Essays on Patient and Provider Behaviors for Maternal and Child Health

Essays on Patient and Provider Behaviors for Maternal and Child Health

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Zeina Ali Siam

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Abstract

This thesis addresses research questions pertaining to maternal and child health using a multi-level perspective, building on existing evidence that emphasizes the essence of considering demand-side, supply-side and contextual factors in advancing health. The dissertation uses quantitative methods to particularly answer the following questions:

1. Assessing whether accuracy of perceived quality levels at facilities predicts pregnant women's utilization of better care for delivery;
2. Investigating whether rewards and penalties predict superior provider effort in the context of primary care in Lebanon; and
3. Analyzing whether certain providers within the Palestinian health system experience higher demand for maternal care during conflict.

The dissertation uses multiple datasets to answer these questions. The first and second papers are secondary analyses and use primary data collected for a randomized control trial in Kenya and an observational study in Lebanon, respectively. The third paper utilizes publicly available data from three sources: Nationally representative surveys of women within the reproductive age, and data on population size, and casualties. Altogether, the papers apply several types of models, including multi-level Poisson models and multivariate logistic and linear regressions. The papers also use various sensitivity analyses to assess the robustness of the findings.

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TO JERUSALEM, THE CITY OF PEACE

TEN WHOLE YEARS APART, NOT A DAY HAS PASSED WITHOUT THINKING OF YOU

I HAVE WORKED HARD JUST FOR YOU, TO REPRESENT YOU IN EVERY PIECE OF WORK I DO

I OWE IT ALL TO YOU

THE PERSISTENCE, RESILIENCE, AND DEDICATION MY ANCESTORS PASSED INTO MY BONES FROM YOU

THAT SPIRITUAL PEACE WITHIN ME, AS A MUSLIM, CHRISTIAN AND JEW

I VOW TO NEVER TIRE OF MY LIFE-LONG RESPONSIBILITY TOWARDS YOU

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Chapter 1: Introduction

1.1 MOTIVATION

The world has made remarkable progress in maternal and child health since the international community's pledge to achieve the Millennium Development Goals in 1990 [1,2,3,4]. Focusing on improving access to needed services, global initiatives concentrated on increasing immunization coverage, promoting institutional deliveries, and enhancing the availability of antenatal care [1,5,6]. Consequently, maternal mortality ratio and under-5 mortality rate respectively fell by 45% and 53% between 1990 and 2015 [2,3]. The Sustainable Development Goals (SDGs) established a further ambitious agenda for this health domain [7]. The SDGs aim to reduce maternal mortality ratio to less than 70 per 100,000 live births and under-5 mortality to less than 25 per 1,000 live births by 2030 [7].

Recent evidence shows that maternal and child health advancements would gain from an increased focus on technical quality of care [8,9]. A study in India found that a cash incentive program for facility births massively increased utilization without bringing the maternal mortality reductions predicted [10]. At the primary care level, evidence from Tanzania points to significant gaps in the quality of antenatal care due to suboptimal provider knowledge and human resource deficiencies [11,12,13,14]. In the child health domain, a recent multi-country study found that institutional delivery was only weakly associated with improved neonatal outcomes, suggesting that enhanced healthcare quality is essential for newborn survival [15]. At the primary care level, providers' sub-optimal adherence to clinical guidelines was as a common factor for poor asthma control among children in the United States of America, Brazil and several European countries [16]. These examples, among others, collectively stress that improved access to care is rather insufficient alone

[17]. Effective delivery also requires the necessary infrastructure and human resources that enable correct diagnoses, appropriate and timely treatments, and referrals when necessary [18].

The interpersonal experiences providers offer to patients are another cornerstone of effective care for maternal and child health. The patient-provider relationship is a significant predictor of healthcare outcomes [19]. In the context of maternal and child care, provider communication was associated with patients' return to facilities for follow-up, and women's sense of empowerment and control over their health and their children's health [20,21]. A systematic review identified interpersonal care as one of the biggest determinants of women's satisfaction with health services [22]. Several studies also highlight the relationship between good interpersonal interaction and patient satisfaction, drug adherence, and follow-up visits among children and young adults receiving non-emergency care [23,24,25,26,27,28]. This evidence asserts the essence of a continuous relationship between patients and providers where the patients' needs, preferences, respect, and privacy are met [29,30].

Additionally, there is ample evidence stressing that the supply of health services should go hand-in-hand with demand-side policies [31,32,33,34,35]. One study surveying pregnant women in Bangladesh reported that most barriers to healthcare access were on the demand-side, including slow or limited transportation [36]. Other research efforts highlighted health education, knowledge on service availability, perceptions of procedures' safety or benefits as predictors of maternal and child care utilization in Laos, Ethiopia, and Papua New Guinea [37,38,39,40,41]. Heavy workload, cultural norms, and perceptions of health facilities have been identified in other contexts [36,42,43]. These findings show that women are important and active agents in their and their

children's health outcomes. They choose when, how and where to approach the health system with their needs. With that, advancing health requires understanding and shaping the health-seeking behaviors of populations [44].

Finally, supply-side and demand-side strategies should be viewed and evaluated in consideration of the state's context, including the demographic, economic, political, legal, ecological, socio-cultural and technological changes and evolutions [44,45,46]. High-performing health systems should be aware of and adaptive to the immediate and gradual contextual factors that influence populations' health needs [18,47].

Recently, *The Lancet Global Health* Commission on High-Quality Health Systems has underscored the importance of a multi-level approach to maternal and child health [18]. The Commission proposed a framework that builds on past academic efforts for health systems-level thinking, including the World Health Organization building blocks and the control knobs [18,48,49]. The Commission's framework deemed both the health system and the people as foundations of effective care. It also enlisted resiliency and response to evolving contextual factors as one of the essential properties of high-quality health systems [18].

1.2 THESIS OVERVIEW

My dissertation follows a multi-level approach to health; it investigates demand-side, supply-side and contextual factors pertaining to maternal and child health in middle-income countries. The three studies that compose my dissertation particularly focus on patient and provider behaviors and attempt to bring policy-level insight.

On the demand-side, I focus on measuring the ability of patients to discern which facilities provide the best care in an area where healthcare quality regulation is sub-optimal within Kenya. Chapter 2, *"*Accuracy of Patient Perceptions of Maternity Facility Quality and the Choice of Providers in Nairobi, Kenya: A Cohort Study*"*, investigates information asymmetry between pregnant women and maternity facilities within the slums of Nairobi. Hundreds of widely varying maternity facilities operate in Nairobi. These facilities however are not well-regulated and many do not meet minimum quality standards [50]. Although facility-delivery is nearly universal in the capital, maternal and newborn mortality rates in Nairobi's informal settlements have been reported to be among the highest in the world [50]. The context of the informal settlements in Kenya thus necessitates the exploration of demand-side policies to promote the utilization of better care.

I measured technical quality by creating an index that summarizes 19 items obtained from direct assessments that measure facilities abilities' to handle birth complications. Then, using primary data collected on pregnant women's rankings of the facilities according to perceived abilities to handle complications, I quantified women's accuracy of perceptions by benchmarking their rankings to the objective rankings provided by the index. I ran multivariate regressions and found a modest relationship between perception accuracy and the quality levels at women's final facilities of choice, with a significant relationship between accurate perceptions and utilizing top quality facilities. At the policy level, the paper suggests that informing women of facilities' technical quality levels, where quality regulation is sub-optimal, could be an option for enhancing the utilization of high-quality care.

On the supply-side, I focus on incentives as potential determinants of competent care. Chapter 3, "Incentives and Provider Effort: Evidence from a Facility-Level Study in Lebanon," attempts to fill a knowledge gap at the primary care level. The need for effective primary care is especially important in Lebanon today. The influx of over one million Syrian refugees in the last eight years, over 50% of whom are children, exerts pressure on the country's primary care network in terms of providing services for a very vulnerable population, and maintaining effective vaccination and surveillance for any potential pandemic [51].

In this chapter, I assess how facility-level incentives relate to the technical and interpersonal quality of care provided to over 1,000 patients, the majority of whom are children. I use mixed effects models bringing facility-level, physician-level, and patient-level characteristics to assess the relationships. I find facility-level penalties to be significantly associated with better technical quality of care. In contrast, facility-level rewards are associated with better interpersonal interactions with the patients. The results suggest that both forms of incentives could work in complementarity to promote different dimensions of provider effort and consequently high-quality care. In the context of Lebanon, I show that the financial mode of incentives is driving these relationships.

Finally, I explore health systems resiliency for maternal and child health in a political context. Chapter 4, "Towards Evidence-Based Health Systems Resilience: Service Utilization Patterns and Neonatal Mortality in the Palestinian Territories During Conflict," assesses the interaction between the health system and the Palestinian-Israeli conflict, one of the most protracted conflicts in the modern history of the Middle East. The long-term nature of the conflict, and its

unpredictability over space and time, make understanding deviations in service utilization patterns and health outcomes policy-relevant questions to building and maintaining health system resilience.

My work assesses patterns in service utilization among pregnant women at times of conflict, building on a recent paper that found a decrease in Cesarean section rates during episodes of political violence in the territories [52]. The study also analyzes the relationship between conflict intensity at time of birth and neonatal mortality, complementing earlier research efforts in the territories showing an increase in the prevalence of low birth weight at times of turbulence [53]. Merging three data sources, I match reported births from four nationally representative surveys conducted in 2004, 2006, 2010 and 2014 with the corresponding conflict intensities, quantified as causalities per 100,000 population, by time and location of birth. Findings point to a significant increase in the utilization of governmental facilities, a significant decrease in the odds of utilizing non-governmental organizations, and a marginal decline in the odds of utilizing the private sector. There is no overall association between conflict and neonatal mortality, a possible indicator that the quality of care for neonatal health may overall not be compromised. The paper suggests that emergency preparedness should possibly concentrate in the public sector for deliveries.

1.3 AUTHORSHIP

I am the first author on all three papers. I led the development of the hypotheses, conceptual frameworks, as well as the statistical models and analyses. I wrote initial drafts of each paper and received valuable edits and feedback from my mentors, co-authors and colleagues.

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Chapter 2: Accuracy of Patient Perceptions of Maternity Facility Quality and the Choice of Providers in Nairobi, Kenya: A Cohort Study

Accuracy of Patient Perceptions of Maternity Facility Quality and the Choice of Providers in Nairobi, Kenya: A Cohort Study

ABSTRACT

Objectives. This study aimed to assess the accuracy of pregnant women's perceptions of maternity facility quality and the association between perception accuracy and the quality of facility chosen for delivery. Participants. 180 women, surveyed during pregnancy and 2-4 weeks after delivery. Primary outcome measures. Women were surveyed during pregnancy regarding their perceptions of the quality of all facilities they were considering during delivery and then, after delivery, about their ultimate facility choice. Perceptions of quality were based on perceived ability to handle emergencies and complications. Delivery facilities were assigned a quality index score based on a direct assessment of performance of emergency "signal functions", skilled provider availability, medical equipment and drug stocks. "Accurate perceptions" was a binary variable equal to one if a woman's ranking of facilities based on her quality perception equaled the index ranking. Ordinary least squares and logistic regressions were used to analyze associations between accurate perceptions and quality of the facility chosen for delivery. Results. Assessed technical quality was modest, with an average index score of 0.65. 44% of women had accurate perceptions of quality ranking. Accurate perceptions were associated with a 0.069 higher delivery facility quality score [p=0.039; 95% CI: 0.004, 0.135] and with a 14.5 percentage point higher probability of delivering in a facility in the top quartile of the quality index [p=0.015; 95%CI: 0.029, 0.260]. Conclusion. Patient misperceptions of technical quality were associated with use of lower quality facilities. Larger studies could determine whether improving patient information about relative facility quality can encourage use of higher quality care.

2.1 INTRODUCTION

Sixty six percent of maternal deaths in 2015 took place in Sub-Saharan Africa, a substantial percentage of which result from conditions that are treatable or preventable with high-quality care such as infections and postpartum hemorrhage [1,2,3]. Nearly one-third of deaths in the first 24 hours of life are attributable to a lack of simple measures such as skin-to-skin contact and proper cleaning of the umbilical cord, and around 75% of maternal deaths are due to preventable and/or treatable causes [3,4].

Recent studies show high variability in maternity facility quality levels in the context of Africa and highlight inadequate quality as a major challenge to maternal and newborn mortality reductions [2,5,6,7,8,9,10]. One study found that nearly 90% of maternal care facilities in five African countries lacked the capacity to perform C-sections [5]. Other multi-country studies have found that high coverage of basic essential services may not be enough to reduce delivery-related mortality without improving the technical quality of care received [2,7,8,9]. In Nairobi, Kenya, hundreds of widely varying maternity facilities operate. These facilities are not well-regulated and many do not meet minimum quality standards [11].

Several studies from Africa provide evidence that, while women have strong stated and revealed preferences for delivering in high-quality facilities, many of them do not end up in facilities of high quality [12,13,14,15]. Important factors in determining maternity facility choice are facility cost and distance, as well as women's education level and cultural beliefs [16,17]. Evidence from low-income countries show that perceptions of facility quality may also influence facility choice [13,14,18]. While pregnant women often express preference for delivering with high-quality

providers, the extent to which women can accurately perceive quality prior to utilization is unknown. Asymmetric information about provider quality is a well-known driver of market failures in health [19,20]. Inaccurate perceptions of provider quality may be significant for pregnant women because obstetric and newborn complications are rare, and the technical skills of maternity providers are hard to observe. Several studies have explored questions pertaining to information asymmetry by, for example, investigating women's reliance on or understanding of quality metrics in their decision-making [21,22]. A recent study in Africa also showed a disconnect between women's perceptions of quality and objective technical quality measures [23]. However, none explores the accuracy of women's perceptions of facility quality prior to facility utilization and the degree to which misperceptions of quality are associated with use of lower quality care.

This study measured the accuracy of perceptions of maternity facility quality among a sample of pregnant women in Nairobi, Kenya and analyzed the extent to which accurate perceptions are associated with delivery in higher quality facilities.

2.2 METHODS

Study participants and data collection

We used data collected for a randomized controlled trial described in detail in Cohen et al (2017) [12]. The study took place between 2015 and 2016 in 24 neighborhoods within the informal settlements ("slums") surrounding Nairobi, Kenya. These neighborhoods are densely populated, with limited access to social services [24]. Pregnant women were recruited through community recruitment events, community health worker listings, and snowball sampling. For study inclusion,

women had to be in their 5th-7th gestational month, at least 18 years old, planning to stay in Nairobi until at least 2 weeks postpartum, and intending to deliver at a health facility. Women were surveyed at three time-points: baseline (5th-7th gestational month), midline (8th gestational month) and endline (2–4 weeks after delivery).

The baseline and midline surveys captured basic demographic information and pregnancy-related history. The endline survey captured information about the woman's delivery, including her facility of choice. Three-quarters of the sample was randomly selected to be surveyed at baseline and midline about perceptions of delivery facility quality. Women in this sub-sample were asked to list all facilities being considered for delivery, regardless of how likely they thought it was that they would use the facility. Each facility name was written on a piece of paper and cut out. Women were then asked to rank these facilities on a visual analog ladder scale from best to worst based on different dimensions of perceived quality and cost, with ties allowed. The quality dimension used in this study was women's ranking of facilities based on her perception of their "ability to handle emergencies and complications".

