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Effect of a free healthcare policy on health services utilisation for non-malarial febrile illness by children under five years in Burkina Faso: an interrupted time series analysis

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Abstract

OBJECTIVE To assess the effect of a free healthcare policy for children under five years old implemented in Burkina Faso since April 2016, on the use of health care of non-malarial febrile illnesses (NMFI).

METHODS To assess the immediate and long-term effect of the free healthcare policy in place, we conducted an interrupted time series analysis of routinely collected data on febrile illnesses from three urban primary health centres of Ouagadougou between 1 January 2015 and 31 December 2016.

RESULTS Of the 39 046 febrile cases reported in the study period, 17 017 NMFI were included in the study. Compared to the period before the intervention, we observed an immediate, non-statistically significant increase of 7% in the number of NMFI (IRR = 1.07; 95% CI = 0.75, 1.51). Compared to the trend that would have been expected in absence of the intervention, the results showed a small but sustained increase of 6% in the trend of monthly number of NMFI during the intervention period (IRR = 1.06; 95%CI = 1.01, 1.12).

CONCLUSION Our study highlighted an increase in the uptake of healthcare services, specifically for NMFI by children under five years of age, after the implementation of a free care policy. This analysis contributes to informing decision makers on the need to strengthen the capacities of healthcare centres and to anticipate the challenges of the sustainability of this policy.

keywords non-malarial febrile illness, interrupted time series, long-term effect, free health care, Burkina Faso

Sustainable Development Goals (SDGs): SDG 3 (good health and well-being), SDG 17 (partnerships for the goals)

Introduction

Free healthcare policies aim at partially remove financial barriers to accessing healthcare services, with the ultimate goal of reducing the overall burden of morbidity and mortality, including decreasing maternal and child mortality burden [1, 2]. Since the year 2000, several interventions of total or partial abolition of direct payment for health care have emerged in many African countries including Burkina Faso [3]. These interventions have been specifically implemented for the benefit of different vulnerable groups including mothers, children under five years of age, people with specific infectious diseases and or chronic conditions such as HIV/AIDS and so-called neglected diseases (since the 1990s) [2, 3]. In April 2016, Burkina Faso organised and implemented a national free healthcare policy for children under five years of age [4], characterised by free consultation, free medication and free laboratory and radiological examinations (including ultrasounds), throughout the country [4].

Several advantages related to the implementation of partial or total free health care have been described in the literature [1, 2, 5-9]. It allows for financial protection of populations [7] and a reduction in household health expenditure [5, 8]. It strengthens women's empowerment in health decision-making [9] and benefits the poor [6]. Partial or total free access to health care stimulates the use of health services in general [2] with an increase in the number of first-line health centre visits [10]. It has a positive and sustained effect on the use of child services [11] and contributes to the reduction of infant mortality [12, 13]. However, if not implemented as planned or expected, free healthcare policies may also result on unexpected effects such as declining quality of care [14, 15], the development of strategies by providers to preserve their personal benefits and informal practices [10], reducing income for healthcare centres and limiting drug's availability [2]. Although it has been proven that in a context of free health care, health workers might find a way to use the system to their own advantage [16], the quality (technical and perceived) of care and the quality of drug prescription do not seem altered in Burkina Faso [17, 18]. While the effect of free health care on the use of health services is well studied, to our knowledge, there are little or no data specifically for non-malarial febrile illnesses.

Fever is the most common illness symptom and reason for consultation in tropical countries [19-21]. Non-malarial febrile illnesses (NMFI) include all episodes of acute fever lasting less than 14 days, not associated to malaria, and for which the infectious origins are not obvious [22, 23]. In Africa, and specifically in Burkina Faso, several studies have shown that a significant proportion of febrile illnesses are non-malarial [24-26] and thus becoming a major public health concern because the possibility of misdiagnosis and mistreatment of NMFI as malaria cases, specifically in the infant population [27]. Among these NMFI, we can cite dengue, typhoid fever, salmonellosis, Zika infection and recently COVID-19 which have become endemic in Burkina Faso [28-30]. To the best of our knowledge, the effects of free healthcare interventions on NMFI consultations have not been studied yet. Therefore, to assess the effects of free health care on NMFI in urban environments, where we observe an emergence of diseases for which the health centres are less well prepared, remains imperative [31-33]. It could contribute to inform decision-makers on the need to strengthen the capacity of urban healthcare centres. Specifically, for the diagnosis and management of non-malarial febrile illnesses, and in order to support a better implementation of the free healthcare policy if necessary.

