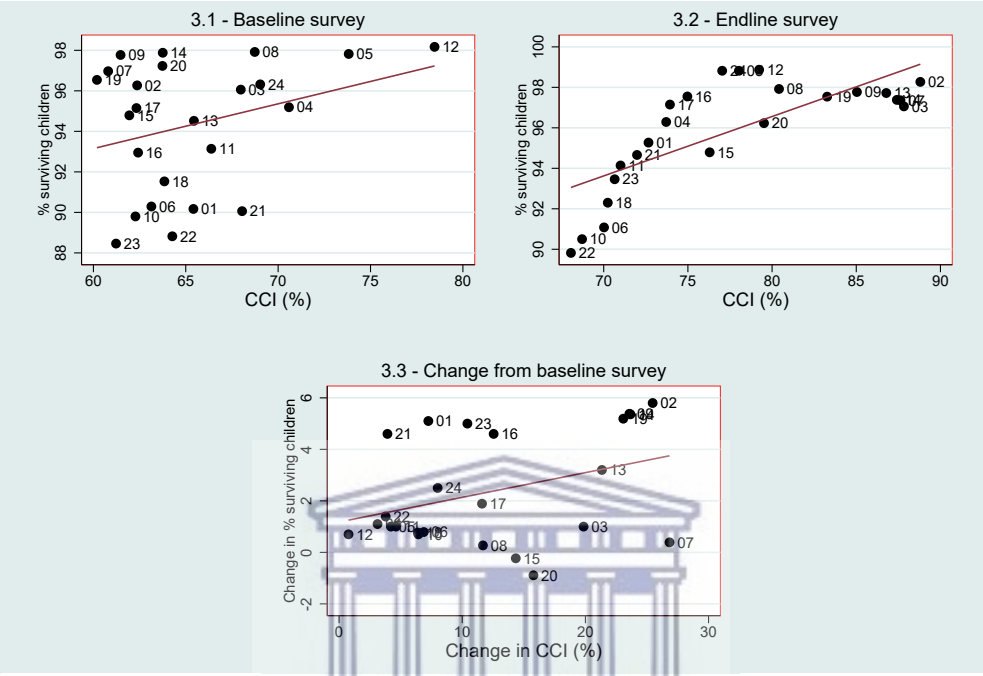
N°	Health District	Baseline survey (2013)			End line survey (2017)		
		N	% Surviving children	CCI	N	% Surviving children	CCI
03	Solenzo	1,166	93.1	62.0	1,080	99.1	70.8
09	Barsalgho	163	98.3	62.7	118	98.8	62.7
14	Nanoro	185	98.3	60.8	175	98.4	66.4
18	Gourcy	1,232	96.3	64.2	1,081	98.3	69.8
02	Nouna	1,678	87.1	62.2	1,484	98.3	69.7
04	Toma	410	94.8	63.6	326	98.3	72.6
08	Zabré	144	97.7	69.3	128	97.9	75.0
05	Manga	367	98.9	64.5	370	97.8	69.0
16	Sapouy	736	96.9	62.6	544	97.6	64.7
10	Kaya	2,001	96.0	63.1	1,680	97.5	68.6
19	Ouahigouya	2,361	96.8	60.5	1,952	97.5	72.5
17	Boussé	562	98.7	60.1	371	97.2	72.5
11	Kongoussi	1,225	91.4	66.9	1,219	97.1	71.9
07	Ouargaye	1,061	97.4	63.4	921	97.1	68.6
12	Ziniaré	707	94.8	62.7	492	97.0	69.2
13	Koudougou	2,289	95.0	62.4	1,601	96.7	65.9
06	Tenkodogo	961	94.9	60.9	732	96.4	67.5
20	Yako	690	97.0	61.1	503	96.2	69.8
15	Réo	691	98.2	62.0	508	94.8	66.0
24	Gaoua	181	94.1	57.5	152	92.8	65.5
21	Batié	354	98.1	58.6	324	92.7	66.9
01	Boromo	427	94.0	65.5	318	92.3	73.8
23	Diébougou	726	88.7	61.3	552	91.5	66.0
22	Dano	167	89.3	64.3	121	89.8	67.4
	Total	20,483	94.8	62.7	16,757	97.0	69.2

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

centage of under-five surviving children as captured by the survey period's fixed effects (Table 2). In these analyses, CCI was associated with an increase in under-five surviving children, indicating a multiplier effect of under-five surviving children independent of survey period effects.