Information about the technical quality of facilities where women delivered was also collected. The facility assessment was adapted from the Averting Maternal Death and Disability Program's emergency obstetric and newborn care (EmONC) Needs Assessment Toolkit [25]. This toolkit assesses inputs including infrastructure, human resources, supplies, and equipment for EmONC. It collects information about performance of "signal functions" of basic and comprehensive emergency obstetric and newborn care, which have been shown to be correlated with delivery

outcomes [25]. The assessment also collected information on recent performance of the routine care signal functions proposed by Gabrysch et al and Tripathi et al [26,27].

Measure of facility technical quality

A facility technical quality index was constructed based on the data collected from the facility assessment. The index captured a facility's ability to handle emergencies and complications through measures of facility process, equipment, supplies and skilled provider availability (Supplementary Table 2A.1). It included 17 facility-reported signal functions measuring recent performance of emergency obstetric and newborn care practices, such as the administration of parenteral oxytocin for postpartum hemorrhage and parenteral antibiotics for newborn sepsis [26, 27]. The index also included a facility-reported variable for whether at least one medical officer was present on site 24 hours a day and 7 days a week, as well as a binary variable for whether the facility was observed to have sufficient stocks of certain essential equipment necessary for common and rare complications as defined by Ngabo et al [28]. The facility quality index was calculated as the fraction among of these 19 variables met at each facility.

Measure of accuracy of quality perceptions

We created a measure of accurate perceptions of facility technical quality using women's rankings during their 8^{th} gestational month. This variable is equal to 1 if the woman's ranking of facilities based on her perception of the facility's ability to handle emergencies matched the actual ranking based on the quality index. For women who had more than one facility with the same relative ranking (17% of the study sample), perceptions were considered accurate if the facilities had an identical quality index score.

Sample

553 women were surveyed at baseline. Among these, 459 women and 454 women were reached for midline and endline, respectively. Attrition was primarily due to temporary relocation around the time of delivery to be with family members, miscarriages, or newborn mortality [12]. The study sample was constructed from the women surveyed at midline who were also randomly selected to be asked about facility quality perceptions (n=334). We restricted the sample to women considering more than one facility, in order for us to assess her quality ranking (n=280), and to women whose consideration sets included at least two assessed facilities (n=221). Finally, we only included women whose delivery facility was assessed. The final analysis sample included 180 women. The characteristics of this analysis sample are similar to the original baseline sample (Supplementary Table 2A.2).

79 health facilities were targeted for assessment in the original study and all but 15 of these were reached for assessment (Supplementary Figure 2A.1). Incompletion was primarily due to facility administrative delays and permanent facility closure. Of these 64 health facilities assessed in the original study, three reported no deliveries in the past three months and 22 were not used by women in our analysis sample. The facility analysis sample thus included 42 facilities, of which 16 were public, 18 were private and 8 were NGO/Mission facilities. 20 of the facilities were hospitals and 22 were health centers.

Statistical Methods

The primary outcome was the quality of facility used for delivery with respect to the facility's ability to manage emergencies and complications, as measured by the quality index. We used

ordinary least squares regressions to analyze the relationship between accurate perceptions and the quality index for the delivery facility used. Adjusted regressions included indicator variables for treatment arm in the original randomized controlled trial (RCT), neighborhood location, gestational month at baseline and the number of facilities in a woman's consideration set. Covariates also included: i) a categorical variable indicating if the woman previously had a C-section or whether the child was a first birth, ii) a binary variable indicating whether she reported receiving information from a health worker that her current pregnancy was high-risk, iii) a binary variable indicating whether she reported that it would be difficult to collect 1,000 Ksh, [roughly 10 USD] if needed for a health emergency, iv) a binary variable for whether she obtained a education or higher, v) a binary variable indicating marital status, vi) a binary variable indicating health insurance status, and vii) a binary variable indicating whether she had 4 or more prenatal care visits. In ordinary least squares and logistic regression specifications, we also estimated the association between accurate perceptions and delivery in a facility in each quartile of the quality index and in facilities at different levels of the health system (primary health center, hospital, and tertiary hospital). Robust standard errors were used in the ordinary least squares specifications.

We tested the robustness of the results to a different definition of facility quality and to a more lenient definition of accurate perceptions. For facility quality, we used the number (count) of Basic Emergency Obstetric and Newborn Care (BEmONC) signal functions (out of 7) performed [29]. For the more lenient definition of accurate perceptions, we consider women who incorrectly ranked two facilities with equal index values as not being tied to have had "accurate" perceptions.

2.3 RESULTS

The mean quality index for the 42 delivery facilities used by women in the study sample was 0.652 (se = 0.240), meaning that the average facility met 65.2% of the quality measures captured in the index. The index ranged from 0.16 to 1 across facilities. Average quality was 0.707 (se = 0.213) for public facilities, 0.544 (se = 0.231) for private facilities and 0.873 (0.193) for NGO/mission facilities. Quality was higher for hospitals than for lower level facilities (0.823 vs. 0.496; $p<0.001$). Supplementary Table 2A.2 presents facilities' performance for each item in the index. There was wide variation in the percentage of facilities meeting each item. For example, most facilities reported administering parenteral antibiotics and oxytocin for maternal sepsis and (pre-)eclampsia, and very few reported conducting assisted delivery with vacuum/forceps.

44% of women had accurate perceptions of facility quality. Table 2.1 presents characteristics of the sample, overall and by perception accuracy. On average, women in the sample were 25 years old, 32.7% of them were pregnant for the first time, and 85.6% were married. There were no statistically significant differences between women with accurate and inaccurate quality perceptions.

Table 2.1. Sample Characteristics (N=180)

Mean/percentage (se)	Overall sample	Inaccurate perceptions	Accurate perceptions	P-Value on Test of Equality: (2)=(3)
	1	2	3	4
Mean age, years	25.34 (4.73)	25.02 (0.43)	25.75 (0.59)	0.31
Married	85.56 (0.35)	85.15 (0.04)	86.07 (0.04)	0.86
Any Secondary or Postsecondary Education	65.56 (0.48)	66.34 (0.047)	64.56 (0.054)	0.80
Electricity in household	93.89 (0.24)	92.08 (0.03)	96.20 (0.02)	0.25
Would be "difficult" or "very difficult" to pay roughly $10 for treatment if household member became ill†	60.00 (0.49)	61.39 (0.05)	58.23 (0.06)	0.67
Health Insurance	38.33 (0.49)	37.62 (0.05)	39.24 (0.06)	0.82
First pregnancy	32.67 (0.47)	27.78 (0.05)	36.71 (0.05)	0.20
Pregnancies, number	2.13 (1.05)	2.15 (0.10)	2.10 (0.12)	0.77
Antenatal visits, number	2.99 (1.05)	2.98 (0.10)	3.01 (0.11)	0.16
Previous C-section (among those with previous birth)	9.83 (0.30)	8.22 (0.03)	12.25 (0.05)	0.46
People with whom delivery location was discussed, number	0.54 (0.76)	0.56 (0.08)	0.51 (0.08)	0.61
Informed by provider to have a high risk pregnancy	8.33 (0.38)	5.15 (0.02)	11.39 (0.035)	0.19

Notes. † Amount converted from Kenyan Shillings (1000) to US Dollars using April 2017 conversion rate of 0.0097.
** p <0.05; ** p< 0.01 ; *** p< 0.001*

Figure 2.1 presents the distribution of the quality index for facilities used by women in the study sample. The mean quality of facility used for delivery was 0.716 and the median was 0.737. Accurate perceptions of facility quality were associated with a 0.075 (p=0.026) higher delivery facility quality in the unadjusted model and a 0.069 (p=0.039) higher delivery facility quality in the adjusted model (Table 2.2). Figure 2.2 demonstrates the fraction of women delivering in facilities of each quartile of the quality index. 10.9% of women with inaccurate perceptions delivered in the highest quartile facilities, compared with 26.6% of women with accurate perceptions (Figure 2.2). Regression coefficient estimates associated with this figure are presented in Supplementary Table 2.A3, along with logistic regression models of the association between perception accuracy and delivery in a facility within each quartile of the quality index.

Figure 2.3 shows multivariate logistic regression estimates of the relationship between perception accuracy and the odds of delivery in facilities at different levels of the health system. Accurate perceptions were associated with 0.49 lower odds of delivering in a primary health center (p=0.084) and 1.73 higher odds of delivering in a tertiary hospital (p=0.199), but neither was statistically significant.

Sensitivity analyses showed that the results were robust to changes in the definition of the quality index and to the construction of the perceptions variable. Accurate perceptions were associated with an increase of roughly 0.5 (out of 7) BEmONC signal functions in the facility used for delivery (Supplementary Table 2A.4). When using a more lenient definition of "accurate perceptions," accurate perceptions were associated with a 0.090 (p=0.009) higher delivery facility quality (Supplementary Table 2A.5).

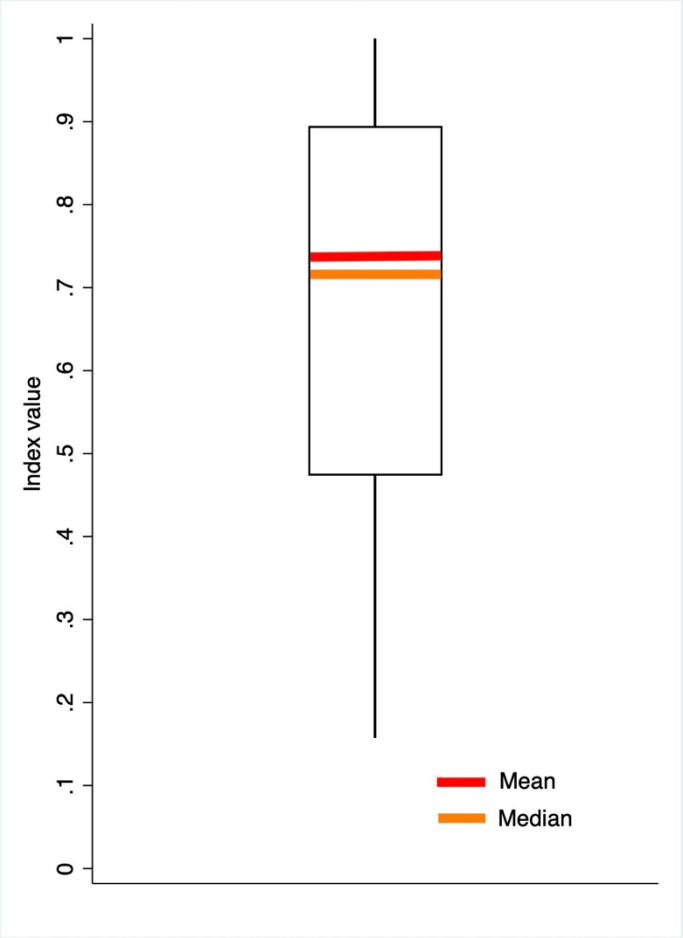

Figure 2.1. Distribution of quality index among facilities used for delivery (N=180).

Notes. Box plot presenting the distribution of the index measure for final facilities of choice in the overall sample of 180 women. Top and bottom horizontal boundaries of the boxes show the 25th and 75th percentiles, respectively, while the extending top and bottom vertical lines denote the 95th and 5th percentiles, respectively.

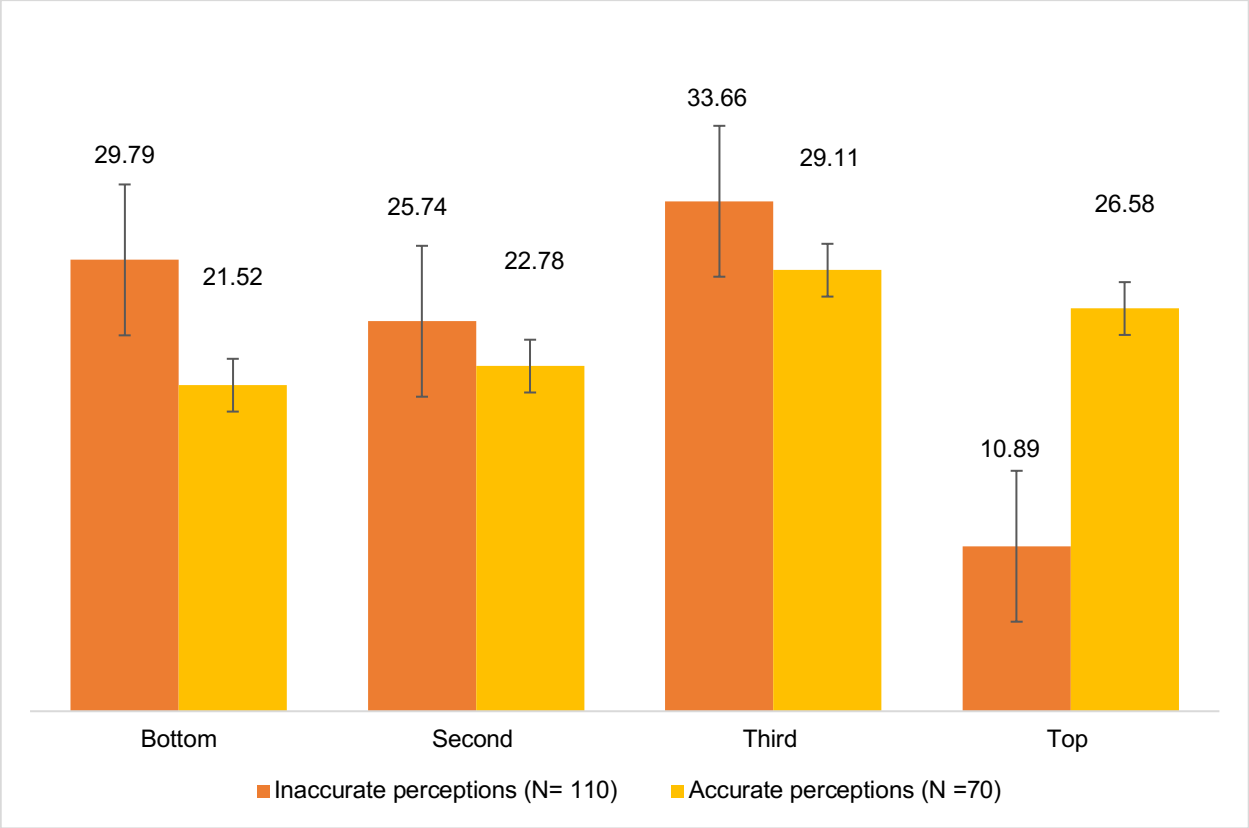

Figure 2.2. Fraction of women delivering in each quartile of quality index, by perception Accuracy (N = 180).

Notes. Quartile ranges: Bottom (0.15-0.47); second (0.53 - 0.74); third (0.79- 0.89); top (0.95 - 1.0)].