This research aims to evaluate the effect of free healthcare policy implemented in Burkina Faso since April 2016 for children under five years old, on the use of health care for non-malaria febrile illness, in three urban health centres of Ouagadougou city.

Methods

Study setting

The study was conducted in three healthcare and social promotion centres (CSPS: primary health centre from the French Acronym), namely the CSPS of Pazani, Zongo and Juvénat Fille. The study sites were purposefully selected from a previous randomly selection of 12 primary health centres of Ouagadougou in a previous study of Flavivirus prevalence [34]. The CSPS of Juvénat Fille is a denominational health facility that has a medical analysis laboratory and it is located in the central areas of Ouagadougou, characterised for having better infrastructure, housing, drainage system and running water available [35-38]. The CSPS of Juvénat fille covers an estimated population of 19 920 inhabitants in 2015 and 20 746 inhabitants in 2016. The CSPS of Zongo and Pazani is located in the peripheral areas of Ouagadougou, mainly composed of unplanned settlement areas. These areas do not have running water or drainage system [35-38]. The CSPS of Zongo covered an estimated population of 48 579 and 50 586 inhabitants in 2015 and 2016, respectively. The estimated population of CSPS of Pazani was 18 132 inhabitants in 2015 (before new administrative subdivision of Sig-Nonghin health district which includes CSPS of Pazani), and 5,900 in 2016. These CSPSs were chosen to cover both types of healthcare areas (allotted/organised and non-allotted/unplanned settlements) that are characteristics of the city of Ouagadougou.

Type of study

We used a quasi-experimental design with an interrupted time series study, following the 'before–after' principle [39], to analyse the effect of the free healthcare access policy for children under five years of age. The assumption is that in the absence of intervention, all things being equal, the trend of the phenomenon remains unchanged [39]. Therefore, we compared the prevalence trend of NMFI from 1 January 2015 to 1 April 2016 (pre-intervention period), with that from 2 April 2016 to 31 December 2016 (post-intervention period). Our series included 24 monthly data points, including 15 months before and 9 months after the policy implementation.

Data

Data on febrile illness cases were extracted from the consultation registers of the three CSPS using smartphones via the Open Data Kit (ODK) application [40]. Data were collected retrospectively between 1 December 2016 to 31 January 2017, by twelve health workers who were not employees of the CSPS under study and who were trained for this purpose. Datasets included clinical information (symptoms, diagnostic and treatment) and date of consultation of all participants over one month of age who sought care at any of the three CSPS during the study period. Febrile illness was defined as presence of objective fever (axillary or rectal temperature greater than 37.5 degrees Celsius) or subjective fever (fever as a reason for consultation) evolving for at most 14 days. Data from consultation registers in Burkina Faso have a recognised reliability and validity and are often used for this type of analysis [11, 41, 42].

Variables

The outcome variable was the monthly number of non-malarial febrile illnesses (NMFI), defined as febrile patients with: (i) a rapid diagnostic tests (RDT) or thick blood smear for malaria negative; (ii) in the absence of a diagnostic test, the clinical diagnosis and treatment received are not those of malaria [43]; (iii) in the absence of a diagnostic test and clinical diagnosis, the symptoms reported and treatment received did not correspond to malaria [44]. The monthly prevalence in each CSPS was calculated by reporting the number of NMFI cases on all febrile cases observed during the month.

Independent variables included in the model were: an indicator variable to identify the periods before and after the implementation of the free healthcare policy (‘*Free_Policy*’). This variable takes the value 0 for the period from 1 January 2015 to 1 April 2016 and the value 1 from 2 April 2016 to 31 December 2016. To capture the trend over time, we included the variable ‘*Time*’ in the model, which corresponded to the 24 months of study duration, taking values from 1 to 24. An interaction term between the time-centred variable at the start date (Time-15) and the variable ‘*Free_ Policy*’ was our main independent variable. Other covariates included were child sex (female or male) and child age in years.

