Faculté de Santé Publique

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# Does the Presence of Refugees Affect the Health Status of the Hosting Community? The Case of Cameroon

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## Declaration of Originality

I hereby confirm that this thesis entitled "Does the Presence of Refugees Affect the Health Status of the Hosting Community? The Case of Cameroon" is my original work. All sources of information from prints and online sources reported by other authors are properly cited and included in the list of references in accordance to the anti-plagiarism guidelines.

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I, Tefera Darge Delbiso, approve this thesis for submission.

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**Abstract**

**Background**: The United Nations High Commission for Refugees (UNHCR) estimates that nine out of ten refugees settle in developing countries. These countries have weak health systems with high maternal and child mortality. With little literature on the influence of refugees on the health of their host, the aim of this study was to explore the impact of refugees on maternal and child health of the local host population.

**Setting**: By 2011, 100,000 refugees, mainly from the Central African Republic (CAR) had settled in Cameroon since 2006. The main area of settlement was the eastern border of the Adamaoua and East regions and spread over 50.000 square kilometers.

**Methods**: Using the 2011 Cameroon's Demographic and Health Survey, we evaluated maternal and child health indicators of the local refugee host population. These indicators were compared to those of a control group selected through propensity score matching from the rest of the country. Our main outcomes were attendance of less than four antenatal clinics (ANC), delivery out of health facilities and non-completion of DPT3 vaccine. The main exposure was living in the refugee occupied zone.

**Results**: Of the 15426 women in our analysis, 902 were resident in the refugee zone. When compared to the rest of the country, women living in the refugee zone were likely to attend less than four ANCs (56.1% vs 35.4%; p<0.001), and be delivered out of health facilities (66.6% vs 32.1%; p-<0.001). However, non-completion of DPT 3 vaccination showed no difference (40.9% vs 37.8%; p=.19). After propensity score matching, the risks of attending less than four ANCs and delivering out of health facilities were still higher in the refugee host by 12.7% (95%CI=8.5-17%; p<0.001) and 17.6% (95%CI=13.9%-21.6%; p<0.001) respectively. Compared to the disparities in 2004, only the gap in infant vaccination coverage had been closed by 2011.

**Conclusion**: Our findings demonstrate that with the presence of refugees, maternal health of the host improves slightly while child health improves more. In this light, emphasising on maternal health during assistance programmes to refugees could maximize the host health benefits.

**Key words:** Cameroon, Maternal and Child Health, Refugees, Host Population

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**List of Abbreviations**

| | |
|---|---|
| AIDS | Acquired Immune Deficiency Syndrome |
| ANC | Antenatal Care (Clinic) |
| ARV | Antiretroviral |
| ATT | Average treatment effect on the treated |
| CAR | Central African Republic |
| DHS | Demographic and Health Survey |
| DPT | Diphtheria, Pertussis (Whooping Cough), and Tetanus |
| EPI | Expanded Programme on immunisation |
| HIA | Health Impact assessment |
| HIV | Human immunodeficiency virus |
| UN | United Nations Organisation |
| UNHCR | United Nations High Commissioner for Refugee |
| WHO | World Health Organisation |

## 1. Introduction

The adverse consequences imposed by internal unrest and civil conflicts are enormous and well acknowledged. Wars produce a large number of deaths, distort human and physical capital accumulation, destroy environment, incapacitate institutions, restrict political governance, and abrade civil liberties. And their horror uproot entire human communities from their own lands, mostly non-combatants who will from then onward live at the mercy of well-wishers. With the increasing number of new and protracted conflicts, the number of refugees worldwide is increasing every year (1). For example, by the end of 2014, the world had witnessed the highest increase in the number of refugees since the previous two decades (2). In fact, in 2015, an estimated 4,600 persons were being forced to flee their countries every day (3). When put together, one out of 122 persons living in the world today are either refugees, internally displaced, or persons seeking asylum (3). If this were the population of a country, it would be the world's 24th biggest country (3).

The observed rapid increase in the number of refugees directly translates to an increase in responsibility from neighboring countries who opt to host these refugees. Unfortunately, contrary to common believes, most of these refugees settle in less developed areas. The United Nations High Commission for refugees (UNHCR) estimates that nine out of ten refugees tend to settle in countries considered to be less developed (3). A less developed country, among several other problems, is often characterised by fragile health systems accompanied by high maternal and child mortality. An extra burden from hosting refugees may further worsen these conditions in the local host population (4).

In general, the risks from hosting refugees may include disease outbreaks, food and land scarcity, unsafe drinking water, wage competition, overburdened school and health care facilities, environmental degradation, and increased criminality and conflicts (25). On the other hand, the arrival of refugees can raise the welfare of their hosts and stimulate their local economies through higher demands, the influx of resources from international humanitarian assistance, and more improved infrastructure (5). Establishing whether the positive effects outweigh the negative effects is at the end a

subject of empirical discussion: Many of these mechanisms operate in different directions and in different contexts, the magnitude of their impacts, which are manifold are rarely known as they are inherently difficult to study.

Furthermore, the way an assistance program is organized may have different outcomes on the host (5). Generally, when many refugees arrive in a country at the same time, they are moved into camps where they can easily get relief assistance (6). Such assistance may have a negative impact on the quality of health services offered to the local host population. This results from the diverting of human and financial resources and even attention towards the refugee health services (7). Encampment, however, is not always inevitable, nor the only appropriate solution. Recognizing the limitations of encampment, the rapid integration of refugees into the host population is encouraged (8). The shift to provide health assistance to refugees while they settle in areas of their own choice has been shown to improve access to health in the local host population (8). The full extent of this influence on maternal and child health is still unclear.

Typically, health services capable of addressing mother and child health problems are usually established as a priority during assistance to refugees. The local host population therefore invariably experiences an abrupt improvement of heath care services in its vicinity. And for a well-designed assistance programs, there should be no disparity in the health care received by the hosts compared to the refugees (5). In keeping with standards, the recommended minimum health services to be provided by an assistance program surpass those experienced by most refugee hosts in developing countries (26). Ultimately, it is expected that the local host should experience improvement in its mother and child health indicators. Assessing this improvement is necessary to guide recommendations to assistance programs.