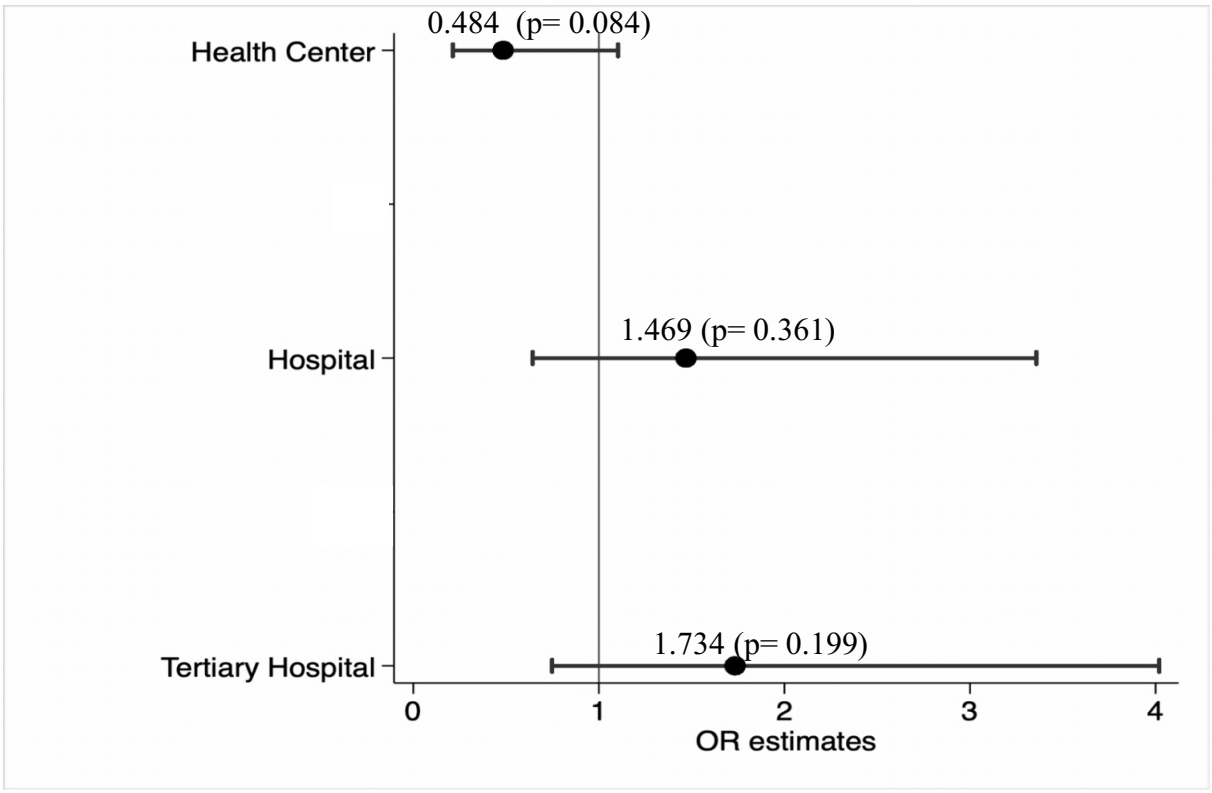

Figure 2.3. Multivariate logistic regressions of delivering in facilities by level (N = 180).

Notes. Multivariate logistic regressions. Each estimate is from a separate regression with odds of delivering at facility level as outcome. All covariates are measured at midline, and missing values are imputed with values reported as baseline.

Table 2.2. Regression Estimates of Association between Perception Accuracy and Quality of Delivery Facility (N=180)

Variable	Unadjusted				Adjusted			
	Estimate	p-value	95% CI		Estimate	p-value	95% CI	
Accurate perceptions of quality	0.075*	0.026	0.009	0.141	0.069*	0.039	0.004	0.135
Antenatal visits, 4+					0.071*	0.032	0.006	0.135
Very Difficult to collect 1000 Ksh					0.042	0.181	-0.020	0.104
Secondary education or higher					-0.065*	0.046	-0.128	-0.001
Consideration set size (Ref = 2)								
3					-0.013	0.741	-0.092	0.066
4+					0.159**	0.001	0.070	0.248
Insurance (self-reported)					0.037	0.246	-0.026	0.099
C-section (Ref = No; not first pregnancy)								
Yes					0.241***	0.000	0.140	0.343
No, because first pregnancy					0.141***	0.000	0.075	0.207
Information about risk in pregnancy by a provider					0.028	0.638	-0.089	0.145
Married					-0.015	0.745	-0.107	0.076

*Notes. Ordinary least squares regressions with robust standard errors. * p <0.05; ** p< 0.01 ; *** p<0.001*

2.4 DISCUSSION

This study found that pregnant women often misjudge the quality of available maternity facilities with respect to their ability to handle emergencies. Accurate perceptions were associated with the use of higher technical quality facilities and with an increase the probability of delivery in the highest-quality (top-quartile) facilities.

Several factors likely contributed to the observed inaccuracy of quality perceptions. First, the maternity landscape in Nairobi, Kenya is complex and women face a substantial degree of choice, with hundreds of different options when choosing a maternity facility. Second, most women do not deliver where they receive prenatal care and there is not a strong role of referral in Nairobi so there are relatively few opportunities to receive information about facilities' technical competence. Additionally, many elements of facility technical quality would be hard for patients to observe and judge. Finally, we do not find meaningful associations between measures of socioeconomic status and quality perceptions. It is possible however that the urban poor patients' perceptions of facility quality are overly positive partly because of the typical living conditions in urban informal settlements and how they compare with the conditions in facilities.

Our study has several strengths. To the best of our knowledge, this is the first study that attempts to quantify the accuracy of patient perceptions of maternity facility quality prior to their delivery. We assess quality perceptions in a context where women have the choice of many widely-varying providers and where the lowest quality facilities appear extremely ill-equipped to manage emergencies. Our study assesses the relationship between stated quality perceptions and facility choice longitudinally, so that perceptions are captured prior to facility choice and delivery

experience. Many studies assess the relationship between patient-reported experiences and assessed facility quality after patients' experience of care [23,30,31]. These studies offer valuable information about how patients' experiences of care align with "objective" measures of facility quality but do not allow for an analysis of how quality perceptions influence facility choice. Our results are also robust to different specifications, covariate adjustment, and constructions of the dependent and independent variables.

Our study has several limitations. First, the sample size was limited and results may not be generalizable to populations outside the urban poor in Nairobi, Kenya. This population is likely to be increasingly important for understanding public health, as nearly one billion people live in urban slums worldwide and more than half of all births are projected to be in urban areas by 2050 [32,33]. Second, while our measure of facility quality was derived from commonly-used indicators in the literature, it was based on facility-reported performance of essential functions and observations of equipment and medications, rather than observations of the actual care women receive in labor and delivery.

There are also several potential limitations to our measure of quality perceptions. In order to align our measure of perceptions with our measure of assessed facility quality, we focused on a facility's emergency capability. However, overall facility quality (and women's perceptions of quality) is based on many factors beyond emergency capability. Full analyses of the relationship between quality perceptions and objective facility quality would need to incorporate the many other dimensions of quality highlighted in the literature including waiting time, respectful care, provider skill, etc [23,34,35]. More research is needed on which aspects of quality perceptions matter most

to women in their choice of delivery facility, and what attributes of quality would most benefit health outcomes when improved [14,23,36,37,38,39]. Furthermore, our study did not necessarily capture the causal relationship between quality perceptions and facility quality. While our estimates were robust to adjustment for measured confounders, potential uncontrolled confounding is still possible.

The United Nations has set ambitious Sustainable Development Goals, which include target reductions in maternal and newborn mortality by 2030 [40]. With poor quality of care estimated to cause half of maternal deaths annually, accelerating progress toward these goals in sub-Saharan Africa requires a shift from ensuring access to institutional delivery toward encouraging delivery in a high-quality facility [41]. Our study supports previous evidence on the wide variation in facility quality that has been found previously in Africa. While our study simply cannot establish a causal relationship between misperception of quality and delivery in high-quality facilities, it suggests that providing information to pregnant women about the quality of available maternity facilities may be a promising approach to steering women toward higher quality options and should be evaluated. To evaluate the potential impact of information on facility delivery choice more research is needed on how to collect and disseminate reliable and comprehensible measures of delivery facility quality in low- and middle-income countries. Future efforts that could complement the results of the study include further investigations of other patient characteristics that predict decision-making and final facility choice, including first pregnancy experience and within-household negotiations [42,43].

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Chapter 3: Incentives and Provider Effort: Evidence from a Facility-Level Study in Lebanon

Incentives and Provider Effort: Evidence from a Facility-Level Study in Lebanon

ABSTRACT

Introduction. Sub-optimal provider effort is a key quality challenge at the primary care level in developing countries. It can manifest in poor adherence to clinical guidelines or limited interpersonal interactions with patients. One suggested pathway to improve provider effort is implementing facility-level incentives. This paper uses observational data to examine the relationship between positive and negative facility-level incentives and the two dimensions of provider effort in primary care facilities in Lebanon. Methods. Data included interviews with 55 chief medical officers and 147 providers, as well as direct observations of clinical appointments with 1,077 patients. Facility-level incentives were the independent variables. Outcome measures were two dimensions of provider effort: technical quality – quantified as the number of routine examinations performed from the clinical guidelines, and interpersonal quality – quantified as the time spent with the patient and the number of questions the provider asks. The relationships between the independent and dependent variables were analyzed using multilevel Poisson regression models. Results. Roughly 67% and 60% of facilities implemented penalties and rewards, respectively. Financial penalties were associated with a 34% increase in the number of routine examinations performed (p=0.02). Implementing reward-based incentives was associated with more time spent with a patient (incident rate ratio (IRR)=1.23, p=0.03) and more questions asked by the provider (IRR=1.22, p=0.03). Conclusion. Penalties and rewards have the potential to complement each other in improving provider effort in Lebanon. Results suggest that penalties could promote higher compliance with clinical guidelines while rewards could enhance interpersonal interactions between providers and patients. Future steps include exploring the

question causally and using qualitative assessments to identify the potential mechanisms through which rewards and penalties work.

3.1 INTRODUCTION

High quality care is essential for advancing human health [1]. At the primary level, quality care involves thorough assessment, correct diagnosis, timely treatment, and respect for the patient [1]. Several factors today, including population aging, rising medical costs, and increased human mobility, make strong routine care delivery at the primary level a major determinant of health outcomes in both the developing and developed worlds [1,2]. Lebanon, where this study takes place, is experiencing a rapid epidemiological transition and an increasing prevalence of non-communicable diseases [3]. It also hosts over one million Syrian refugees, more than half of whom are under 18 years of age [4].

Sub-optimal provider effort is a key barrier to high-quality primary care in developing countries [5,6,7,8,9,10]. Previous literature has identified multiple manifestations of sub-optimal provider effort. The first is absenteeism, due to unscheduled work absence or excessive staff leave-taking [6,7,11]. Absenteeism compromises the quality of services because fewer workers are left on duty, resulting in work overload for the remaining providers or interrupted service delivery.

A second dimension of provider effort is technical quality, the application of adequate and up-to-date medical knowledge [1]. Poor technical care can lead to inadequate treatment of conditions. Evidence from developing countries identify poor application of medical knowledge or guidelines as a reason for sub-optimal treatment and diagnosis at the primary care level [9,10,12,13,14].

Finally, provider effort also manifests in the interpersonal experience among providers and patients. Effective provider communication is an established determinant of healthcare utilization

and health outcomes [15]. In a recent study in sub-Saharan Africa, superior provider communication, measured through diagnosis explanation, symptoms discussion, and attentiveness, was associated with greater likelihood of patients' return to the facilities [16].

Implementing facility-level incentives is a promising accountability strategy for promoting provider effort. Brinkerhoff (2003) proposes two accountability methods for better provider performance: Monitoring mechanisms and incentives [17]. Incentives -both rewards and penalties- can be implemented to create an obligation of individuals or agencies to justify their actions and performance in light of agreed-upon targets and expectations [17]. While their impact has been well explored, the effect of rewards on provider effort remains highly mixed. Financial rewards, often termed as pay-for-performance, have been evaluated extensively for their potential to improve technical quality [18,19,20,21,22,23,24,25]. Results however are inconclusive [21,22,23,24]. Non-financial rewards, such as social recognition, performance reporting, and public reporting, have also been explored and have yielded varying results [26,27,28,29,30,31,32,33]. In contrary, evidence on penalties is limited to technical quality improvements in tertiary care settings within developed countries and focuses almost exclusively on financial penalties [34]. A few studies have pointed out the need to consider and implement different accountability mechanisms concurrently to achieve desired effects on provider performance; nevertheless, this option is not fully studied [35,36,37].

This study aimed to investigate the predictive relationship between incentives (both rewards and penalties) and provider effort, in the context of primary care in Lebanon. We first assess the relationship between the implementation of both incentives and the different dimensions of

provider effort. We then evaluate whether the mode of the incentive (financial versis non-financial) drives any of the relationships we find.

3.2 METHODS

Study Context and Data Collection

The study uses data collected in 2017 from a nationally representative sample of health centers from the Ministry of Public Health Network. The network, which predominantly serves low- to middle-income strata of the society, comprises more than 220 facilities run by public and non-state organizations, including religious charities, political parties largely with sectarian affiliations, non-affiliated local non-governmental organizations (NGOs) that are unaffiliated with religious or political groups, and the public sector [38,39] (Supplementary Table 3A.1). Facilities run independently while the MOPH assumes a coordination role, and provides subsidized medications, equipment and capacity building seminars [37,38]. Improving healthcare quality within primary care has been a priority in the MOPH over the last decade [40,41]. Details on the randomization process and facility selection for the study are in the pre-analysis plan [42].

The study included administrative information about the facilities, surveys with the chief medical officer (CMO) and providers, clinical observations, and patient exit surveys. Criteria for patient selection included receiving care from a clinician practicing internal medicine, pediatrics, family medicine, or general medicine. Respondents (18 years or older) reported on their own experience or on care provided to the minors or individuals with cognitive impairment they accompanied.

The data for this study are primarily derived from the surveys with CMOs and providers, as well as data from direct observations of patient visits. The CMO interviews gathered information on the background of the respondents, facility infrastructure, hiring procedures for staff, and the accountability mechanisms implemented. The physician surveys collected information about the providers' backgrounds and perceptions of the workplace. Direct observations included indicators of technical and interpersonal quality of care.

Starting from the initial sample of 69 facilities, 220 providers and 1,575 patient observations, we restricted the facilities in our analysis to those in which the CMO had completed survey questions related to educational background and accountability mechanisms. On the provider level, we excluded providers who were CMOs themselves. We imputed compensation status for three providers with missing information on payment using information on working hours and center affiliation. We excluded three providers for whom the patient mix (by age) was not reported and could not be inferred from the responses of other physicians in the same center. Finally, we excluded patients with missing data on gender, age, reported symptoms, routine examination checks, time spent with physician, and questions asked by the provider during their appointments. Our final sample included 55 facilities, 147 providers and 1,077 patients (Supplementary Figure 3A.1). Compared to the original sample, our study sample was not statistically significant with regards to facility location, type, or number of patients who came to the facility in the last 30 days (Supplementary table 3A.2).

Measures of Incentives

The study's primary exposures were binary variables indicating CMO use of facility-level rewards and penalties. The following questions assessed rewards and penalties in the CMO survey: "Do you [reward/penalize] your staff for any of the following?", allowing the CMO to select all applicable reasons including timeliness in arrival, shift completion, meeting expectations in performance, and absences. Among those CMOs who reported implementing rewards and/or penalties, we also captured whether rewards were in the form of financial incentives or social recognition, and whether penalties were in the form of financial penalties, negative evaluations, or contract suspension/termination.