Statistical analyses

Interrupted time series analysis allowed us to compare the trend of the prevalence of NMFI during the period from 1 January 2015 to 1 April 2016 to that between 2 April 2016 and 31 December 2016. First, a monthly NMFI prevalence curve over time was plotted to visually examine trend, seasonality and outliers [39]. Second, summary statistics of the monthly prevalence of NMFI, by sex and child age were estimated for the overall study duration and for each of the before and after free healthcare policy periods. For the ‘Before versus After’ comparison, we used (i) Pearson’s chi-square test for categorical variables (Sex and Diagnosis (NMFI or not)); (ii) ANOVA for the child mean age and Wilcoxon rank-sum test for child medians age. Third, the evaluation of the potential effect of the free healthcare policy was carried out using a Negative Binomial regression model given the nature of the dependent variable [45] (monthly count of NMFI with overdispersion). An interaction variable was included in the model to assess the change in the slope of NMFI prevalence trend. The coefficient of the interaction term could be interpreted in light of the potential effect of the intervention (free healthcare policy) on the studied phenomenon (NMFI access to health care). In addition to the variables in the regression model, the seasonal or periodic nature of the NMFI was taken into account in the model by introducing the Fourier terms [39, 46], which are the pairs of sine and cosine functions of time with an underlying period reflecting the full seasonal cycle [46]. The log of the total number of febrile cases recorded each month was introduced in the NMFI prevalence model equation as offset to account for the volume of consultations which vary from month to month. To verify that there is no residuals autocorrelation, the plot of autocorrelation and partial autocorrelation were used [39]. The likelihood ratio test ($P = 0.994$) indicated that the variables ‘average age of children consulted’, and ‘proportion of girls consulted’ did not make a significant contribution to the model. Thus, the model not including these two variables was considered. All analyses were done with Stata 13 software [47].

Ethical approval and consent to participate

The research project obtained the approval N° 2016-11-129 of the Health Research Ethics Committee of Burkina Faso and a data collection authorisation from the Regional Health Direction of the centre region of Burkina Faso. The Health Research Ethics Committee of Université de Montréal (CÉRÈS) allows the publication of the results (Decision # CERES-51-6 a.II.).

Results

Of the 39 046 cases of fever during the study period, 17 017 non-malarial fever were included in the study. From January 2015 to December 2016, our database included 17 017 observations [5555 pre-intervention and 11 462 post-intervention]. The proportion of children consulted before and after the intervention did not vary by sex ($P = 0.87$). Children seen after the intervention were on average older (2 ± 1.3 years) than those seen before the intervention (1.8 ± 1.2 years old) with $P < 0.001$. Table 1 presents the summary statistics for the entire study period and for the pre- and post- free healthcare policy periods and the average monthly prevalence of NMFI.

Table 1 Summary Statistics of non-malarial febrile illness participant in three healthcare centres of Ouagadougou, Burkina Faso (2015–2016)

	Number of health centres	Number of observations	Age (in years)				Sex*		Monthly prevalence (%) of non-malarial febrile illness	Total febrile illnesses
			Minimum	Maximum	Median (IQR¶)	Mean age (SD**)	Male n (%)	Female n (%)		
Pre-policy of free health care	3	5555	0.08	4.5	1.3 (0.9–3.0)	1.8 (1.2)	6950 (52.9)	6185 (47.1)	42.28	13 139
Post-policy of free health care	3	11 462	0.08	4.9	2.0 (1.0–3.0)	2.0 (1.3)	13676 (52.8)	12215 (47.2)	44.24	25 907
P-value					<0.001‡	<0.001§	0.87†		<0.001†	

*Missing data for sex variable = 20 (0.05%).
†Pearson chi square test.
‡Wilcoxon rank-sum test.
§Analysis of variance (ANOVA).
¶interquartile range.
**standard deviation.