From a policy point of view, one can argue that the impact of refugees on their local host population has for long been neglected. Fortunately, the UNHCR seems to be increasingly aware that this overlook is overdue: The UN agency for refugees now implements new programs to ease the transition phase following the closure of camps (9). There is sound literature evaluating various conditions in refugees (10, 11). But only few studies have addressed the impact of refugees on their host population, and

focusing most of the times on economic and security aspects (4, 5). At its extreme, refugees are accused of diffusing conflicts to their host community (25). However, to our knowledge, the impact of the presence of refugees on maternal and child health of the local host population has not been extensively explored.

It becomes even more imperative to provide such assessment since only minor adjustments in assistance programs are needed to improve the health of the host population if it were otherwise poorer.

## 2. Objectives

Faced with this gap in the literature, the overall objective of this study was to assess changes in mother and child health indicators of the local host population of refugees living in Cameroon between 2006 and 2011 due to the presence of refugees.

Specifically, we sought to achieve the following:

(1) To compare the proportion of women not attending the recommended number of antenatal clinics in the refugee host community to a control group from the rest of Cameroon.

(2) To compare the proportion of women being delivered out of health facilities in the refugee host population to a control group of women living elsewhere in Cameroon.

(3) To compare infant vaccination coverage in the refugee host population to a control group from the rest of the country.

(4) To assess how risks of non-attendance of the recommended number of ANCs, out of health facility delivery and non-completion of DPT3 had changed in the refugee zone between 2004 (pre-refugee arrival) and 2011 (with the presence of refugees).

## 3. Methods

### 3.1. Study Design

This is a retrospective cross sectional study designed to evaluate the impact of refugees on maternal and child health of the local refugee host population in Cameroon. Using data from the Cameroon Demographic and Health Survey VI collected in 2011, we compared maternal and child health indicators for the local refugee host population with those of people living elsewhere in the country. Our control population was selected using propensity score matching. A similar procedure was applied to the 2004 DHS to establish the background characteristics of the study population. A total of 15426 participants were part of this analysis and the study is reported in accordance with the guidelines for a Master's Thesis at the Université Catholique de Louvain.

### 3.2. Setting

Cameroon is a lower middle income country in sub-Saharan Africa, specifically, in Central African. It has a population of about 22.25 million (projections based on the 2005 population census), spread over a total surface area of 475 650 square kilometers. It is a relatively peaceful and stable country compared to neighboring countries in the subregion which are continually in conflict. To the west, it is bounded by Nigeria, to the south by Congo, Gabon and Equatorial Guinea, to the east by Central African Republic and to the north by Chad (Figure 1).

Because of the continual conflicts in this subregion, most of the resulting refugees have been moving to Cameroon. For example, by December 2015, Cameroon was hosting more than 277000 people of concern to the UNHCR, and the majority of these refugees came from the Central African Republic. Since 2006, most Central African Republic refugees fleeing from high levels of banditry and other criminal acts settled along the eastern border of Cameroon. In 2011, the number of refugees had risen to more than 100000 (12). Most of the refugees live in at least 314 villages spread over an area of more than 50.000 square kilometers, spanning the East and Adamaoua regions.


Figure 1: Cameroon and its neighbouring countries in the central African region

As a destination country for refugees, Cameroon is signatory to all major legal instruments on refugees, including the 1951 Refugee Convention and the 1969 OAU Refugee Convention. The nation had also adopted a law defining the legal framework for refugee protection in July 2005, though it only went into force in November 2011 (12). In this regard, Cameroon is at least aware of its responsibilities towards refugees. The country allocated the site for settling of refugees and together with UNHCR and

other NGOs have managed programs for refugee assistance. The extensive Central African Republic border presents a challenge for the humanitarian actors on the ground, with more than 30 entry points and further aggravated by poor road conditions, making access difficult. To help this situation, the government provides armed escorts for refugees and humanitarian actors in operational areas as well as facilitates access to local schools and health centers for refugees, with the support of UNHCR.

The settling of refugees in a well circumscribed area provides an ideal opportunity to sample the host population for evaluation. Also, because these refugees are distributed over a large surface area (Figure 2), refugee assistance programs are correspondingly spread over a large number of hosts in attempt to reach all the refugees.

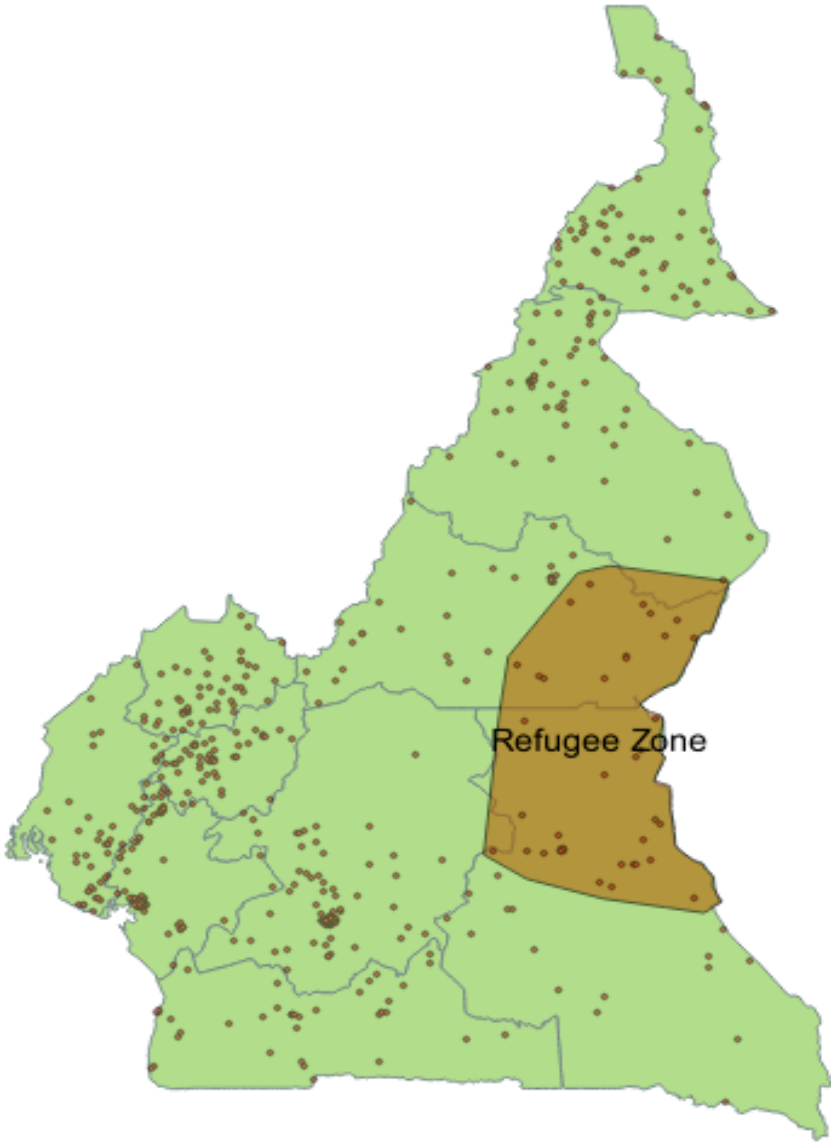



Figure 2: Refugee occupied zone in Cameroon and the distribution of the 2011 Demographic and Health Survey clusters.