Measures of Provider Effort

We tested for three measures of provider effort that have been previously used in the literature [43,44]. We first measured the number of routine physical examinations that the provider carried out for the patient, including the use of a stethoscope, measurement of blood pressure, checking of temperature, checking of the ear, nose and/or throat, and palpating the abdomen. The Lebanese MOPH and a certified and practicing physician verified these measures as standard procedures in the network's guidelines. Additionally, we also counted weight and/or height measurements, given their frequency in the sample. The second measure of provider effort is time spent with patients in minutes, which captures the effort the provider puts into symptom explanation, diagnosis, and treatment discussion. The third measure of provider effort is the total number of questions the doctor asks, with more questions asked signaling greater communication, and/or efforts to discuss the patient's condition.

Statistical Methods

We used three-stage multilevel Poisson regression models to explore the relationships between facility accountability mechanisms and provider effort, using STATA/SE. All models included explanatory covariates at the facility, provider and patient levels and used random effects for both facilities and providers to account for correlation in the care patients received at these two levels. Facility-level covariates included a categorical variable for CMO educational attainment (non-medical training, medical training, and medical training with a fellowship) and binary variables to capture facility-level rewards and penalties. Using principal component analysis, we created a variable that summarized monitoring mechanisms based on the following questions in the CMO survey: 1) how frequently do you conduct observations of clinic? 2) how frequently do you carry out a patient clinical record audit? and 3) how do you keep track of employee timeliness and absences? While the questions aimed to capture the frequency of these monitoring approaches, the lack of variation in responses to all three questions led us to create binary variables for facility-level monitoring practices.

At the provider level, we included a binary variable for holding a fellowship degree to account for expertise level. Given the wide variation in compensation arrangements, we created a binary variable reflecting payment mode (monetary versus volunteer). We imputed the type of compensation for three providers based on the payment scheme applicable to others working in the same facility and with similar working hours. We also controlled for the case mix reported by adjusting for the reported percentage of patients under 18 years of age seen on a weekly basis, given that it could affect the routine examinations that providers performed. We estimated the case

mix for those with missing information as a simple average of what other providers in the clinic reported.

Patient-level characteristics included a categorical variable for age group (under 5, 5-17, 18-34, 35-54, and over 54 years) and a binary variable for gender. We also controlled for the symptoms reported by the patient, including fever, rash, pregnancy, diarrhea, injury, pain, or vomiting as binary variables. For time spent with patient and number of questions asked, we additionally controlled for the number of questions the patient asked during the appointment.

Robustness Checks

We conducted a robustness check with regards to the implementation of incentives, given that they were all self-reported. We particularly restricted incentive implementation to those facilities that reported using rewards and penalties as well as having the necessary corresponding monitoring mechanisms. A facility was only coded as using penalties or rewards pertaining to timeliness and attendance if the CMO also reported the corresponding monitoring mechanism\ for provider absenteeism, of reviewing provider check-in and check-out times in the facilities. Facilities in which CMOs did not report conducting clinical observations to monitor provider performance were not considered to effectively have rewards or penalties in place for provider performance, even if the CMO reported the use of incentives. At least 80% of CMOs reported the use of the corresponding monitoring mechanism for each performance area where they implemented incentives (Supplementary table 3A.3).

3.3 RESULTS

Table 3.1 shows the background characteristics of the sample at the facility, provider, and patient levels. In the 55 facilities surveyed, more than half of the CMOs had at least a medical degree and the average number of years of experience for CMOs was about 18 years. Around 96% of facilities implemented clinical guidelines. With reference to providers, over 98% worked less than 40 hours per week. Around 11% worked as volunteers, 40% were female, and 20% had completed fellowships beyond their medical degrees. The majority of patients were under 18 years of age.

Overall, about 67 and 60% of facilities implemented penalties and rewards, respectively, and 50% of facilities implemented both. The average number of justifications reported for using penalties was 2.1 out of 4 possible reasons (timeliness of arrival, completion of shifts, absences, and performance). The average number of reasons for which rewards were implemented was 1.7.

Panel A in Figure 3.1 shows the distribution of the number of routine examinations carried out by providers for the 1,077 patients in the sample. The average number of examinations conducted was 2.2 (out of seven possible). Panel B in Figure 3.1 show the distribution of the time spent (in minutes) with the patients, with an average of 8 minutes per patient. During clinical examinations, providers asked 16 questions on average (Panel C). All outcomes exhibited a right-skewed distribution.

Table 3.1. Background characteristics of the study sample at the facility, provider and patient levels.

A. Facility level variables (N= 55)	mean / %	se
Education of CMO, type		
Non-medical training (%)	45.4	0.5
Medical training (%)	25.4	0.4
Medical training and fellowship, %	29.1	0.5
Age of CMO, years	36.0	10.3
Monitoring implemented		
Tracking absences, %	81.8	0.4
Clinical records monitoring, %	70.0	0.5
Clinical observations, %	63.6	0.5
Reward mechanisms implemented		
Financial reward, %	32.7	0.6
Social recognition, %	49.1	0.5
Penalty mechanisms implemented		
Suspension or contract termination, %	10.9	0.3
Negative evaluation, %	38.2	0.5
Payment, %	16.4	0.4
B. Physician level variables (N=147)	mean / %	se
No compensation/ volunteering, %	11.0	0.3
Hours working, N**	8.5	8.8
Female, %	40.4	0.5
A. Patient level variables (N= 1,077)	mean / %	se
Number of reported symptoms, N	2.41	1.5
Female, %	45.3	0.5
Age group , years		
<5 years	46.5	0.5
5-17 years	15.0	0.4
18-34 years	15.9	0.4
35-54 years	9.8	0.3
55+ years	12.7	0.3

*Notes. **Value missing for 4 physicians*

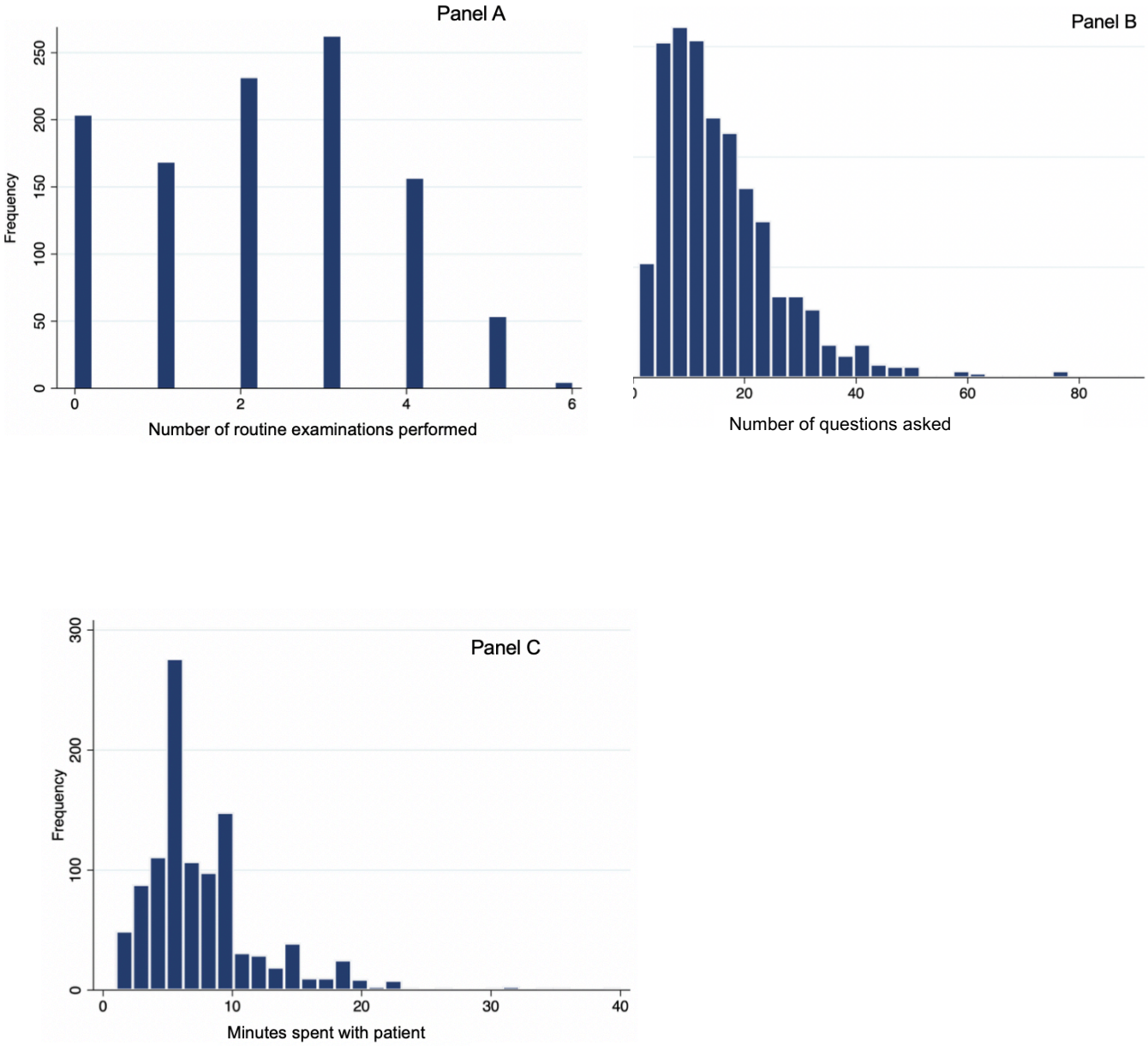

Figure 3.1. Histograms showing the distribution of the different measures of provider effort across the 1,077 patients included in the study. Panel A shows the distribution of routine examinations performed. Panel B shows the distribution of the number of questions the provider asked. Panel C shows the distribution of time spent with the patient.

Table 3.2 presents the results of the multi-level Poisson regressions for the relationship between the presence of facility-level rewards and penalties and each measure of provider effort. Providers working at facilities that used penalties performed 25% more (IRR = 1.25; 95% CI: 1.04, 1.50; p=0.02) routine examinations compared to providers at facilities that did not use penalties. No significant association was found between the number of routine examinations performed and working at a facility that used rewards (IRR = 0.97; 95% CI: 0.81, 1.16; p = 0.74). Other factors associated with the total number of routine examinations performed were patient age and the reported symptoms. While symptoms such as vomiting and diarrhea were associated with more examinations performed, injury and general pain were predictive of fewer routine functions conducted. Patients under five years old received more routine examinations than older patients. None of the physician-level variables, including provider education and financial compensation, were associated with a greater number of routine examinations performed.

Exploring the relationship between penalties and performance of routine examinations further, we found that financial penalties were the main driver of the findings: Monetary penalties were associated with a 34% increase in the number of routine examinations performed, holding everything else constant (95%CI: 1.03, 1,73; p = 0.03). Contract suspension or termination, and negative evaluations of the provider were not predictive of more routine examinations performed (Supplementary Table 3A.4).

Table 3.2. Multilevel Poisson regressions for the three provider effort measures.

	Routine examinations, number				Time spent with patient, minutes				Questions asked, number			
A. Facility level	**estimate**	**p-value**	**95% CI**		**estimate**	**p-value**	**95% CI**		**estimate**	**p-value**	**95% CI**	
Training (Ref= non-med)												
Medical	0.876	0.217	0.711	1.081	1.072	0.509	0.873	1.316	1.02	0.881	0.79	1.317
Medical and fellowship	0.955	0.693	0.759	1.201	1.009	0.922	0.846	1.203	0.817	0.079	0.652	1.024
Monitoring measure	0.993	0.928	0.851	1.158	1.003	0.968	0.856	1.176	1.102	0.215	0.945	1.285
Reward	0.969	0.735	0.808	1.162	1.229*	0.032	1.018	1.484	1.243*	0.025	1.028	1.503
Penalty	1.249*	0.019	1.038	1.503	0.93	0.441	0.774	1.118	0.844	0.051	0.712	1.001
B. Physician level	**estimate**		**95% CI**		**estimate**	**p-value**	**95% CI**		**estimate**	**p-value**	**95% CI**	
Female	0.986		0.813	1.195	1.257***	0	1.122	1.409	1.289**	0.001	1.105	1.504
No compensation	1.01	0.914	0.85	1.199	1.101	0.424	0.87	1.393	1.097	0.403	0.883	1.361
Fellowship training	0.899	0.354	0.717	1.126	0.996	0.945	0.875	1.132	0.981	0.831	0.82	1.173
Case mix	1.003	0.244	0.998	1.007	0.993***	0	0.989	0.997	0.994*	0.016	0.989	0.999
C. Patient level	**estimate**		**95% CI**		**estimate**	**p-value**	**95% CI**		**estimate**	**p-value**	**95% CI**	
Age (Ref = 5-17 years)												
<5 years	1.335***	0	1.193	1.494	1.081	0.088	0.989	1.182	0.94	0.206	0.854	1.035
18-34 years	0.761	0.012	0.615	0.941	1.09	0.214	0.951	1.248	1.173*	0.022	1.024	1.345
35-54 years	0.752	0.014	0.599	0.943	1.246**	0.002	1.086	1.429	1.16*	0.025	1.019	1.322
55+ years	0.778	0.013	0.638	0.949	1.231**	0.004	1.068	1.419	1.131	0.101	0.976	1.31
Female	0.953	0.201	0.886	1.026	0.979	0.473	0.922	1.038	1.041	0.251	0.972	1.114
Symptoms reported												
Fever	1.14	0.13	0.962	1.351	1.044	0.381	0.948	1.149	1.291***	0.000	1.137	1.465
Diarrhea	1.183**	0.001	1.073	1.303	1.11**	0.001	1.046	1.179	1.11*	0.012	1.023	1.204
Injury	0.534**	0.009	0.334	0.855	1.037	0.587	0.909	1.183	1.377*	0.016	1.063	1.785
Vomit	1.158**	0.004	1.048	1.28	1.203***	0.000	1.104	1.31	1.126**	0.009	1.031	1.231
Rash	1.221**	0.005	1.061	1.406	0.886	0.187	0.74	1.061	0.65***	0.000	0.555	0.762

Table 3.2. Multilevel Poisson regressions for the three provider effort measures *(Continued)*.

Pregnancy	1.114	0.263	0.922	1.346	1.089	0.421	0.885	1.339	1.083	0.35	0.916	1.28
Pain	0.639***	0	0.585	0.697	1.003	0.972	0.867	1.16	0.857	0.005	0.769	0.954
Questions asked, number					1.037***	0.000	1.026	1.048	1.036***	0.000	1.028	1.044

Notes. Monitoring variable was generated through principal component analysis of monitoring mechanisms for attendance, clinical audit and clinical observations. Case mix refers to the percentage of cases that are children seen per week, as reported by the physicians. Questions asked indicates the number of questions that the patient asked during the appointment. Random effects for provider and facility were included. * $p< 0.05$; ** $p< 0.01$; *** $p< 0.001$

In contrast, rewards were associated with more time spent with patients (IRR= 1.23; 95% CI: 1.02, 1.48; p= 0.03) and more questions asked by providers (IRR= 1.24; 95%CI : 1.03, 1.50 ; p= 0.02). Penalties were not predictive of these dimensions of provider effort at the 0.05 significance level, though they had a marginal protective effect for the number of questions asked (OR= 0.84; 95% CI: 0.71, 1.00 ; p= 0.05). Female providers tended to ask more questions and spend more time with patients. Furthermore, providers generally spent more time with and asked more questions to older patients. Symptoms were also predictive of higher levels of these two dimensions of provider effort.