In a second model (model 2), a child-level analysis was conducted that included all preventive health care associated with under-five children's survival. Table 3 shows the sample sizes and unadjusted (OR) and adjusted (aOR) odds ratio by preventive health care variable: ANCS ($p<0.05$), SBA ($p<0.001$), and full immunization ($p<0.05$) were associated with under-five children's survival. Indeed, children

Fig. 3: Correlation between under-five children surviving and CCI at baseline (panel 3.1, n=24 surveys) and end-line (panel 3.2, n=24 surveys) surveys and correlation between the change in under-five children surviving and change in CCI from baseline (panel 3.3, n=24 surveys)



Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

whose mothers had no access to skilled antenatal care or a skilled attendant at birth are less likely to survive. The children under five who did not receive full immunization are less likely to survive.

Model 3 includes, in addition to the variables of preventive health care, covariates related to the household, the mother, and the child in the child-level analysis.

Table 4 presents the results of the bivariate analysis of child survival and the covariates related to the household, the mother, and the child. The wealth index, place of residence, mother's age at birth, maternal occupation, sex of the child, birth interval and birth order were significantly associated with the survival of the child. For multivariate analysis, the results of this model presented in Table 4 show that household wealth quintile (rich, richest) and received skilled attendant at birth (SBA) were associated with better under-five child survival. Indeed, it is noted that maternal age at childbirth (25–29 years, aOR=0.73) and high parity is associated with a low chance of under-five child survival (aOR=0.59 for 4-6 parity and aOR=0.42 for 7&+). Children from rich and richest households (aOR = 1.4 for richest, aOR=1.23 for rich, were less likely to die before their 5th birthday than those from the poorest households.

Tab. 2: Coefficients of the health district model (ecological model) predicting under-5 children surviving across 48 survey periods in 24 Health Districts, Burkina Faso (model 1)

Variables	Model 1	
	Beta	Standard Error (SE)
Survey period		
Baseline (reference)		
End line	0.33	1.26
Composite coverage index (per Standard deviation (SD) increase)	0.10	0.15
Constant	88.77	8.69

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

Tab. 3: Bivariate odds ratios (OR), and multivariable adjusted odds ratios (aOR) of child survival according to preventive health care (Model 2)

Variables	Children, n	%	Odds Ratio	95% CI	P-value	Adjusted Odds Ratio	95% CI	P-value
Family planning needs satisfied (FPS)								
Yes	9,135	24.53	1.00			1.00		
No	28,112	75.47	1.05	(0.91 - 1.21)		0.94	(0.71 - 1.26)	
Received skilled antenatal care (ANCs)								
Yes	30,238	81.19	1.00			1.00		
No	7,006	18.81	0.93	(0.81 - 1.06)	*	0.46	(0.23 - 0.95)	*
Skilled attendant at birth (SBA)								
Yes	27,403	73.58	1.00			1.00		
No	9,841	26.42	0.74	(0.63 - 0.87)	***	0.69	(0.51 - 0.93)	*
Full immunization								
Yes	22,175	59.54	1.00			1.00		
No	15,069	40.46	0.83	(0.68 - 1.00)	*	0.80	(0.65 - 0.98)	*

*** p<0.001, ** p<0.01, * p<0.05, OR: Odds Ratios, CI: confidence interval, n = number of observations

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

Tab. 4: Bivariate odds ratios (OR), and multivariable adjusted odds ratios (aOR) of child survival according to preventive health care, child, maternal and household-level covariates (Model 3)