### 3.3. The Demographic and Health Survey (DHS) database

The DHS Program is funded by the United States' Agency for International Development (USAID) and has been providing technical assistance to more than 300 surveys in over 90 countries since 1984. It focuses on advancing global understanding of health and population trends in developing countries. This Program has earned a worldwide reputation for collecting and disseminating accurate, nationally representative data on fertility, family planning, maternal and child health, gender,

HIV/AIDS, malaria, and nutrition. In Cameroon, data has been collected in 1991, 1998, 2004 and 2011. Data collection for 2016 is ongoing with plans of regular survey arranged after every five years. The 2011 Demographic and Health Survey in Cameroon included a total sample of 15050 ordinary households from 580 clusters selected from the entire country. The final survey units being the households, were selected through a multistage clustered sampling with probability of sampling being proportional to cluster size. The sample obtained was representative both at the national and regional levels as well as in terms of being in a rural or urban setting. While this dataset can be used to analyze a wide range of health indicators, this study focused on exploring sections addressing mother and child health.

### 3.4. Participants

The participants selected for our analysis were all the women together with their children who took part in the 2011 and 2004 Cameroon DHS. These women were those between the ages of 15 and 49 years. They were either permanent residents of the households selected for the survey or had spent the previous night in these households and as well, had given their consent to participate in the survey. Children of selected mothers who were less than five years were included.

#### *Assigning Participants as Refugee Host*

Participants were assigned to be resident in either the refugee occupied zone or not using Quantum GIS (QGIS) version 2.14. First, clusters were redistributed over the national territory based on their GPS coordinates recorded during the cluster sampling phase of the survey. The zone occupied by refugees was considered to be the area mapped out by the UNHCR in their 2011 country report (12). Clusters found in the refugee mapped zone were then considered as the exposed clusters and assigned the value 1 while those out of the refugee zone were assigned the value 0. Participants in each cluster subsequently received a number same as that assigned to their clusters.

### 3.5. Variable Definition

From a wide range of dummy coded variable in the dataset, the following variables were defined using the study questionnaire and the recoding manual (27).

***Outcome Variables***

The main outcomes of interest were the number of antenatal clinics (ANC) mothers attended, where the mothers were being delivered and the infant vaccination coverage.

ANC indicates the visits by a pregnant woman to a trained health worker with the goal to monitor, detect, treat and prevent pregnancy related problems. The WHO recommends a minimum of four antenatal visits, comprising interventions such as tetanus toxoid vaccination, screening and treatment for infections, and identification of warning signs during pregnancy. In the DHS, mothers were asked the various places they did their ANC, the person attending to them at the ANC and the number of times they consulted for their pregnancy. ANC attendance was counted for each visit paid to a health facility. The number of ANCs attended was defined as no ANC attended, 1 to 3 ANCs attended and 4 or more ANCs attended for descriptive statistics. Finally ANC attendance was grouped as non-attendance of the recommended number of ANCs for any ANC attendance less than four to obtain a binary outcome for association tests.

The place of delivery referred to where mothers were being delivered. Typically deliveries out of health facilities carry a high risk of negative outcomes to both the mother and child in these settings. Mothers were asked if they were delivered in a government or private health facility or at home/elsewhere. All deliveries not taking place in a health facility were defined as delivery out of health facility.

Infant vaccination coverage referred to the proportion of the children in the population who were vaccinated correctly. This is an important indicator of level of care to children. Determining the proportion of children who correctly complete the third dose of the DPT3 vaccine has been used as a good indicator for evaluating EPI vaccination coverage in other studies (13). In the DHS, mothers were asked the number of times their children received DPT3. Based on the child's age, it was then determined if the child had correctly completed vaccination or not. Variable was therefore defined as non-completion of DPT3 vaccine for children beyond one year who had not received up to three doses of DPT.

***Exposure Variable***

The exposure variable was the zone of residence of the participants. Participants who were living in the mapped refugee occupied area where considered to be the refugee host population while others living elsewhere in the country were not.

***Potential Confounding Variables***

The potential confounding variables were other determinants of mother and child health status which were selected based on the review of literature (14). Specifically, we selected mothers' educational level, residence in urban or rural area, and wealth index and mothers previous birth experience as variables which were most likely to generate a difference in our study groups as suggested by the literature (15, 16).

### 3.6. Data Management

Data were downloaded from the DHS website (http://dhsprogram.com) after obtaining permission to use the data. This data came in a pre-processed state, with imputations already done for dates as well as dummy coding for most variables. Further management included the recoding of variables of interest using the recoding manual as well as the survey questionnaires. Processed data was stored in a csv format for analysis. All data management and subsequent analyses were done using R software version 3.2.3.

### 3.7. Statistical Methods

Our exploratory analysis started by evaluating distributions for each numeric variable of interest as well as frequencies and percentages for each of the categorical variables. Specifically, numeric variables were evaluated for normality in their distributions while categorical variables were evaluated for near-zero variation (presence of very few observation in any class) (17). Extensive graphical displays were used for both univariate analysis and bivariate associations, accompanied by broader tests such as Maximal Information Coefficient (18) and Nonnegative Matrix Factorization (19) algorithms for numeric variables. Missing data were explored using a combination of graphical displays involving univariate, bivariate and multivariate methods. No further imputations were performed.