Evolution of the monthly prevalence of NMFI

Figure 1 shows that the monthly prevalence of non-malarial febrile illnesses is greater during the months of February to June with a peak in April–June corresponding to the end of the dry season and the beginning of the rainy season. The evolution of the NMFI seems seasonal during the year with an upward trend during the year 2016.

Effect of free healthcare policy on the monthly prevalence of non-malarial febrile illness

Comparing the average rate of NMFI before the intervention to the average rate of NMFI immediately after the intervention, we observed a non-statistically significant increase in the expected number of NMFI cases by 7% after implementation of free healthcare policy (IRR = 1.07; 95% CI = 0.75–1.51). There was a 2% decrease in the expected number of NMFI cases over time for the entire study period (IRR = 0.98; 95% CI = 0.96–0.99) (Table 2). There is an increasing trend in the number of NMFI cases in the post-intervention period. This result is corroborated by the trend line (Figure 2). Compared to what could have been observed in absence of the intervention, after implementing free healthcare policy the number of NMFI cases increased on average by 6% per month (IRR = 1.06; 95% CI = 1.01–1.12). The significant character of Fourier terms (Cosine and Sinus) reflects the pertinence of taking into account the seasonality in the modelling. Indeed, after adjusting the seasonality by the Fourier terms, there is no significant autocorrelation, all the autocorrelations are within the 95% confidence limits and there is no apparent trend on the Figure S1 in the appendix.

Discussion

This study presents one of the first analyses about the specific effect of free healthcare policies on the use of healthcare services for NMFI in Burkina Faso. Data availability on the use of care for NMFI reported in CSPS consultation registers allowed the use of interrupted time series analysis, which is a widely accepted and robust quasi-experimental design that accurately assesses the effects of an intervention by controlling for temporal trends [39, 48-51]. To the best of our knowledge, including the local health system and overall context, there were no other interventions implemented than the one studied here in these three centres during the study period.

The results show a non-statistically significant short-term effect and a positive effect over time of the free healthcare policy for children on the use of care for NMFI. Our results are not comparable with other studies

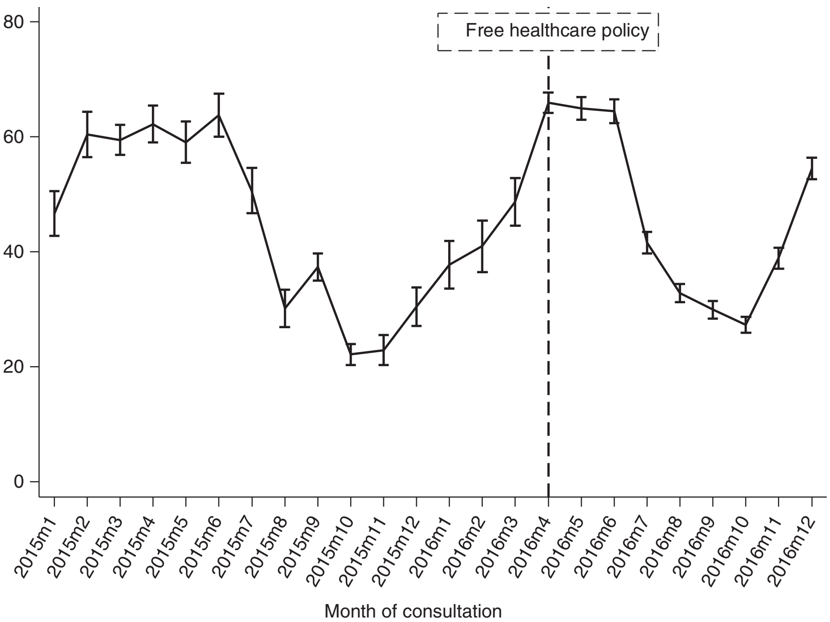

Figure 1 Evolution of the monthly prevalence of non-malarial febrile illnesses in three healthcare centres of Ouagadougou, Burkina Faso (2015–2016).