Variables	Children, n	%	Odds Ratio	95% CI	P-value	Adjusted Odds Ratio	95% CI	P-value
Survey period								
Baseline	20,483	55.00	1.00			1.00		
Endline	16,757	45.00	1.57	(1.52 - 1.64)	***	1.47	(1.37 - 1.62)	***
Household wealth quintile								
Poorest	6,464	17.36	1.00			1.00		
Poorer	6,935	18.62	1.17	(0.99 - 1.39)	*	1.22	(1.00 - 1.50)	
Middle	7,36	19.77	1.13	(0.96 - 1.34)		1.21	(0.99 - 1.47)	
Rich	8,197	22.01	1.16	(0.99 - 1.36)		1.23	(1.01 - 1.49)	*
Richest	8,279	22.23	1.35	(1.14 - 1.59)	***	1.40	(1.14 - 1.72)	***
Area of residence								
Urban	16,958	45.54	1.00			1.00		
Rural	20,277	54.46	1.63	(1.47 - 1.81)	***	0.93		
Maternal age at child birth								
15-19	3,200	8.60	1.00			1.00		
20-24	8,328	22.37	1.12	(0.94 - 1.33)		0.79	(0.58 - 1.07)	
25-29	10,293	27.65	1.37	(1.13 - 1.67)	**	0.73	(0.54 - 0.99)	*
30-34	7,906	21.24	1.32	(1.05 - 1.65)	*	1.11	(0.80 - 1.53)	
35-39	4,855	13.04	1.35	(0.99 - 1.82)		1.29	(0.90 - 1.83)	
40-44	2,011	5.40	1.82	(1.02 -3.28)	*	1.25	(0.83 - 1.89)	
45-49	651	1.75	0.66	(0.24 - 1.83)		1.22	(0.70 - 2.11)	
Maternal education								
No education	35,041	94.08	1.00			1.00		
Primary &+	2,205	5.92	1.16	(0.92 - 1.47)		1.27	(0.92 - 1.75)	
Maternal occupation								
No working	17,592	47.23	1.00			1.00		
Working	11,887	31.92	0.87	(0.78 - 0.97)	**	0.92	(0.81 - 1.05)	
Parity								
1-3	17,443	46.83	1.00			1.00		
4-6	14,231	38.21	0.67	(0.60 - 0.76)	***	0.59	(0.50 - 0.70)	***
7 & +	5,570	14.96	0.57	(0.49 - 0.67)	***	0.42	(0.33 - 0.54)	***
Sex of child								
Male	18,935	50.84	1.00			1.00		
Female	18,309	49.16	1.14	(1.03 - 1.27)	*	1.13	(1.00 - 1.29)	
Birth order								
1st child	7,526	20.31	1.00			1.00		
2-3	8,938	24.12	1.46	(1.26 - 1.69)	***	1.23	(0.71 - 2.13)	
4-5	3,366	9.08	1.45	(1.18 - 1.78)	***	1.64	(0.91 - 2.92)	
>= 6	17,234	46.50	1.46	(1.28 - 1.66)	***	1.38	(0.79 - 2.42)	

Tab. 4: Continuation

Variables	Children, n	%	Odds Ratio	95% CI	P-value	Adjusted Odds Ratio	95% CI	P-value
Birth interval								
1st chid	7,915	21.25	1.00			1.00		
<=24 months	2,617	7.03	0.90	(0.75 - 1.09)		0.67	(0.38 - 1.18)	
24-47 months	15,592	41.86	1.66	(1.45 - 1.90)	***	1.61	(0.94 - 2.76)	
>=48 months	11,120	29.86	1.70	(1.47 - 1.96)	***	1.43	(0.82 - 2.48)	
Family planning needs satisfied								
Yes	9,135	24.53	1.00			1.00		
No	28,112	75.47	1.05	(0.91 - 1.21)		1.03	(0.89 - 1.20)	
Received skilled antenatal care								
Yes	30,238	81.19	1.00			1.00		
No	7,006	18.81	0.93	(0.81 - 1.06)	*	0.89	(0.58 - 1.37)	
Skilled attendant at birth								
Yes	27,403	73.58	1.00			1.00		
No	9,841	26.42	0.74	(0.63 - 0.87)	***	0.77	(0.58 - 1.37)	**
Full immunization								
Yes	22,175	59.54	1.00			1.00		
No	15,069	40.46	0.83	(0.68 - 1.00)	*	0.84	(0.67 - 1.05)	

*** p<0.001, ** p<0.01, * p<0.05, OR: Odds Ratios, CI: confidence interval, N = number of observations

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

4 Discussion

This study aimed to investigate the main preventive health-care factors associated with under-five children's survival in Burkina Faso. The results of this study support the conceptual framework that guided this study, namely, that the intermediate variables related to preventive health-care factors and the independent variables related to the household, mother and child were associated with under-five children's survival in Burkina Faso. Improvement in preventive health care coverage (use of family planning, skilled antenatal care, SBA, and full immunization) was associated with an increase in under-five children's survival in Burkina Faso. This association was significant for the two types of populations considered in this study.