***Propensity Score Matching***

The association between non-attendance of the recommended number of ANCs, delivery out of a health facility and infant vaccination coverage as outcome variables and residence in the refugee zone as predictor variable was evaluated using propensity scores matching (30). This analysis started by building propensity scores in a generalized linear model. This model used the zone of residence as the dependent variable and the potential confounding variables (mothers' educational level, residence in urban or rural area, wealth index and mothers previous birth experience) as predictor variables. After modeling, each individual was assigned a score which corresponded to her probability of belonging to the refugee zone given her values of the confounding variables. The propensity scores were then matched between the two arms, those living in the refugee zone and those living elsewhere, so that the control group had very similar characteristics as those living in the refugee zone. Matching was done on a one to one basis (1 to 1 match) using the matching package in R. Balance between groups was evaluated through a combination of plots as well as statistical tests, specifically t-tests and chi-square tests. Once matched controls were found, the association between zone of residence and attendance of the recommended number of ANCs, place of delivery as well as infant vaccination coverage were performed. The measure of association used was the average treatment effect on the treated (ATT), which was calculated as the risk difference between those living in the refugee zone and their controls for each outcome. The t-statistics was used to test for significance at a p-value less than 0.05 and the 95% confidence interval was calculated using the Abadie-Imben Standard error. The Abadie-Imben's standard error was used as a better estimate for the standard error as it takes into consideration errors resulting from the propensity score matching (30).

### 3.8. Ethical Considerations

From an ethical point of view, this study posed minimal to no risk to physical and mental well-being of the target population or violation of any ethical principles. Nonetheless, given that data was obtained from a data base, the following considerations were made:

1. Data were used in strict conformity with the DHS rules and regulations for researchers
2. Data were only shared among people who were registered as co-authors for this study
3. No attempt was made to further identify any individual in the dataset.

## 4. Results

### Characteristics of the study participants

A total of 15426 women were part of this analysis, and 902 of them were living in the refugee-occupied zone. The women had an average age of 28 (Standard deviation [SD] = 9.55) years with over 18% of them having no education. Women in the refugee occupied area were on average poorer and had lower levels of education than their counterparts living elsewhere in the country. Also, most women living in the refugee zone dwelled in rural areas and had lesser knowledge on contraception as well as its use. In most cases (73%), males headed the households. The median number of children each woman had given birth to was 2.74 babies, of whom 2.46 were living. The median number of children per household was 1.47 (Table 1).

Table 1: Background characteristics of study participants stratified by area of residence (refugee zone), Cameroon DHS, 2011

| Characteristics | Whole Country (n=15426) | Non-Refugee zone (n=14524) | Refugee zone (n=902) | p-value |
|---|---|---|---|---|
| Age* | 27.98 (9.55) | 28.01 (9.56) | 27.49 (9.45) | 0.105 |
| Education | | | | < 0.001 |
| No education | 2796 (18.1 %) | 2494 (17.2 %) | 302 (33.5 %) | |
| Primary | 5480 (35.5 %) | 5109 (35.2 %) | 371 (41.1 %) | |
| Secondary | 6426 (41.7 %) | 6206 (42.7 %) | 220 (24.4 %) | |
| Higher | 724 (4.7 %) | 715 (4.9 %) | 9 (1 %) | |
| Residence | | | | 0.004 |
| Rural | 7654 (49.6 %) | 7164 (49.3 %) | 490 (54.3 %) | |
| Urban | 7772 (50.4 %) | 7360 (50.7 %) | 412 (45.7 %) | |
| Household size* | 7.39 (4.45) | 7.41 (4.49 ) | 7.07 (3.79 ) | 0.008 |
| Household head | | | | < 0.001 |
| Female | 4101 (26.6 %) | 3912 (26.9 %) | 189 (21 %) | |
| Male | 11325 (73.4 %) | 10612 (73.1 %) | 713 (79 %) | |
| Wealth index | | | | < 0.001 |
| Poorest | 2292 (14.9 %) | 2075 (14.3 %) | 217 (24.1 %) | |
| Poorer | 3053 (19.8 %) | 2842 (19.6 %) | 211 (23.4 %) | |
| Middle | 3188 (20.7 %) | 2982 (20.5 %) | 206 (22.8 %) | |

| | | | | |
|---|---|---|---|---|
| Richer | 3443 (22.3 %) | 3286 (22.6 %) | 157 (17.4 %) | |
| Richest | 3450 (22.4 %) | 3339 (23 %) | 111 (12.3 %) | |
| Children per household** | 1.47 (1.45) | 1.46 (1.45 ) | 1.55 (1.44) | 0.07 |
| Children ever born** | 2.74 (2.78) | 2.72 (2.77 ) | 3.09 (2.9) | < 0.001 |
| Children living per woman** | 2.46 (2.39) | 2.44 (2.38 ) | 2.75 (2.5) | < 0.001 |
| Child bearing experience | | | | 0.007 |
| No previous experience | 6733 (43.6 %) | 6379 (43.9 %) | 354 (39.2 %) | |
| 2 or more births | 8693 (56.4 %) | 8145 (56.1 %) | 548 (60.8 %) | |
| Contraception knowledge | | | | < 0.001 |
| Knows no method | 796 (5.2 %) | 688 (4.7 %) | 108(12%) | |
| Knows traditional method | 22 (0.1 %) | 22 (0.2 %) | 0 (0 %) | |
| Knows modern method | 14608 (94.7 %) | 13814 (95.1 %) | 794 (88 %) | |
| Contraception use | | | | < 0.001 |
| No use | 8690 (56.3 %) | 7996 (55.1 %) | 694 (76.9 %) | |
| Used | 6736 (43.7 %) | 6528 (44.9 %) | 208 (23.1 %) | |

* Mean (SD)
** Median (Inter Quartile Range)

**Maternal Health Indicators**

When evaluating maternal health indicators, we found that mothers in the refugee zone were less likely to attend at least four of the recommended number of antenatal clinics (43.9% vs 64.6%, $p < 0.001$). In addition, mothers in the refugee zone started their first ANC later than those elsewhere [4.35(+/- 1.7) vs 3.99(+/-1.5) months, $p < 0.001$]. Regarding the content of the ANC mothers received, blood pressure measurement, receiving Fancidar and worm medication were similar for the two groups, while performing urine tests, blood tests, explaining pregnancy related complications to mothers, taking iron medications and anti-tetanus toxoids were less likely in women living in the refugee zone ($p < 0.001$), (Table 2).