In assessing whether a specific type of reward drove these relationships, we found that financial incentives had a significant association with time spent with patient (IRR= 1.22; 95% CI: 1.05, 1.43; p= 0.01) and number of questions asked patient, though not quite significant at the 0.05 level (IRR =1.23, 95%CI: 0.98, 1.56; p= 0.08). On the contrary, there is no significant relationship between social recognition and the number of questions asked or time spent with patient (Supplementary Table 3A.4).

When incentive implementation was restricted to those facilities also implementing corresponding monitoring mechanisms, the effective use of penalties and rewards was reduced to 62% and 56%, respectively. Nonetheless, the results held, with rewards as the main predictors of time spent with patients (IRR= 1.23; 95% CI: 1.02, 1.49; p= 0.03) and a greater number of questions asked by providers (IRR= 1.22; 95% CI: 1.00, 1.49; p= 0.05) and penalties being predictive of routine examinations (IRR= 1.23; 95% CI: 1.02, 1.49; p= 0.03) (Supplementary Table 3A.5).

3.4 DISCUSSION

Based on a sample of primary care centers in Lebanon, this study suggests that implementing penalties is potentially a key accountability mechanism at the facility level to boost the number of routine clinical examinations carried out in appointments. We find a significant relationship between facility-level rewards and two other outcome variables, the duration of the interaction between patient and provider, and the number of questions asked by the provider. The findings suggest that penalties nudge providers to focus on clinical protocols. In turn, rewards seem to prompt providers to deepen their interpersonal interactions with the patients and to spend more time discussing symptoms, diagnosis and treatments. This hypothesis is supported by a previous proposition from the literature suggesting that penalties induce employees to stick with the terms governed by their contracts more than rewards do [45]. In the context of primary care in Lebanon, providers seem to comply more with facility rules, including the standardized clinical guidelines, when penalties apply.

Overall, our results are congruent with previous findings that suggest implementing both rewards and penalties have the potential to improve the quality of care [46]. In the context of penalties specifically, our findings agree with existing research showing that penalty implementation in tertiary care enhances technical quality [34]. Our results particularly contribute to the limited evidence on the potential of the 'stick and the carrot': They suggest that financial rewards and penalties are not substitutionary accountability options and could be used concurrently for better results [47,48].

In the context of Lebanon, both rewards and penalties seem to work best when they are financial, compared to other modes of incentives, such as feedback, social recognition, and contract termination/suspension. These results are most likely because primary care physicians generally receive low compensations and most work on a part-time basis within the Lebanese MOPH Network. Providers may thus more sensitive to financial incentives than other measures. In addition, it may be possible that working in NGOs or 'serving' in facilities of religious or political affiliation may itself be a source of social recognition to the provider by the community. This possibility may make the benefit from further recognition at the facility-level rather marginal for providers.

Our study makes several contributions. First, it explores the predictive power of two types of incentives--positive and negative--while examining the potential effects of different modes of rewards and penalties on provider effort. Second, the research adds value by exploring the relationship between penalties and provider effort in the context of primary health care delivery in a developing country, with is understudied. Third, the study sample is relatively comprehensive, with about 25% of the facilities in the Lebanese MOPH primary health care network.

At the same time, our findings should be interpreted with caution. First, our study design is observational, and reverse causality is likely. Facilities may have implemented incentives as a result of identified poor provider effort. Second, we assumed that incentives were applied uniformly in a given health center. Third, most facility- and provider-level variables are based on self-reported data and Hawthorne effects may artificially boost provider efforts in observed examinations, although this effect is known to dissipate beyond the first few patients [49]. Finally,

the study context is unique, and one in which incentives are not uniformly implemented across regions or on a national level, which may limit the external validity of the results to other settings.

Future research should aim to gather additional information from providers on the best means of boosting effort from their own perspectives. Qualitative data from interviews with physicians could help assess potential mechanisms through which rewards and penalties may affect different dimensions of provider effort. In addition, further research could explore the determinants of provider effort with models that enable more robust causal inference, and with more information on the nature of the incentives, their magnitude and duration of implementation.

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Chapter 4: Towards Health Systems Resilience: Service Utilization Patterns for Maternal Care and Neonatal Mortality in the Palestinian Territories during Conflict

Towards Health Systems Resilience: Service Utilization Patterns for Maternal Care and Neonatal Mortality in the Palestinian Territories during Conflict

ABSTRACT

Background. The global incidence of man-made crises has increased in the last decade. There is a need to assess health systems' ability to maintain routine care services without compromise while responding to crisis-induced health needs. We assessed the association between conflict intensity in the Palestinian Territories at time of birth and 1) utilization patterns for deliveries across different providers; and 2) neonatal mortality. Methods. We combined 4 surveys (2004 Demographic and Health Survey, 2006 Pan Arab Project for Family Health Survey, and 2010 and 2014 Multiple Indicator Cluster Surveys), that included nationally representative samples of women of childbearing age, with information on conflict intensity. Our exposure variable was casualties per 100,000 population in defined sub-regions of the West Bank and Gaza Strip. Short-term conflict intensity was the average casualty rate over a month's period. Longer-term conflict intensity was the average casualty rate over the three months surrounding the birth time. Our outcome specifications were binary variables for neonatal deaths and delivery location time. We used multivariate logistic regressions. Results. High conflict intensity was associated with shifts in the utilizing services from the private sector [OR= 0.98, p= 0.109], and non-governmental organizations [OR= 0.90, P=0.013] towards public facilities [OR=1.04, p=0.020]. Effects were larger in magnitude during longer-term conflict. Conflict intensity was however not predictive of neonatal mortality beyond 2004. Conclusion. Conflict intensity was associated with greater service utilization at public facilities in the Palestinian Territories. Neonatal mortality was overall not correlated with conflict intensity beyond 2004. Next steps include better preparedness in the

public sector for maternal care provision during conflict and exploring reasons for the slow decline in neonatal mortality in the territories beyond conflict at time of birth.

4.1 INTRODUCTION

Since 2011, armed conflict has been on the rise, with one in every four people living in a conflict zone today [1]. Ample evidence has linked adverse child health outcomes to conflict, including child mortality in Myanmar, Iraq and several African contexts [2,3,4]. Conflict has also been associated with low birth weight and congenital complications in Kuwait, Libya, and US populations, and polio outbreaks in Syria and Nigeria [5,6,7,8,9].

The link between conflict and adverse child health outcomes necessitates health systems that can withstand shocks in healthcare demand in conflict-prone settings [10]. Self-regulation, the ability of a health system to adequately meet routine health needs during crises, is a defined cornerstone of resilience [10]. Evidence on how service uptake or delivery varies during conflict remains limited [11,12]. Examples include a study on Former Yugoslavia, whereby conflict was associated with reductions in services, staff attendance, and medications [13]. In the Palestinian Territories, conflict was predictive of delayed vaccinations [14].

In this study, we focus on the self-regulation domain of the Palestinian health system during heightened conflict. We first investigate deviations in health service utilization for deliveries during times of political turbulence, to assess whether certain providers experience increased demand for healthcare. Institutional delivery has been over 95% in the Palestinian Territories since 2006, and around 90% of the population has health insurance [15,16]. Several providers offer delivery and neonatal care including the public sector, the private sector, non-governmental organizations (NGOs), facilities within Israel, and one United Nations Relief and Works Agency hospital available for refugees [17]. Accessing Israeli facilities requires getting permits via a

lengthy process, and long-travel distances with cross borders. Healthcare provision is overall fragmented, with no clear referral system from primary to tertiary care, and provider choice largely depends on the patient.

Research in developing country contexts shows that women are willing to bypass closer facilities for better care [18,19]. However, heightened conflict may push women to avoid facilities that require long travels. Women may also avoid Israeli facilities in an atmosphere of low trust and/or due to movement restrictions across borders. Households reliant on the informal economy may be susceptible to the economic consequences of conflict and may limit themselves to the free care provided by public facilities. Our hypothesis is thus that conflict intensity is predictive of shifts towards the public sector from other parts of the health system.

We also investigate whether conflict at time of birth predicts neonatal mortality. Heightened conflict during pregnancy predicted lower birth weight in the territories [20]. Evidence from other contexts shows that prenatal stressors can cause several birth complications [21,22]. Neonatal mortality from complications is however largely preventable with simple measures such as breathing masks, and skin-to-skin contact [23]. With that, conflict may induce mortality if providers of maternal care cannot respond to the induced complications properly, or if they experience consequences like reduced staff attendance or supply shortages. Neonatal mortality has also stalled in parts of the territories since 2006, the reasons for which warrant exploration [24]. We hypothesize that conflict intensity is predictive of neonatal mortality at the 5% level.

4.2 METHODS

Data and Study Sample

This study uses three data sources. The first set of sources are the 2004 Demographic and Health Survey, 2006 Pan Arab Project for Family Health, and 2010 and 2014 Multiple Indicator Cluster Surveys. These surveys provide nationally representative samples of women of childbearing age (15 to 54 years). The surveys include details about women's birth histories in the 5 years preceding the survey, including delivery location. The first two surveys are a two-stage random design, whereby the territories were divided into enumeration areas before cluster selection. Later surveys have a two-stage cluster design, whereby governorates were divided into strata by locality type (rural, urban and refugee camp), before cluster selection [25,26,27,28]. The duration during which this study takes place, ranging between 2002 and 2014, covers the second Intifada from 2002 to 2006, the 2008 Israel-Gaza war, and other shorter-term conflicts. The second dataset comes from B'Tselem, the Israeli Information Center for Human Rights, which tracks the number of conflict-based casualties on a daily basis. The third data source is the Palestinian Central Bureau of Statistics, which provides mid-year population projections at the province level in the territories.

We build pooled cross-sectional data using the household surveys to create a sequence of births between 2002 and 2014. Our sample consists of mothers who had births in the 2 years preceding each survey (N= 14,153). The 2-year frame was chosen to maximize sample size and avoid survey overlap with respect to births covered. It was also chosen to minimize recall bias and changing household circumstances from time of child birth and until survey date. To identify our subjects, we calculate the hypothetical age of all live births, whether alive or dead by time of survey, by subtracting their dates of birth from the dates of the interview and include all those who were two

years or less by the type of the surveys. Given that the older surveys (2004 and 2006) extended over three months but did not provide exact interview dates, the second month of data collection period as an estimation of interview time.

Measuring Conflict Intensity

The primary exposure is the number of conflict-induced casualty per 100,000 population during the month of birth in each sub-region (North West Bank, Central West Bank, South West Bank, North and Central Gaza, South Gaza). While measuring conflict intensity at a smaller geographical scale would have produced a more in-depth exploration of the relationship, the 2004 survey did not provide information on subject location beyond sub-region. To quantify the exposure, the number of casualties was divided by the corresponding estimated population size. We assumed a linear monthly increase in population between each yearly estimate. The order of the measure was 100,000 population, equivalent to the order of sub-region population size. We matched each birth with the corresponding conflict by month, sub-region, and year. We called our exposure conflict intensity.

The second exposure is the average conflict intensity over the three-month interval during which the birth took place. We calculated this variable as the simple average of conflict intensity for the month before delivery, conflict intensity during the month of delivery, and conflict intensity for the month after delivery. This specification explores the relationship of longer-term average conflict intensity with the two outcomes.

Measuring Neonatal Mortality and Delivery Location

The first outcome is neonatal mortality, identified through women's recall of their births. Deaths occurring within 28 days from date of birth were deemed neonatal. The second set of outcomes are binary variables for the self-reported delivery location of the births, specified by ownership: governmental facilities, private facilities, NGOs, and Israeli facilities . Information was missing for 4.6% of births, and was particularly skewed for the 2006 survey, where data were missing for 10% of the sample.

Statistical Methods

We applied multivariate logistic regression models to assess each relationship. Covariates were based on previous literature and subject matter knowledge. Infant-level variables include single status (singleton versus not), child sex, and birth interval (less than 2 years, years or more, or not applicable for a first birth). Maternal-level factors included maternal age at time of birth (less than 18 years, 18-25, 25-35, and over 35 years), marital status (married versus not), and educational attainment (primary or less, secondary, high school or higher). Given the absence of a wealth index for the 2004 and 2006 surveys, we measured household socioeconomic status for all surveys through a principal component analysis (PCA) following the method by Filmer et al. (2001) [29]. We generated the wealth index from type of dwelling, ownership of a private car, presence of piped water source, presence of a flush toilet within dwelling, availability of a fridge within household, household head gender, maternal education level and type of floor in the household. Overall, the variation in the PCA results allowed us to create 4 quartiles of income levels in each survey. We controlled for locality type (i.e. rural, urban, and camp) and sub-region to assess for regional-level variations such as infrastructural development and religious views. The sub-regions

were: North West Bank, Central West Bank, South West Bank, North and Central Gaza, and South Gaza.

To account for the variation in stratification by survey, we generated a variable for survey-specific strata. We also generated a primary sampling unit variable for the 2004 and 2006 surveys, given the unavailability of the variable, via a 'k-means clustering' approach. This statistical approach partitions observations into a predefined number of clusters based on the nearest mean. The primary sampling unit assignment is based on dwelling ownership, water source, toilet type, presence of a private car, type of floor, availability of fridge, and locality type for the 2004 survey, and all the aforementioned variables in addition to governorate in the survey for 2006. Sample weights were used for summary statistics and models. Standard errors were clustered at the primary sampling unit in all models.

Robustness checks

We ran two sensitivity analyses to account for design limitations. First, we included births occurring one month outside the 0-24 months inclusion criteria for surveys 2004 and 2006, to account for the potential exclusion of births given our estimation method for the interview date for those two surveys. Given that the 2006 survey only inquired about birth location for the last birth, we used multiple imputation to estimate the birth location for all births that fell into our inclusion criteria (birth within the two years preceding interview date), but the survey question missed, and other data points were missing in the other surveys. We imputed missing values using locality type, region, and socioeconomic status and survey year as predictors.

4.3 RESULTS

Figure 4.1 shows the variation conflict intensity during the period of the study over time and sub-region. Central West Bank has, on average, the lowest conflict intensity, while the two sub-regions of the Gaza Strip have the highest conflict intensity after 2004.

Table 4.1 shows the weighted summary measures for background characteristics for the samples within each survey, including household-, maternal- and infant-level covariates. Maternal age at birth and maternal education have both increased across survey years. The percentage of women delivering at less than 18 yeas of age decreased from 2.4% in the 2004 survey to less than 1% in the 2014 survey. Women with high-school education or more increased from 12.8% to 39.0% over that period. Table 4.1 also summarizes the neonatal mortality rate per 1,000 live births for each survey, and it shows that the rate has stalled between 2010 and 2014 at around 11 per 1,000 live births. With regards to the birth location distribution, the percentage of deliveries at governmental facilities has increased – from 518 per 1,000 live births in the 2004 survey to 618 per 1,000 in the 2014 survey but was variable among other providers. Deliveries in Israeli facilities and NGOs were the lowest in all survey years, at 31 and 90 per 1,000 lives births in 2014, respectively.