On average, the increases in CCI correlated with increases in the percentage of under-five surviving children, however not all HDs fit this trend. These findings suggest that other factors not considered here may also be influencing changes in the percentage of under-five surviving children. Further, the CCI is a composite measure, and a decline in CCI may reflect one of the components decreasing over time while other components may have increased. We were not able to assess the association of each component of the CCI with the percentage of under-five surviv-

ing children, but it is likely that some components are more strongly associated than others. For example, the results of the analysis presented in Table 4 suggest that a skilled attendant at birth is particularly important in increasing the percentage of under-five surviving children. It is therefore possible that increases in coverage of certain interventions (but not others) may result in an improvement in the percentage of under-five surviving children without a corresponding improvement in CCI.

This paper shows that several preventive health care factors are associated with children's survival. A study conducted in 35 sub-Saharan countries in 2014 (*Corsi/Subramanian* 2014) on DHS data showed that under-five children's mortality was related to the coverage of skilled antenatal care, SBA, vaccinations, and so on. Also, *Ghimire et al.* (2019) conducted a study in Nepal in 2019 that showed that family planning intervention as well as the promotion of universal skilled antenatal care (at least two doses of the tetanus vaccine) are essential in helping improve child survival in Nepal.

Another study conducted by *Walker et al.* (2013) in 71 Countdown to 2015 priority countries[2] on the patterns of maternal, newborn, and child health coverage showed that substantial reductions in child deaths are possible but only if intensified intervention efforts, e.g. for SBA, are implemented successfully within each of the Countdown countries.

It appears that health system improvements, including the scaling up of key maternal, newborn and child health (MNCH) interventions, are a key explanation for reductions in U5MR in sub-Saharan Africa. For example, in Tanzania between 1999 and 2004-05, the coverage of interventions relevant to child survival improved substantially (*Masanja et al.* 2008).

It has been suggested that effective implementation of cost-effective preventive health-care interventions can prevent much of the current under-five mortality in low-income settings (*Black et al.* 2003; *Bryce et al.* 2006; *Victora et al.* 2005). Based on our child-level analyses, it appears that the coverage of health interventions has played a relatively important role in reducing child mortality. However, it is not clear whether these improvements are being driven by supply side increases in the national or regional availability and coverage of health services and interventions, or through increased demand and access at an individual level.

Based on the results of this study, concentrated efforts aimed at sensitizing the population (especially women of childbearing age) to the use of family planning, skilled antenatal care, SBA, and child vaccination will help improve the survival of children (*Corsi/Subramanian* 2014; *Ghimire et al.* 2019; *Rockli et al.* 2018; *Walker et al*. 2013). This indicates that activities aimed at increasing knowledge and awareness of the importance of family planning, skilled antenatal care, SBA, child immunization, and other preventive measures for child survival should be conducted with women of childbearing age.

[2] The Countdown to 2015 for Maternal, Newborn, and Child Survival initiative monitors coverage of priority interventions to achieve the Millennium Development Goals (MDG) for reduction of maternal and child mortality.

In this study, it was not possible to explore certain important variables revealed in studies of factors associated with child survival, such as those related to the quality of the pregnant woman's diet, to children's nutrition in general, and to breastfeeding in particular. These variables were not taken into account in the analysis because of the quality of the information about these variables in the database. Recommendations for future research include qualitative studies to provide a much deeper understanding of the factors that contribute to child survival. Future research on this topic should explore the quality of pregnant women's nutrition, child nutrition, the beliefs of women and their partners, and the influence of partners and the extended family on issues surrounding the adoption of preventive health care with the aim of improving child survival.

5 Conclusion

This study found that children whose mothers had not received SBA at the birth of the child, those with high parity, and children who had lived in poorer and the poorest households were at greater risk of experiencing under-five mortality in Burkina Faso. Hence, to achieve Sustainable Development Goal (SDG) child survival targets, the present findings indicate the need for family planning interventions such as the promotion of contraception as well as universal SBA coverage. In addition, these interventions should target women from socioeconomically marginalized groups as well as those who have lived in poorer and the poorest households.

Burkina Faso could attain child survival Sustainable Development Goal targets if this trend of improved child survival were to be sustained. Investing in health systems and scaling up key maternal, newborn and child health (MNCH) interventions can produce a rapid improvement in child survival.

Notes

Authors' contributions: HB, ARB and HH developed the detailed plans for the fieldwork, designed the data collection instruments, implemented and supervised the fieldwork. HB and AS conceived and designed the paper and developed the analysis strategy. HB analyzed the data and wrote the first draft. All authors reviewed, made inputs to and approved the final paper. AS is the overall guarantor and the corresponding author.

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