Table 2: Crude ANC indicators stratified by zone of residence, Cameroon DHS, 2011

| Indicators [Not Applicable] | Whole Country (n=15426) | Non refugee zone (n=14524) | Refugee zone (n=902) | p-value |
|---|---|---|---|---|
| Person who conducted ANC [8760] | | | | 0.002 |
| Doctor | 1170 (17.6 %) | 1125 (18 %) | 45 (10.8 %) | |
| Nurse/midwife | 4513 (67.7 %) | 4213 (67.4 %) | 300 (71.8 %) | |
| Nurse aid | 931 (14 %) | 862 (13.8 %) | 69 (16.5 %) | |
| Others | 52 (0.8 %) | 48 (0.8 %) | 4 (1 %) | |

| | | | | |
|---|---|---|---|---|
| Time at first ANC [8771]* | 4.02 (1.51) | 3.99 (1.5) | 4.35 (1.7) | < 0.001 |
| Number of ANC attended [7802] | | | | < 0.001 |
| None | 959 (12.6 %) | 876 (12.3 %) | 83 (16.6 %) | |
| 1 to 3 | 1844 (24.2 %) | 1646 (23.1 %) | 198 (39.5 %) | |
| 4 or more | 4821 (63.2 %) | 4601 (64.6 %) | 220 (43.9 %) | |
| Blood Pressure measured at ANC [8730] | 6408 (95.7 %) | 6003 (95.7 %) | 405 (96.4 %) | 0.524 |
| Urine tested at ANC [8730] | 5959 (89 %) | 5564 (88.7 %) | 395 (94 %) | < 0.001 |
| Blood tested at ANC [8730] | 6040 (90.2 %) | 5641 (89.9 %) | 399 (95 %) | < 0.001 |
| Complications of Pregnancy explained during ANC [8730] | 3303 (49.3 %) | 3107 (49.5 %) | 196 (46.7 %) | 0.282 |
| Took Iron during Pregnancy [7771] | 6302 (82.3 %) | 5914 (82.7 %) | 388 (77.1 %) | 0.002 |
| Took Fancidar during Pregnancy [7771] | 3486 (45.5 %) | 3264 (45.6 %) | 222 (44.1 %) | 0.543 |
| No anti-malaria during Pregnancy [7771] | 2179 (28.5 %) | 1996 (27.9 %) | 183 (36.4 %) | < 0.001 |
| Number of ATT in pregnancy [7771] | 1.74 (+- 1.32) | 1.76 (+- 1.33) | 1.57 (+- 1.13) | < 0.001 |
| Dewormed during pregnancy [7771] | 3366 (44 %) | 3129 (43.8 %) | 237 (47.1 %) | 0.154 |

***Mean (SD)**

Generally, most deliveries in Cameroon occurred in health facilities (77.1%). Most women in the refugee zone were likely to be delivered out of a health facility following the crude analysis (61.6% vs 32.1%, $p < 0.001$). Also less skilled personnel (people other than doctors, midwives and nurses) conducted most of the deliveries in the refugee zone with very few check-ups occurring after delivery. (Table 3)

Table 3: Crude delivery indicators stratified by refugee zone, Cameroon DHS, 2011.

| **Indicators [Not Applicable]** | **Whole country (n=15426)** | **Non refugee zone (n=14524)** | **Refugee zone (n=902)** | **p-value** |
|---|---|---|---|---|
| Out of health facility [7798] | 2595 (34.1 %) | 2286 (32.1 %) | 309 (61.6 %) | <0.001 |
| Person conducting delivery [7798] | | | | < 0.001 |
| Doctor | 580 (7.6 %) | 545 (7.6 %) | 35 (7 %) | |
| Nurse/midwife | 4117 (54 %) | 3949 (55.4 %) | 168 (33.5 %) | |
| Other persons* | 2733 (35.8 %) | 2452 (34.4 %) | 281 (56 %) | |
| Alone | 198 (2.6 %) | 180 (2.5 %) | 18 (3.6 %) | |
| Check-up after delivery [7771] | 3479 (45.4 %) | 3293 (46 %) | 186 (37 %) | < 0.001 |
| Time of check-up after delivery **(minutes) [12067] | 145.18(+- 57.71) | 145.41(+- 57.44) | 141.07(+- 62.16) | 0.356 |

** average time to between delivery and check-up of woman for any complications
* Other persons who conducted deliveries other than doctors, nurses or midwives included nurse aids, traditional birth attendants and relatives.

## Child Health Indicators

When analyzing child health indicators, there was an overall high rate of vaccination for the country. Considering the individual vaccines administered, polio vaccines were less likely to be administered in the refugee zone: polio 0 (60.3% vs 73.1, $p < 0.001$), polio 1 (84.2% vs 87.2%, $p = 0.068$) and polio 2 (72% vs 78.2%, $p = 0.002$). DPT 3 vaccine which was used to evaluate vaccination coverage did not show any difference between the two groups in the crude analysis. Also, there was no difference between the two groups regarding how mothers treated diarrhea and where they sought treatment for their children's diarrhea, pneumonia and fever. (Table 4).

Table 4: Child Health Indicators stratified by zone of residence, Cameroon DHS, 2011