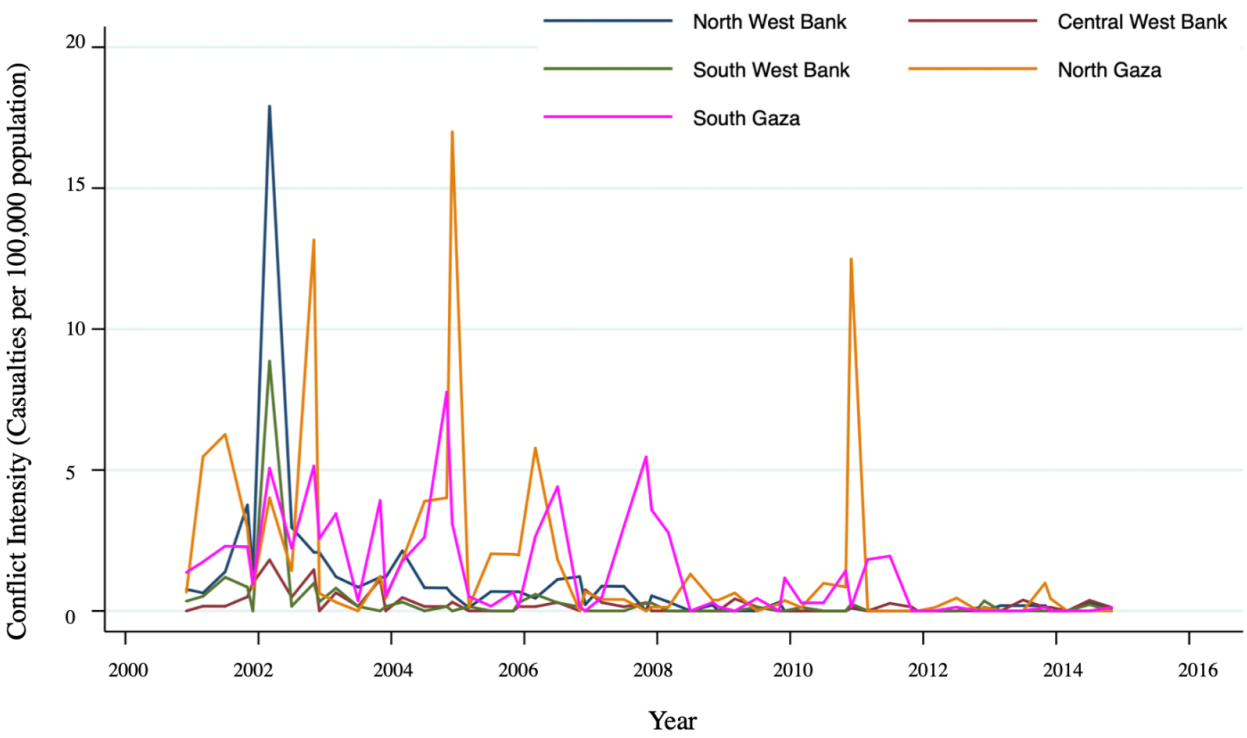

Figure 4.1. Conflict intensity by sub-region and time

Table 4.1. Survey summary statistics, including background characteristics, neonatal mortality per 1000 live births, and delivery location per 1,000 births for each survey.

	Survey year			
	2004	**2006**	**2010**	**2014**
	N = 2156	**N= 4373**	**N = 4472**	**N = 3152**
Neonatal mortality rate, per 1000 births	18.9 (0.00)	17.6 (0.00)	10.8 (0.00)	10.8 (0.00)
Delivery location, per 1000 births				
Public	518.3(0.02)	565.6(0.02)	601.5 (0.01)	617.9 (0.02)
Private	260.6(0.02)	302.5(0.01)	296.7 (0.01)	248.3 (0.01)
NGOs	40.1(0.02)	66.3 (0.01)	45.1 (0.01)	89.9 (0.01)
Israel	13.4 (0.00)	7.4 (0.00)	20.1 (0.00)	30.9 (0.01)
Maternal age, %				
<= 18	2.4 (0.00)	2.1 (0.00)	1.2 (0.00)	0.8 (0.00)
18+ till 25	36.8 (0.01)	31.0 (0.01)	31.9 (0.01)	35.4 (0.01)
25+ till 35	46.5 (0.01)	50.1 (0.01)	51.0 (0.01)	49.6 (0.01)
35+	14.3 (0.01)	15.9 (0.01)	15.0 (0.01)	14.2 (0.01)
Maternal Education, %				
primary or less	64.4 (0.01)	62.5 (0.01)	53.8 (0.01)	27.1 (0.01)
Secondary	22.8 (0.01)	23.0 (0.01)	25.7 (0.01)	34.0 (0.01)
High-school or higher	12.8 (0.01)	14.5 (0.01)	20.5 (0.01)	39.0 (0.02)
Birth interval, %				
Less than 2 years	31.9 (0.01)	31.2 (0.01)	29.7 (0.01)	28.1 (0.01)
2 years or more	49.8 (0.01)	55.3 (0.01)	54.0 (0.01)	48.8 (0.01)
Female, %	47.8 (0.01)	47.6 (0.01)	49.1 (0.01)	47.2 (0.01)
First Birth, %	18.2 (0.01)	13.5 (0.01)	16.4 (0.01)	23.1 (0.01)
Single, %	97.1 (0.01)	95.8 (0.00)	96.1 (0.00)	96.4 (0.01)

We find a significant association between conflict intensity at time of birth and deliveries in governmental facilities, whereby a one unit increase in casualties per 100,000 population is associated with a 0.04 increase in the odds of delivering there (95%CI: 1.01, 1.07; p= 0.015). Conflict intensity is also associated with a decline in the odds of utilizing NGOs (OR = 0.90, 95%CI: 0.82, 0.98; p = 0.020), and private facilities (OR = 0.98; 95%CI: 0.95, 1.01; p = 0.109) (Table 4.2). Imputing missing delivery location does not change the results (Supplementary Table 4A.1).

The effects are stronger for long-term conflict intensity. A one unit increase in the average of conflict intensity over the three-month interval is associated with a 9% increase in the odds of delivery at governmental facilities (95%CI: 1.04, 1.14; p< 0.001), an 18% decrease in the odds of utilizing an NGO (95% CI: 0.73, 0.93; p= 0.001), and an 8% decrease in the odds of utilizing the private sector (95%CI: 0.88, 0.98; p= 0.003) (Supplementary Table 4A.2 Panels 2-5).

Conflict intensity at time of birth had no overall association with neonatal mortality, with an odds ratio of 1.00 (95%CI: 0.94, 1.06; p=0.99). Breaking the relationship further in Table 4.3, we find that conflict intensity at time of birth was only associated with neonatal mortality for births between 2002 and 2004 but not further (OR=1.18, 95%CI: 1.04, 1.33; p = 0.008). Other factors predicting neonatal mortality were congruent with the literature, including being a single female child, for a younger and educated mother, with birth spacing of more than 2 years. The relationship between the quarterly average of conflict intensity and neonatal intensity is also overall insignificant (Supplementary Table 4A.2- Panel 1). We re-ran the analysis including births within

Table 4.2. Multivariate logistic regressions for the relationship between conflict intensity and delivery location.

	Governmental Facilities				Private sector				NGOs				Israeli Facilities			
	OR	P-value	95% CI		OR	P-value	95% CI		OR	P-value	95% CI		OR	P-value	95%CI	
Intensity of conflict	1.04*	0.015	1.01	1.07	0.98	0.109	0.95	1.01	0.90*	0.020	0.82	0.98	0.88	0.621	0.52	1.48
Survey year (Ref = 2004)																
2006	1.32**	0.001	1.11	1.57	1.21*	0.029	1.02	1.44	0.66	0.099	0.40	1.08	0.51	0.062	0.25	1.04
2010	1.30**	0.005	1.08	1.56	1.11	0.278	0.92	1.33	1.01	0.941	0.72	1.43	1.17	0.648	0.60	2.26
2014	2.14***	0.000	1.73	2.65	0.83	0.085	0.67	1.03	0.14***	0.000	0.08	0.27	1.85	0.084	0.92	3.72
SES (Ref= lowest quartile)																
second	1.01	0.871	0.89	1.15	1.10	0.153	0.96	1.26	0.66*	0.021	0.47	0.94	1.65	0.141	0.85	3.21
third	0.90**	0.001	0.70	0.91	1.28**	0.001	1.11	1.47	1.39	0.097	0.94	2.06	1.25	0.487	0.67	2.34
highest	0.71***	0.000	0.59	0.85	1.61***	0.000	1.33	1.95	1.16	0.580	0.69	1.96	1.33	0.443	0.64	2.80
Maternal age at birth (Ref < 18)																
18-25	0.88	0.437	0.63	1.22	1.13	0.507	0.79	1.62	3.93*	0.035	1.10	14.01	0.92	0.936	0.11	7.91
25-35	0.95	0.760	0.68	1.32	1.07	0.725	0.74	1.54	3.96*	0.031	1.13	13.77	0.61	0.654	0.07	5.33
35+	1.22	0.252	0.87	1.73	0.79	0.228	0.54	1.16	3.80*	0.045	1.03	13.95	0.66	0.710	0.07	5.94
Not married	1.08	0.790	0.62	1.87	1.18	0.552	0.68	2.09	0.29	0.231	0.04	2.19	0.41	0.406	0.05	3.36
Maternal Education (Ref= Less than secondary)																
Secondary	0.89	0.062	0.78	1.01	1.10	0.161	0.96	1.26	1.17	0.374	0.83	1.65	1.12	0.634	0.70	1.80
High school or higher	0.69***	0.000	0.58	0.83	1.40**	0.001	1.16	1.69	1.20	0.476	0.72	1.99	1.02	0.948	0.50	2.09
Single birth	0.70*	0.021	0.51	0.95	1.42*	0.039	1.02	1.20	1.78	0.189	0.75	4.23	0.36*	0.029	0.15	0.90
Male	1.02	0.624	0.94	1.10	0.97	0.492	0.90	1.05	0.92	0.398	0.74	1.12	1.28	0.158	0.91	1.80
Birth internal (Ref= Less than 2 years)																

Table 4.2. Multivariate logistic regressions for the relationship between conflict intensity and delivery location *(continued)*.

	Governmental Facilities				Private sector				NGOs				Israeli Facilities			
	OR	P-value	95% CI		OR	P-value	95% CI		OR	P-value	95% CI		OR	P-value	95% CI	
Greater than 2 years	0.86**	0.001	0.78	0.94	1.21***	0.000	1.10	1.33	1.04	0.767	0.82	1.30	0.99	0.946	0.67	1.45
First Birth	0.95	0.434	0.84	1.08	1.13	0.086	0.98	1.20	1.20	0.261	0.88	1.64	0.78	0.257	0.51	1.20
Region (Ref= North West Bank)																
Central West Bank	0.88	0.135	0.75	1.04	0.88	0.139	0.73	1.04	1.04	0.909	0.58	1.85	20.15	0.000	11.03	36.82
South West Bank	0.76**	0.001	0.65	0.90	1.77***	0.000	1.50	2.10	0.21***	0.000	0.11	0.43	1.00	0.991	0.44	2.25
North Gaza	1.43***	0.000	1.21	1.69	0.79***	0.007	0.66	0.94	1.47	0.166	0.85	2.55	1.00			
Central and South Gaza	5.75***	0.000	4.77	6.93	0.22***	0.000	0.18	0.27	0.28***	0.000	0.14	0.53	0.13	0.011	0.03	0.63
Location (Ref= Urban)																
Rural	1.56***	0.000	1.34	1.80	0.75***	0.000	0.650	0.87	0.51*	0.011	0.31	0.86	0.14	0.000	0.07	0.27
Refugee camp	0.87	0.080	0.74	1.02	1.17	0.062	0.99	1.38	1.43	0.073	0.97	2.11	0.74	0.406	0.37	1.50

*Notes. We control for socioeconomic status quartile, household location by locality and region, maternal education, marital status at time of survey, maternal age at birth, year of survey, whether the birth is a singleton, female, and a first birth. We also control for birth interval. * $p< 0.05$; ** $p< 0.01$; *** $p< 0.001$*

Table 4.3. Multivariate logistic regressions for the relationship between conflict intensity and neonatal mortality and after interacting conflict intensity with survey year

	Odds Ratio	P-value	95% CI		Odds Ratio	p-value	95% CI	
Intensity of conflict, casualties per 100,000 population	1.000	0.997	0.941	1.063	1.181*	0.008	1.045	1.334
Survey year (Ref = 2004)								
2006	0.912	0.658	0.607	1.370	1.372	0.235	0.814	2.312
2010	0.547	0.011	0.344	0.869	0.765	0.364	0.428	1.365
2014	0.654	0.151	0.367	1.167	0.921	0.807	0.473	1.790
Interaction (Ref = 2004)								
2006					0.797*	0.004	0.682	0.931
2010					0.906	0.850	0.327	2.510
2014					0.844	0.138	0.675	1.056
SES (Ref= lowest quartile)								
second	0.931	0.746	0.604	1.436	0.904	0.649	0.586	1.395
third	0.845	0.458	0.541	1.319	0.835	0.430	0.534	1.306
highest	1.387	0.343	0.706	2.724	1.350	0.385	0.686	2.655
Maternal age at birth, years(Ref < 18)								
18-25	0.617	0.275	0.259	1.470	0.617	0.281	0.257	1.485
25-35	0.780	0.585	0.320	1.904	0.778	0.587	0.314	1.926
35+	1.352	0.505	0.557	3.281	1.355	0.506	0.553	3.324
Not married	3.992*	0.005	1.506	10.582	4.041*	0.005	1.524	10.712
Maternal Education (Ref= secondary)								
Secondary	0.578*	0.039	0.344	0.972	0.587	0.044	0.349	0.987
High school or higher	0.498*	0.038	0.258	0.964	0.507	0.044	0.262	0.983
Single birth	0.182***	0.000	0.110	0.303	0.184***	0.000	0.110	0.306
Male	0.661*	0.006	0.491	0.890	0.660*	0.006	0.491	0.889
Birth internal (Ref= Less than 2 years)								

Table 4.3. Multivariate logistic regressions for the relationship between conflict intensity and neonatal mortality and after interacting conflict intensity with survey year *(Continued).*

	Odds Ratio	P-value	95% CI		Odds Ratio	p-value	95% CI	
Greater than 2 years	0.534***	0.000	0.387	0.737	0.539***	0.000	0.390	0.744
First Birth	1.264	0.263	0.838	1.905	1.281	0.237	0.849	1.932
Region (Ref= North West Bank)								
Central West Bank	0.475*	0.011	0.267	0.844	0.486*	0.014	0.274	0.865
South West Bank	0.712	0.154	0.446	1.136	0.716	0.163	0.448	1.145
North Gaza	0.748	0.248	0.456	1.225	0.744	0.247	0.451	1.227
Central and South Gaza	0.805	0.411	0.480	1.350	0.756	0.306	0.443	1.291
Locality type								
rural	0.679	0.071	0.446	1.034	0.676	0.067	0.445	1.027
camp	0.895	0.637	0.563	1.422	0.870	0.558	0.545	1.388

*Notes. We control for socioeconomic status quartile, household location by locality and region, maternal education, marital status at time of survey, maternal age at birth, year of survey, whether the birth is a singleton, female, and a first birth. We also control for birth interval; * p <0.05; ** p< 0.01 ; *** p< 0.001.*

one month of the inclusion criteria for the older surveys and found similar results (Supplementary Table 4A.3).