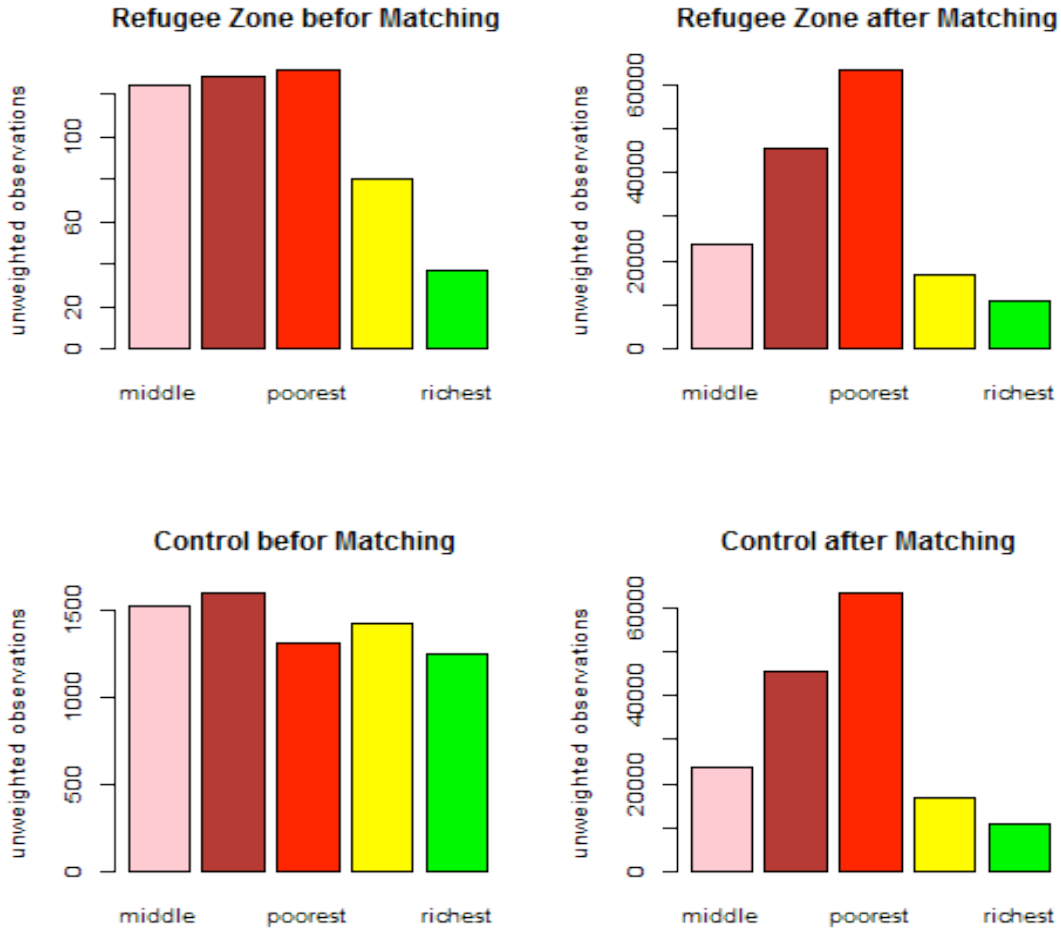
| **Indicators [Not Applicable]** | **Whole Country (n=15426)** | **Non Refugee zone (n=14524)** | **Refugeezone (n=902)** | **p-value** |
|---|---|---|---|---|
| Polio 0 vaccine [8176] | 5241 (72.3 %) | 4959 (73.1 %) | 282 (60.3 %) | < 0.001 |
| BCG vaccine [8176] | 6287 (86.7 %) | 5894 (86.9 %) | 393 (83.8 %) | 0.063 |
| DPT 1 vaccine [8219] | 5907 (82 %) | 5529 (82 %) | 378 (80.9 %) | 0.596 |
| Polio 1 vaccine [8185] | 6302 (87 %) | 5908 (87.2 %) | 394 (84.2 %) | 0.068 |
| DPT 2 vaccine [8227] | 5286 (73.4 %) | 4945 (73.5 %) | 341 (73 %) | 0.879 |
| Polio 2 vaccine [8191] | 5627 (77.8 %) | 5290 (78.2 %) | 337 (72 %) | 0.002 |
| DPT 3 vaccine **[8170] | 2755 (38 %) | 2563 (37.8 %) | 192 (40.9 %) | 0.187 |
| Polio 3 vaccine [8191] | 4456 (61.6 %) | 4184 (61.8 %) | 272 (58.1 %) | 0.122 |
| Measles vaccine [8245] | 4149 (57.8 %) | 3895 (58 %) | 254 (55.1 %) | 0.248 |
| Treating Diarrhea at hf [13823] | 416 (26 %) | 387 (25.7 %) | 29 (29 %) | 0.548 |
| Treating Diarrhea with ORS [13823] | 316 (19.7 %) | 297 (19.8 %) | 19 (19 %) | 0.956 |
| Treating Pneumonia at hf [12072] | 936 (27.9 %) | 899 (28 %) | 37 (26.2 %) | 0.723 |
| Place of treating of Fever [13530] | | | | 0.353 |
| Non health facility | 716 (37.8 %) | 682 (37.6 %) | 34 (42.5 %) | |
| Private health facility | 536 (28.3 %) | 519 (28.6 %) | 17 (21.2 %) | |
| Public health facility | 644 (34 %) | 615 (33.9 %) | 29 (36.2 %) | |

** Number of children who did not receive up to three doses of DPT by the required age
.hf = health facility

**Testing for Balance after Propensity Score Matching**

After a 1:1 matching of women living in the refugee zone to those living elsewhere in the country, a control group was obtained. The two groups each had on average, 501 participants for each outcome of interest. Further testing for balance for each covariate included in the model (mothers' level of education, zone of residence (rural or urban), wealth index and child bearing experience) was then performed. Balance was achieved for each of the covariates included. For example, wealth index, which initially had a different distribution between the two groups achieved a good balance with the groups having similar distributions after matching (Figure 3). A table showing balance for all other covariates is included in the annex (Annex 1).

Figure 3: Testing for balance in wealth index after matching, Cameroon DHS, 2011




**Evaluating Outcome after Propensity Scores Matching**

Final outcomes were evaluated after propensity scores with a 1:1 match for the treatment group (being in the refugee zone) and ensuring that balance was achieved for both groups for each of the covariates. We found that for women living in the refugee zone, there was a 12.7% (95%CI 8.5% to 17%, $p < 0.004$) higher chance for not attending the recommended number of ANCs. There was also a 17.6 % (95%CI, 13.9% to 21.3%, $p < 0.001$) higher chance of delivering out of health facilities for women in the local host population of refugees compared to their control living elsewhere in the country. On the contrary, for child vaccination coverage, the risk of not receiving up to three doses of DPT3 was lower in the refugee zone, -2.8% (95%CI,-7.4% to 1.8%, p= 0.23) compared

to the control from the rest of the country, though the difference was not statistically significant. (Table 5).

The risk differences observed in 2011 when compared to those observed in 2004 prior to the large influx of refugees into the country showed some differences. The risk of not attending the recommended number of ANC stayed almost the same (11.9% in 2004 vs 12.7% in 2011), while the risk of delivering out of a health facility had decreased (26.6% vs 17.6%). The risk of lower vaccination coverage improved (7.2% vs -2.8%), such that there was no difference in the risk of not being vaccinated in both population in 2011 compared to 2004 when there was a significantly higher risk of less vaccination coverage in the refugee zone.

Table 5: Average treatment effect on the treated (Attributable risk) after propensity score matching, Cameroon DHS, 2004 and 2011

| *Indicator* | *2004* | | *2011* | |
|---|---|---|---|---|
| | **Attributed Risk (95% CI)** | **P-value** | **Attributed Risk (95% CI)** | **p-value** |
| *Non-Attendance of recommended ANC* | 11.9 (7.3, 16.5) | < 0.001 | 12.7 (8.5, 17) | < 0.001 |
| *Delivery out of a Health Facility* | 26.6 (22.4, 30.9) | <0.001 | 17.6 (13.9, 21.3) | <0.001 |
| *Non completion of DPT3* | 7.2 (2.2 , 12.3) | 0.005 | -2.8 (-7.4, 1.8) | .23 |

(Attributed risk is the average treatment effect on the treated calculated as the risk difference between the treated and the control. Treated are those in the refugee zone and controls are the matched pairs from rest of the country)

## 5. Discussion, Conclusion and Recommendations

### 5.1. Discussion

To the best of our knowledge, very few studies have addressed the impact of refugees on the health of their local host population. This study therefore aimed at evaluating how the presence of refugees in an area influenced the health of the local host population, specifically focusing on maternal and child health. We found that in 2011, women living in the refugee occupied zone had higher risks of not attending the recommended number of antenatal clinics as well as being delivered out of a health facilities when compared to those living elsewhere in the country. For children health indicator (vaccination coverage) however, there was no significant difference between

the two groups. When compared to the pre-existing risk disparity in 2004, the risk of non-attendance of the recommended number of ANCs and delivery out of health facilities continued to be higher in the refugee host community. However, the disparity in the risk of not completing DPT3 vaccine had been effaced by 2011.

Generally, the observation of poorer maternal health indicators in the refugee host population could be explained by a number of factors. For instance, Cameroon, as other developing countries in sub-Saharan Africa, has poor maternal health indicators as evidenced by the usual high maternal mortality (22). Though trends in maternal mortality have been decreasing over the last three decades, absolute maternal mortality ratios are still high (23). These poor maternal health indicators are not evenly distributed over the country since they are influenced by factors that are as well not evenly distributed. For example, the utilization of health care services, which is an important determinant for maternal health, is itself influenced by several other factors including: educational level, parity, health insurance coverage, ethnicity, household wealth and geographic region (24). The unequal distribution of these determinants was typical in our study population as the refugee host population was less wealthy, having lower levels of education, higher fertility rates as well as mostly living in rural areas. As would be expected in the first instance therefore, the maternal health indicators would be correspondingly poorer.

On the contrary however, it will not be out of place to argue that with the presence of the refugees in this area, one would expect better health status in the local host. The local host population is invariably exposed to improved healthcare services resulting from assistance programs. In addition, the presence of many refugees in this areas led to additional social and economic changes. Economic changes have been more important in the refugee-affected areas as the presence of and assistance to refugees transformed the economy in remote rural areas. The presence of freely settled refugees meant cheap labour and increased exploitation of agricultural resources. Relief food was sometimes resold, which substantially increased trade and circulation of money in the area. Some members of the host population registered as refugees and obtained free food, and, therefore, economic assets. Agencies assisting the refugees employed hundreds of staff,

which introduced more money into the local economy. These changes should have enabled better access to cash for the Cameroonian rural population of the refugee-affected areas. Increased cash and better health services would mean better health indicators. With the exposure to refugees for a period of six years, even if changes in outcome indicators were not yet not perceptible, process indicators should have changed.

The baseline indicators from the 2004 DHS before the influx of refugees in their large numbers demonstrates a pre-existing disparity in maternal and child health indicators. This disparity could normally be explained by the fact that our host population was located at the border, and the population at the borders have been found to generally have poorer health conditions (28). Even after interacting with refugees for over six years, the health indicators still continued to be poorer in the refugee zone. ANC attendance was likely getting worse while delivery out of health facilities was getting slightly better, hence a slow positive change. The fact that these indicators are this poor, even if the changes noticed were to be considered positive, it is clear that these change must have been unexpectedly slow. This goes as far as pointing a finger at the efficiency of the assistance programs that target maternal health. An effective program would generally improve services to the host community (26). In addition, current policies seek to identify potential factors that worsen maternal health indicators or at least do not improve maternal health indicators. It will therefore be interesting to consider the refugee occupied areas as risk zone where indicators will not improve as expected if assistance programmes are not well managed. This claim is further strengthened by the fact that, where assistance programs have been well integrated in the community, the community has benefited in terms of improved health indicators. For instance, the health assistance program to refugees in Guinea showed improved obstetric surgical operations to the local host population without even increasing the average cost of implementing the programme (8).

Furthermore, it was also observation that other maternal indicators were not favorable in the refugee host population. These indicators included the time of first antenatal clinic, the content of the antenatal care package (measuring of blood pressure, doing urine and blood tests, malaria treatment, taking iron anti-tetanus vaccine) and deliveries

attended by skilled personnel. This further strengthens the claim that the overall maternal health was poorer in the local host population of the refugees.

Child health on the other hand did not seem to be different between the two groups considered. The national child health indicators are still no better with high infant mortality, for example, the under-five mortality was 95 deaths per 1000 live births in 2013 (29). Thus reason to evaluate every possible factor that could influence child health. Among the several possible determinants of child health, being in a refugee zone did not seem to affect children's health negatively, especially when it comes to EPI vaccination coverage. The equal EPI vaccination coverage for the two groups may annul the claim of difficult health access in the refugee zone and rather support an equally managed national vaccination program. The contribution of the assistance programs to put pressure on the health system to vaccinate children so as to foster herd immunity cannot be denied. Child health programs addressing malnutrition problems in these areas, do so without discrimination of whether a child is a refugee or not. And this may also have help improve the identification and vaccination of children who would otherwise not have been vaccinated. Moreover, the inversion of the risk of low vaccination in the refugee zone in 2011 compared to 2004 may further support the positive input from assistance programmes. In addition, how mothers treated diarrhea and where they sought treatment for diarrhea and pneumonia was similar for the two groups, hence strengthening the claim that there is no difference in child health.