4.4 DISCUSSION

This study investigated utilization patterns for deliveries and neonatal mortality during conflict in the Palestinian Territories. Our results show that conflict intensity at time of birth is not associated with neonatal mortality beyond the initial years of the second Palestinian uprising (i.e. beyond 2004). One hypothesis from these results is that the second Intifada (2000-2005) comprised a rather longer-term conflict that possibly overstretched the health system and potentially impacted on health outcomes due to compromised routine care delivery. Subsequent political turbulences have been shorter in duration. The 2008 Gaza-Israel war for example, was around one month long.

Another hypothesis is that the health system has evolved over time to become resilient to conflict. Evidence supporting this proposition, while limited, allude to improvements in neonatal care that may have possibly delinked conflict intensity from neonatal death in later years. Between 2009 and 2016, the number of neonatal units increased from 181 (15.5 per 10,000 live births) to 219 (16.7 units per 10,000 live births) [30]. A recent neonatal study has also shown that basic equipment and medical staff on duty on weekdays are available in the majority of facilities [31]. Nevertheless, quality protocols, referral systems, and necessary drugs for complications like antibiotics and infusion drugs constitute shortages [31]. The suboptimal quality of care, particularly for complications, could be a potential explanation for neonatal mortality stalling in recent years.

Our study also shows that conflict at time of birth predicts shifts in service utilization from the private sector and NGOs to governmental facilities. These changes become larger in magnitude as the average conflict over the three-month period surrounding the birth increases. These results suggest the hypothesis that women may be more likely to utilize closer facilities and free services during conflict. As the public sector is the largest provider in the Palestinian Territories, governmental facilities are presumably easier to access, and reaching them may be less restricted.

Our analysis presents a number of strengths. First, it is of direct policy relevance and can help better preparedness for maintaining high-quality care for maternal delivery during conflict times in the Territories. Results suggest that deliveries concentrate in public facilities at times of conflict, which means that public facilities could focus on better preparedness for conducting a higher number of deliveries. Our study also builds on previous evidence, including one study showing that conflict predicts low birth weight and another study showing that increased conflict predicts a decline in C-section rates [14]. Together, these findings help complete the image on the care delivery process for maternal and child health during heightened conflict and suggest that increased demand in the public sector possibly stretches resources and leads to a reduced number of C-section surgeries. Second, our study combines information from multiple years, and we account for survey design issues and limitations with robustness checks. Furthermore, we assess health outcomes and health services utilization in response to the exposure for both immediate and longer-term spans. Our specification of conflict intensity is an improvement of other specifications previously used in the literature, which used either the absolute number of casualties or the square root of the number of casualties [14,20], and allows for a more straightforward interpretation of the associations.

Our work comes with several limitations. First, our exposure is based only on casualty number. Creating an index that includes other attributes of conflict such as curfews, and morbidity, could offer a more representative measure. Additionally, the limitation of geographical location of births in 2004 to sub-regions, did not allow measuring conflict intensity at the governorate level. Future explorations of the relationship on a daily basis and on a smaller geographical scale are warranted. In addition, mortality is a stark outcome and it is likely that conflict could be associated with maternal and child health complications not covered in the surveys. Lastly, conflict intensity is an endogenous variable affected by region and time. Areas of younger populations, poorer economic situations, those closer to checkpoints and border controls are more likely to experience political turbulence. Our analysis thus does not explore the relationship causally.

Future work could explore other child health outcomes and use data on the governorate level for stronger evidence. Identifying rationales behind the shifts in utilization through focus groups can also confirm the behavioral mechanisms underlying the patterns during conflict.

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Chapter 5: CONCLUSION

5.1 FINDINGS AND POLICY IMPLICATIONS

For further health gains, considering demand-side, supply-side, and contextual factors, when researching potential policies is necessary [1]. In my dissertation, I followed this approach through addressing questions related to maternal and child health advancements in middle-income countries. All papers explored behavioral questions and yielded distinct contributions with potential policy implications.

In Paper I, and in the context of Kenya's informal settlements, I assessed the relationship between information asymmetry and the technical quality women receive for delivering at their facilities of choice. Information asymmetry is one of the oldest and key theories of market failure in healthcare [2,3]. The theory recognizes the credence nature of healthcare services - the fact that the quality of a service may be hard to predict or judge prior to utilization [1,4]. While coined in 1963, the theory has not been fully explored in developing country contexts, where quality of care may significantly vary and referral systems are suboptimal [5,6,7,8]. The limited existing evidence focuses patients' perceptions of care *after* utilization [9,10,11,12,13,14,15]. Our study filled in the research gap surrounding information asymmetry in developing country contexts. It found that two out of every five women included in the study sample incorrectly ranked the relative technical quality levels at facilities they were considering for delivery. Women who correctly perceived technical quality variations were more likely to utilize top-quality facilities.

The key policy implication from our study is the potential of providing information on facility quality in contexts where quality of care is not standardized or regulated. Information dissemination on facility quality levels can promote high-quality care utilization and consequently

averting adverse maternal and neonatal outcomes. It thus can present a short-term policy option to complement international and governmental efforts in raising and regulating the quality of care in developing countries.

In Paper II, I investigated the relationship between incentives and provider effort, in the context of Lebanon. Rewards, particularly pay-for-performance, have been popular accountability mechanisms for quality improvement over the last two decades in developed and developing country contexts [16,17,18,19,20,21,22,23,24]. Nevertheless, evidence on their effectiveness remains mixed [18,20,24]. At the primary care level, studies have mostly focused on positive incentives and their impact on technical quality of care [16,21,24,25]. Our study filled in an existing gap in this area of work by: 1) exploring the potential of penalties in promoting provider effort in primary care; 2) generating plausible hypotheses on how rewards and penalties could influence different dimensions of provider effort; and 3) addressing incentives for the first time in the context of the Middle East. The study used observational data to examine the relationship of positive and negative incentives with several dimensions of provider effort in Lebanon, where quality of primary care is suboptimal and health quality comprises a national priority [26].

Our study confirmed healthcare quality gaps within the Lebanese Ministry of Public Health Primary care network. In our sample, patients on average received only two routine examinations from the seven recommended by the Network's clinical guidelines. Patients also only enjoyed, on average, eight minutes of their provider's time. Our study generated plausible hypotheses on how facility-level accountability mechanisms could push the frontier of provider effort on the interpersonal and technical dimensions. We show that the "stick and carrot" could work together:

Penalties could nudge providers to comply with facility guidelines, while rewards could promote better interactions with the patients without a particular focus on 'following the rules'. In Lebanon, the financial mode of incentives were the only significant predictors of provider effort. Policy implications, pending further causal investigations, include potentially financially incentivizing physicians beyond their intrinsic motivation.

In Paper III, I examined the relationship between heightened conflict, service utilization patterns for deliveries, and neonatal mortality in the Palestinian territories. One of the fundamental components of health systems resilience is the ability of the system to maintain adequate response to routine healthcare demands while absorbing conflict-induced health needs [27]. However, the majority of quantitative research assessing the impact of conflict has focused on the immediate relationship between conflict and health outcomes, with limited evaluation of possible mechanisms that drive these relationships [28,29,30,31,32,33,34,35,36].

We filled this research gap investigating the health seeking behavior of pregnant women for deliveries during heightened conflict in the territories, along with neonatal mortality. We found a shift towards public facilities away from private and NGO sectors during high conflict, but no overall impact on neonatal mortality. The research offers hypotheses on women's decision making in conflict, mainly that they possibly prefer nearby and free care at times of political turbulence and economic uncertainty. Building on past evidence that heightened conflict in the territories is associated with fewer C-sections, we presume that this may be due to women utilizing the public sector more, which may less capacitated than the private sector or NGOs [37]. Policy implications

thus point to greater emergency preparedness in the public sector of the health system for maternal health.

5.2 FUTURE RESEARCH

The three papers set the path for further important research endeavors. This section provides a snapshot of potential explorations beyond the scope of this thesis and building on its findings.

As paper II has shown, improving quality of care requires looking at how different parts of the health system building blocks interact with each other [1,38]. Our study focused on how accountability could influence the productivity of the health workforce at the primary care level. A better understanding of how other dimensions of facility-level governance - including decision space and institutional capacity - impact provider motivation and technical quality, can offer further insight on the interaction between the health workforce and governance building blocks [39]. Given the particular context of Lebanon, whereby facilities are affiliated with different religious and political groups, these dimensions of governance may also vary and thus allow further exploration of this field [40].

In the context of the study questions particularly explored, research efforts assessing how penalties and rewards are perceived by providers who are intrinsically versus extrinsically motivated can allow the identification of heterogenous impacts of incentives on provider satisfaction and job retention, building on recent findings that examine spillover effects of incentives on physicians beyond their effort in service provision [41,42]. Additionally, the study context could possibly allow the confirmation or present behavioral economic hypotheses surrounding the effectiveness of incentives. These include mental accounting, delivery of financial rewards at times of monetary

scarcity, and salience -or lack of- with regards to the mode of monetary trasnfers [43,44,45]. Oustanding questions from the literature, such as the size of the positive or negative incentive needed to promote long-term behavioral change, could also be assessed if there is varation across facilities [46,47,48]. Finally, political economy analyses of the factors that enable the implementation of penalties in certain facilities but not others is warranted for a holistic policy-level planning and implementation.

The complexity of evaluating, developing and implementing policies at the health system level for quality improvement, as described above, points us to also assessing and evaluating short-term policy options. As paper I has shown, accurate perceptions of relative facility quality levels can potentially guide women into utilizing better care. With that, consumer information could be powerful in ensuring women's receipt of competent care during their deliveries and can present a short-term policy option. Whether consumers would be active agents in researching quality information, if available, should be explored in the context of Kenya and beyond, building on our study and existing literature [49,50,51]. One important next step would thus be trying to understand how much women seek this information, and from whom [52]. Approaches to information delivery, based on previous studies, could include text messaging or community workers that work to tweak women's perceptions and priorities in facility choice [53,54]. The availability of information on facility quality levels has been widely explored in developed country contexts, and results point only to marginal changes in patients' choices [55,56,57,58,59]. A comparative assessment of the efficacy of these policies in developing settings within Kenya and beyond is nevertheless warranted.

However, as Paper I has also shown, accurate perceptions are only modestly predictive of the quality levels at the final facilities of choice. Identifying competing factors that women take into consideration when determining facility choice, including interpersonal care, cleanliness, distance and cost is thus a next step in this population [60,61,62]. In fact, Paper III suggested hypotheses for pregnant women's health seeking behaviors during conflict. The study showed that, at conflict settings, women may have increased preferences for free care and closer facilities over better care. A qualitative examination of the competing preferences for facility choice is warranted for both study contexts, particularly through focus groups. In the context of Paper III particularly, there is a need for examining the response of the health system during conflict could give further insight, including supply shortage, staff deficiencies, and power outage. There is also a need for evaluating the technical and interpersonal quality of care women may receive during heightened conflict times, especially in the public sector.

5.3 CONCLUDING REMARKS

In this dissertation, I applied different methods to study questions related to maternal and child health through a multi-level lens. The findings offer potential policy implications for achieving the corresponding SDG 3 targets. The thesis answers three questions and points to many others in this ambitious global pursuit.

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SUPPLMENTARY INFORMATION

SUPPLEMTARY INFORMAITON FOR CHAPTER 2

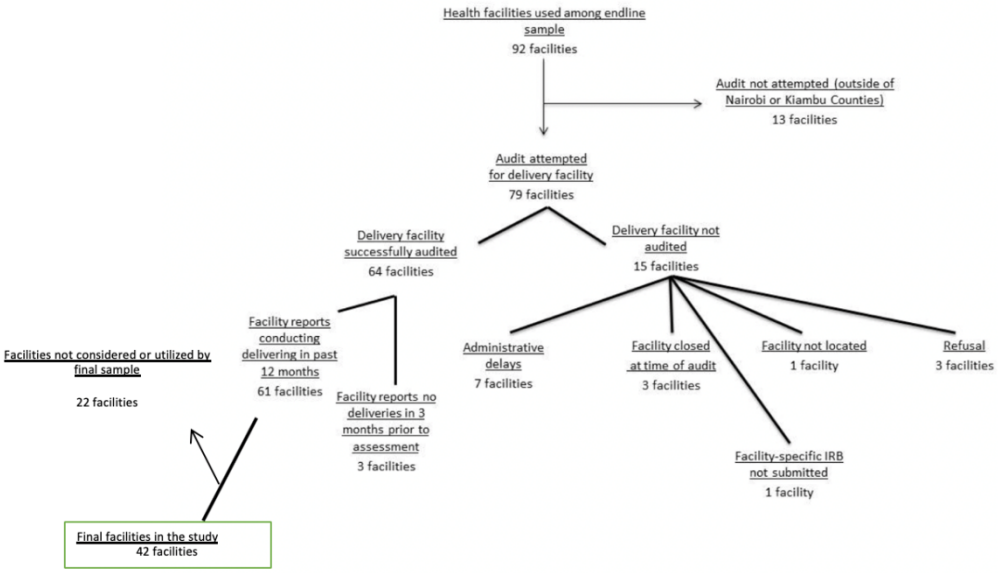

Figure 2.A1. Flow chart of facility inclusion in the study (Adapted from Cohen et al 2017[12]).

Table 2A.1. Fraction of facilities performing each item in the quality index (N=42)

Quality Index Item	Percentage of Facilities Meeting Item
Reported practice in the past three months	
1. Removal of retained products of conception	73.8
2. Parenteral oxytocin for maternal hemorrhage	97.6
3. Parenteral anticonvulsants for (pre-)eclampsia	54.8
4. Manual removal of placenta	69.1
5. Parenteral antibiotics for maternal infection	90.5
6. Assisted vaginal delivery (vacuum or forceps)	26.2
7. Caesarean section	47.6
8. Blood transfusion	40.5
9. Antibiotics given to mother for preterm labor or prolonged rupture of membranes	73.8
10. Parenteral antibiotics for neonatal sepsis	66.7
11. Corticosteroids given to mother for preterm labor	47.6
12. Newborn resuscitation (with bag and mask)	81.0
13. Kangaroo Mother Care practiced for premature/very small newborns	64.3
14. Alternative Feeding for newborns unable to breastfeed	64.3
15. PMTCT if mother is HIV-positive	71.4
16. IV fluids given to newborn	47.6
17. Safe administration of oxygen to newborn	71.4
Verified presence of	
18. At least one medical officer present 24 hours 7 days a week	85.7
19. Essential medical supplies and equipment for medical complications †	52.4

Notes †. Medical equipment and supplies include syringes and needles, injectable oxytocic, IV infusion set, suture material with needle, injectable anticonvulsant and injectable antibiotics.

Table 2A.2. Characteristics of study sample (N= 180) compared to original (full study) baseline sample (N=553).

Mean/percentage (se)	Study sample (N= 180)	Original Study Baseline Sample (N = 553)	Test of equality. p-value on F-test that 1=2
	(1)	(2)	(3)
Mean age, years	25.34 (4.73)	25.27 (4.53)	0.87
Married	85.56 (0.35)	88.43 (0.32)	0.31
Any Secondary Education	65.56 (0.48)	67.09 (0.47)	0.70
Electricity in household	98.89 (0.24)	92.39 (0.27)	0.50
Difficult to get 1000 Ksh †	60.00 (0.49)	59.60 (0.49)	0.92
Health Insurance	38.33 (0.49)	40.65 (0.49)	0.41
First pregnancy	31.67 (0.47)	33.82 (0.47)	0.62
Previous C-section (among those with previous birth)	9.83 (0.30)	12.39 (0.33)	0.45
People with whom delivery location was discussed, number	0. 54 (0.76)	0.42 (0.72)	0.06
Informed to have a high-risk pregnancy	8.33 (0.38)	6.15 (0.24)	0.31

Notes. † Amount converted from Kenyan Shillings (1000) to US Dollars using April 2017 conversion rate of 0.0097.

Table 2A.3. Association between perception accuracy and the probability/odds of delivery in a facility in each quartile of the quality distribution (multivariate ordinary least square and logistic regressions; N=180).

	Dependent Variable Is a Binary Variable Indicating:											
	Delivered in Bottom Quartile Facility			Delivered in Second Quartile Facility			Delivered in Third Quartile Facility			Delivered in Top Quartile Facility		
	Estimate or Odds Ratio	95 % CI	p-value	Estimate or Odds Ratio	95 % CI	p-value	Estimate or Odds Ratio (se)	95 % CI	p-value	Estimate or Odds Ratio (se)	95 % CI	p-value
Ordinary least square regression (unadjusted)												
	-0.082	-0.211, 0.047	0.211	-0.030	-0.157, 0.098	0.647	-0.045	-0.183, 0.092	0.516	0.157**	0.041, 0.273	0.008
Ordinary least square regression (adjusted)												
	-0.070	-0.218, 0.079	0.358	-0.039	-0.173 0.116	0.599	-.036	-0.196, 0.124	0.659	0.145*	0.029, 0.260	0.015
Logistic regression (unadjusted)												
	0.649	0.327, 1.288	0.216	0.851	0.427, 1.696	0.647	0.809	0.428, 1.531	0.515	2.962**	1.330, 6.597	0.008
Logistic regression (adjusted)												
	0.737	0.311, 1.748	0.489	0.854	0.358, 2.038	0.721	0.835	0.379, 1.838	0.654	4.39*	1.302, 14.77	0.017

Notes. Each specification is a regression of a binary outcome indicating delivery in a facility within the specific quality quartile on the perception accuracy variable. There are four of these regressions, one for each quartile of the quality distribution. Adjusted regressions include the following covariates: Marital status, educational attainment, choice set size, ANC visits more than 4, previous pregnancy, C-section history, insurance status, information about risk in pregnancy, SES status, treatment arm, gestational month at baseline and neighborhood group.

** p <0.05; ** p< 0.01 ; *** p< 0.001*

Table 2A.4. Sensitivity Analysis: Association between Perception Accuracy and an Alternative Measure of Facility Quality (OLS Regression)

	Unadjusted			Adjusted		
	Estimate	95 % CI	p-value	Estimate	95 % CI	p-value
Outcome: BEmONC Count[1]	0.525	-0.007, 1.057	0.053	0.570*	0.043, 1.098	0.034

Notes. Models are ordinary least squares regressions. Adjusted regressions include: Marital status, educational attainment, choice set size, previous pregnancy, C-section history, insurance status, information about risk in pregnancy, ANC visits more than 4, SES status, treatment arm, gestational month at baseline, and neighborhood group.

1 BEmONC Count is the number of (out of 7) signal functions that the facility meets. These functions are detailed in items 1-6 and 12 in Table 2.A1.

** p <0.05; ** p< 0.01 ; *** p< 0.001*

Table 2A.5. Sensitivity Analysis: Association between a Lenient Definition of Accurate Perceptions and Facility Quality Index (N=180).

Unadjusted			Adjusted		
Estimate	95 % CI	p-value	Estimate	95 % CI	p-value
0.096**	0.030, 0.161	0.005	0.090**	0.023, 0.156	0.009

Notes. These specifications consider a version of the "accurate perceptions" variable in which women were considered accurate if they either were exactly correct or if they were incorrect in their ranking of facilities that had equal index values (ranked one as better than the other). Specifications are ordinary least squares regressions. Adjusted regressions include the following covariates as midline: Marital status, educational attainment, choice set size, previous pregnancy, C-section history, ANC visits more than 4, insurance status, information about risk in pregnancy, SES status, treatment arm, gestational month at baseline, and neighborhood group.

** p <0.05; ** p< 0.01 ; *** p< 0.001*

SUPPLEMTARY INFORMAITON FOR CHAPTER 3

Table 3A.1. Facility types in the MOPH and the realized sample, %.

	MOPH Network N=221	Realized sample N= 69
Public	26	26
Religious charities	26	32
Sectarian political parties	24	12
Non-affiliated NGOs	24	30

Table 3A.2. The distribution facility-level characteristics in original study sample and the final sample for the study.

Facility attribute,%(se)	Original sample (N = 69) (1)	Final sample (N = 55) (2)	p-value for Test of Equality (1) = (2)
Facility type			
Public	26.1 (0.05)	27.3 (0.06)	0.88
Religiously affiliated	31.9 (0.06)	32.7 (0.06)	0.92
Politically affiliated	11.9 (0.04)	12.7 (0.05)	0.85
Non-affiliated NGOs	30.4 (0.06)	23.3 (0.06)	0.70
Facility location			
Beirut	13.0 (0.04)	10.9 (0.04)	0.72
Mount Lebanon	29.0 (0.06)	23.6 (0.06)	0.50
North Lebanon	17.4 (0.05)	21.8 (0.06)	0.54
Aakkar	7.2 (0.03)	9.1 (0.04)	0.71
Beqaa	7.2 (0.03)	9.1 (0.04)	0.71
Baalbek-Hermel	8.7 (0.03)	7.3 (0.04)	0.77
South	14.5 (0.04)	14.5 (0.05)	0.99
Nabatiyeh	2.9 (0.02)	3.6 (0.03)	0.82
Patients in last 30 days, number †	1086.1 (130.1)	1145.5 (148.3)	0.69
Employed physicians, number††	17.3 (1.4)	16.4 (1.6)	0.68

*Notes. † Data available for 62 and 51 facilities respectively. †Data available for 59 and 47 facilities respectively; * p <0.05; ** p< 0.01 ; *** p< 0.001*

Table 3A.3. Reported facility-level monitoring mechanisms implementation for reported facility-level penalty and reward implementation, by reason (N= 55).

Reason for reward	Reported implementation of incentive, N(%)	Reported implementation of necessary monitoring, N(%)	Effective implementation of incentive N (%)
Timeliness, absenteeism, and/or early departure	29 (52.7)	47(86.2)	25 (45.46)
Performance	29(52.7)	50(89.7)	26(47.28)
Reason for penalty			
Timeliness, absenteeism, and/or early departure	36(65.5)	49(88.9)	32(58.18)
Performance	23(41.8)	53(95.7)	22(40.00)

Notes. Both monitoring mechanisms and incentive implemented are self-reported by the CMO. Corresponding monitoring mechanisms for performance include report of conducting clinical observations and/or reviewing patient records. Corresponding monitoring mechanisms for timeliness, absenteeism, and/or early departure is reported tracking of provider attendance.

Table 3A.4. Association between penalties and routine examinations performed (Panel A), and rewards with time spent with patient and questions asked by provider (Panel B), by mode of implementation.

Panel A	Number of routine examinations		
Penalty mode	Estimate	95% CI	p-value
Contract termination/suspension	0.834	0.632 1.100	0.198
Financial	1.336*	1.031 1.729	0.028
Negative Feedback	1.000	0.839 1.191	0.996

	Dependent variables are counts of:						
Panel B	Time spent with patient (minutes)			Number of questions asked			
Reward mode	Estimate	95% CI	p-value	Estimate	95% CI		p-value
Financial reward	1.224*	1.046 1.431	0.012	1.232	0.976	1.556	0.079
Social Recognition	0.960	0.814 1.133	0.628	0.980	0.723	1.049	0.146

*Notes. Each column represents a separate regression. Models are multilevel Poisson that control for CMO education, monitoring, provider education, payment, gender, and case mix as well as patient age group, gender, symptoms, and questions asked. Facility and physician fixed effects were used. * p <0.05; ** p< 0.01 ; *** p< 0.001*

Tables 3A.5. Sensitivity analysis: Restricting facility-level incentive implementation to those that report implementing the corresponding monitoring mechanisms does not change the overall results.

	Dependent variables are counts of:											
	Questions asked, number				Time spent with patient, minutes				Routine examinations, number			
	Estimate	95% CI		p-value	Estimate	95% CI		p-value	Estimate	95% CI		p-value
Reward	1.222*	1.004	1.485	0.045	1.23*	1.017	1.487	0.033	0.999	0.834	1.202	0.992
Penalty	0.808	.683	.9567	0.013	0.893	.744	1.071	0.223	1.234*	1.022	1.493	0.029

*Notes. Each column represents a separate regression. Models are multilevel Poisson that control for CMO education, monitoring, provider education, payment, gender, and case mix as well as patient age group, gender, symptoms, and questions asked. Facility and physician fixed effects were used. * p <0.05; ** p< 0.01 ; *** p< 0.001.*

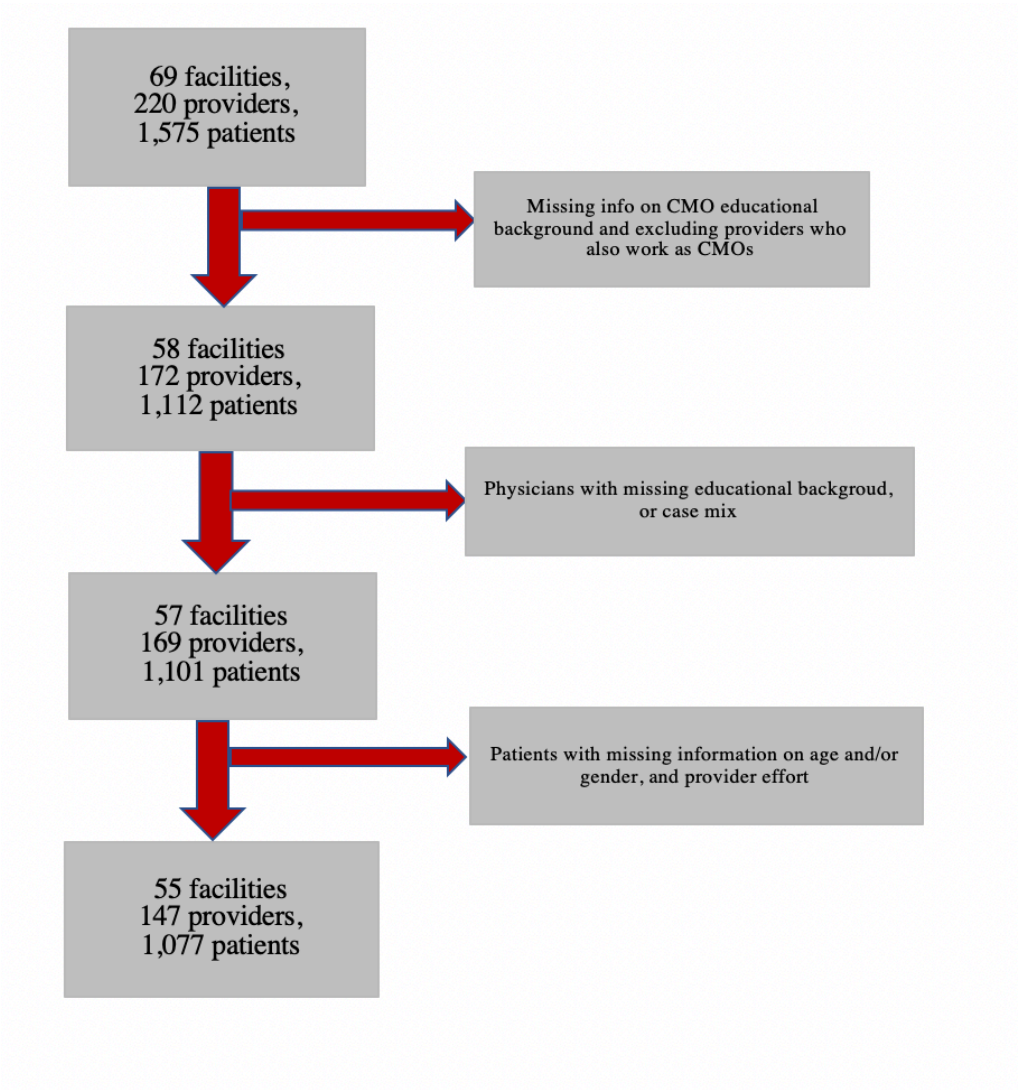

Figure 3A.1. Flow chart showing sample selection process

SUPPLEMTARY INFORMAITON FOR CHAPTER 4

Table 4A.1. Sensitivity analysis: Imputing delivery location for all missing values yields similar results.

Delivery location	Estimate	p-value	95% CI	
Public sector	1.036*	0.015	1.007	1.066
Private sector	0.976	0.108	0.948	1.005
NGO	0.895*	0.013	0.820	0.977

*Notes. We control for socioeconomic status quartile, household location by locality and region, maternal education, marital status at time of survey, maternal age at birth, year of survey, whether the birth is a singleton, female. We also control for birth interval and being a first birth; * p <0.05; ** p< 0.01 ; *** p< 0.001.*

Table 4A.2. Quarterly average of conflict intensity shows larger changes in patterns of utilization but similar result for overall effect on neonatal mortality.

Panel 1	Estimate	p-value	95 % CI	
Neonatal mortality	1.007	0.903	0.901	1.125
Panel 2	**Estimate**	**p-value**	**95 % CI**	
Delivery in a public facility	1.088	0.000**	1.043	1.136
Panel 3	**Estimate**	**p-value**	**95 % CI**	
Delivery in a private facility	0.926	0.003*	0.880	0.975
Panel 4	**Estimate**	**p-value**	**95 % CI**	
Delivery in an NGO	0.823	0.001*	0.730	0.927
Panel 5	**Estimate**	**p-value**	**95 % CI**	
Delivery in an Israeli facility	0.552	0.351	0.159	1.925

*Notes. We control for socioeconomic status quartile, household location by locality and region, maternal education, marital status at time of survey, maternal age at birth, year of survey, whether the birth is a singleton, female. We also control for birth interval and being a first birth; * p <0.05; ** p< 0.01 ; *** p< 0.001.*

Table 4A.3. Relaxing the inclusion criteria for the 2004 and 2006 surveys given the missing exact month of interview to include all births within 1 month of the 0-24 original selection criteria.

Panel 1	Estimate (se)	p-value	95 % CI
Neonatal mortality	1.005 (0.030)	0.881	0.946 1.065
Panel 2	**Estimate (se)**	**p-value**	**95 % CI**
Delivery in public sector	1.028* (0.014)	0.042	1.001 1.056
Panel 3	**Estimate (Se)**	**p-value**	**95 % CI**
Delivery in private sector	0.976 (0.015)	0.114	0.947 1.006
Panel 4	**Estimate (se)**	**p-value**	**95 % CI**
Delivery in an NGO	0.900* (0.041)	0.02	0.824 0.984
Panel 5	**Estimate (se)**	**p-value**	**95 % CI**
Delivery in Israeli facilities	0.892 (0.226)	0.651	0.543 1.465

*Notes. We control for socioeconomic status quartile, household location by locality and region, maternal education, marital status at time of survey, maternal age at birth, year of survey, whether the birth is a singleton, female. We also control for birth interval and being a first birth. * p <0.05; ** p< 0.01 ; *** p< 0.001.*

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