Our finding of disparity in health indicators between the local refugee host population and women living elsewhere in the country has important implications. It emphasizes the importance of continual evaluation of changes in health parameters as the environment changes, including the movement of refugees and hence assistance programs into an area. The assessment of the impact of phenomena such as the environment, policy and interventions on the health of a population is quite challenging and has led to the development of varying frameworks. The Health impact assessment (HIA) framework for example is widely used and has the advantage of expressing results in terms of attributable morbidity and mortality (20). Thus assessing indicators of morbidity and mortality or their proxies could give a close assessment of the health impact of refugees on the host population. The World Health Organisation proposes 11

indicators for evaluating mother and child health including: maternal mortality ratio, under-five child mortality, children under five who are stunted, unmet need for contraception, antenatal care coverage (at least four times during pregnancy), antiretroviral (ARV) prophylaxis among HIV positive pregnant women, skilled attendant at birth, postnatal care for mothers and babies within two days of birth, exclusive breastfeeding for six months, three doses of combined diphtheria-tetanus-pertussis (DTP3) immunization coverage and antibiotic treatment for suspected pneumonia (21). Evaluating all these indicators would have given a broader better picture of mother and child health. However, we selected three main process indicators which were considered to be sensitive to changes within the time of exposure to refugees.

Despite filling an important gap in the literature, our study does have limitations, most of which are associated with the retrospective cross sectional design. First, the entire analysis was based on data in which women report past events. This is therefore subject to recall bias. However, the fact that well trained interviewers were used in this survey, data collected tend to be of high quality, reliable and free from common errors. Second, we used propensity score matching to select our controls from the general national population. Despite all efforts to include determinants of mother and child health, there is still a chance that other determinants which could have influenced the association between outcomes and predictors were left out of the exploration. Nonetheless, this method was considered more practical and appropriate since it provided the opportunity to visually evaluate and select covariates and not just throwing a set of potential confounding variables into a regression model. In this way, we were more certain that "oranges were compared with oranges and apple with apples." Third, despite our best efforts in controlling for missing rates, some of our variables had high rates. Despite this limitation, further imputation was avoided since it was considered that each variable still had sufficient observation for the analysis. However, a complete set of items for every unit might have provided better estimates. Finally, our study was conducted in a specific context and it will be difficult to have other contexts that match exactly, hence limiting the ability to generalize our results. Notwithstanding, the concepts of humanitarian assistance, the interplay between foreign assistance programs

and the host government as well as the settling of refugees in less privileged areas are universal.

## 5.2. Conclusion

Maternal and child health indicators were poorer in the border region prior to the arrival or refugees. After interacting with refugees and assistance programmes for six years, there was some improvement in health indicators, mainly on child health. Delivery out of health facility had improved to an extent, but women living in the refugee zone continued to have higher risks of non-attendance of the recommended number of ANCs and delivery out of health facilities. Therefore, while the settling of refugees in an area invariably attracts assistance programmes addressing several health needs, the local host of refugees may still not befit from these fully. The gains in child health are rapid while maternal health gains are slow or even negative. These findings further deepen the controversy of the impact of refugees on the health of their local host.

## 5.3. Recommendations

Maternal health of the local host population of refugees should be a target area for action. This is especially feasible given the improved health services in the vicinity of the population. Also, other well implemented programs have successfully improved the health status of the local host population without a significant increase in cost.

Further research evaluating the impact of refugees on the health of the host population should consider the perception of the host community as well as the use more comprehensive longitudinal datasets.

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## Annexes

Annex 1*: Balance testing for all covariates after Propensity Scores Matching*

| | | |
|---|---|---|
| | ***** (V1) education (no education) ***** | |
| | *Before Matching* | *After Matching* |
| *Mean treatment.....* | *0.36128* | *0.36128* |
| *Mean control.....* | *0.22111* | *0.36128* |
| ** Std mean diff.....* | *29.149* | *0* |
| | ***** (V2) education (primary) ***** | |
| | *Before Matching* | *After Matching* |
| *Mean treatment.....* | *0.4491* | *0.4491* |
| *Mean control.....* | *0.39787* | *0.4491* |
| *Std mean diff.....* | *10.29* | *0* |
| | ***** (V3) education (secondary) ***** | |
| | *Before Matching* | *After Matching* |
| *Mean treatment.....* | *0.18164* | *0.18164* |
| *Mean control.....* | *0.34775* | *0.18164* |
| *Std mean diff.....* | *-43.041* | *0* |
| | ***** (V4) residence (urban) ***** | |
| | *Before Matching* | *After Matching* |
| *Mean treatment.....* | *0.39721* | *0.39721* |
| *Mean control.....* | *0.42889* | *0.39721* |
| *Std mean diff.....* | *-6.4692* | *0* |
| | ***** (V5) wealth index (poorest) ***** | |
| | *Before Matching* | *After Matching* |
| *Mean treatment.....* | *0.26347* | *0.26347* |
| *Mean control.....* | *0.18419* | *0.26347* |
| *Std mean diff.....* | *17.979* | *0* |
| | ***** (V6) wealth index (poorer) ***** | |
| | *Before Matching* | *After Matching* |
| *Mean treatment.....* | *0.25549* | *0.25549* |
| *Mean control.....* | *0.22561* | *0.25549* |
| *Std mean diff.....* | *6.8447* | *0* |

| | | |
|---|---|---|
| | ***** (V7) wealth index (richer) ***** | |
| | *Before Matching* | *After Matching* |
| *Mean treatment.....* | *0.15968* | *0.15968* |
| *Mean control.....* | *0.20048* | *0.15968* |
| *Std mean diff.....* | *-11.126* | *0* |
| | ***** (V8) wealth index (richest) ***** | |
| | *Before Matching* | *After Matching* |
| *Mean treatment.....* | *0.073852* | *0.073852* |
| *Mean control.....* | *0.17493* | *0.073852* |
| *Std mean diff.....* | *-38.609* | *0* |
| | ***** (V9) childbearing experience (No experience) ***** | |
| | *Before Matching* | *After Matching* |
| *Mean treatment.....* | *0.21557* | *0.21557* |
| *Mean control.....* | *0.22294* | *0.21557* |
| *Std mean diff.....* | *-1.7907* | *0* |

*Std mean diff is the standardized mean difference in the proportions of each group