Table 2 Effect of free healthcare policy on the prevalence of non-malarial febrile illnesses in three healthcare centres of Ouagadougou, Burkina Faso (2015–2016)

Variables	IRR	95% confidence interval	*P*-value
Free_Policy (Reference: Before)	1.07	[0.75–1.51]	0.718
Time	0.98	[0.96–0.99]	0.031
(Time-15)*Free_Policy	1.06	[1.01–1.12]	0.014
cos(360*Time/12)	0.78	[0.69–0.88]	0.001
cos(2 * 360*Time/12)	1.07	[0.98–1.17]	0.127
sin(360*time/12)	1.45	[1.31–1.60]	0.001
sin(2 * 360*Time/12)	1.02	[0.92–1.12]	0.694
Constant	0.49	[0.41–0.57]	0.001

conducted in Burkina [11, 42] and elsewhere in Africa [52-55], which describe an immediate positive and significant effect of free healthcare policy on the use of health services. This lack of significant immediate effect possibly indicates that the uptake of free healthcare services was gradual. Our time points were months and it could be expected to not observe a change from one month to another. These findings could also be explained by the fact that there was no media campaign or social mobilisation in the communities to inform the population about this free healthcare policy [56]. Likewise, recurrent episodes of dengue epidemics since 2013 [57, 58], could have prepared the community (users of healthcare services) to seek care for any fever episodes of their children. Also, although a generalised practice of presumptive malaria diagnosis and treatment for any febrile disease has been the norm for over three generations, sensitised health workers may no longer systematically attribute fever cases to malaria [59, 60].

The increased and sustained use of services after the implementation of free healthcare policies has also been described by other studies [11, 52, 61-63]. However, this initially sustained effect may decline gradually after a certain period of implementation [11, 52, 62]. In our study, we did not observe any decline in the uptake of services for NMFI after the implementation of the free healthcare policy, which could be explained by several factors. First, our post-intervention period was short (nine months), limiting the possibility to observe further changes. Actually, for some time now, the policy under study has been facing many implementation challenges including several months of delay in reimbursements for health centres and drug stockouts [6]. Although these challenges can undermine the effectiveness of the policy, other studies from our team have shown that such interventions could be effective if its implementation is conducted as planned too [6]. Second, the fact that the policy under study included receiving medical treatment free of charge could

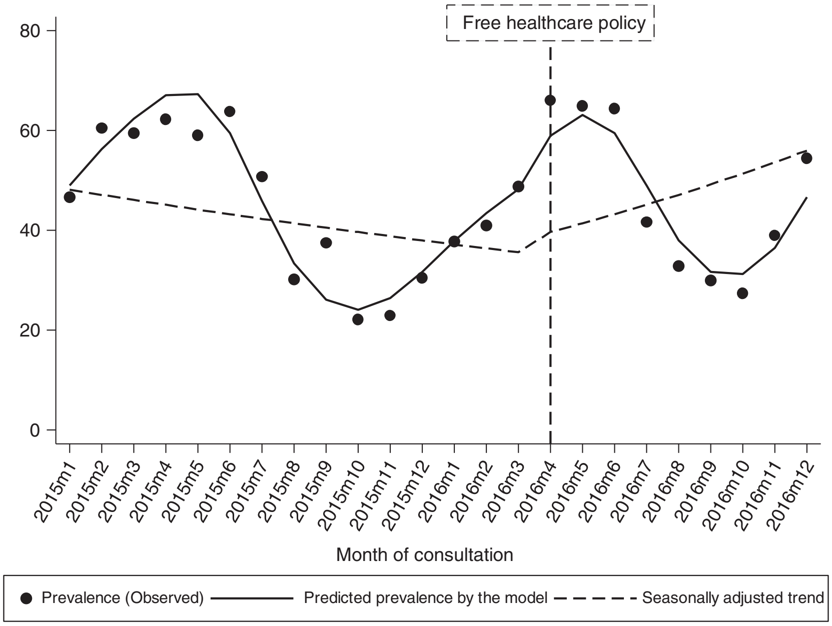

Figure 2 Evolution of the monthly prevalence trend of non-malarial febrile illnesses in three healthcare centres of Ouagadougou, Burkina Faso (2015–2016).

have contributed to an increased and sustained uptake of services following the intervention [62]. In addition, some important contextual aspects may have also favoured a sustained effect of this policy: i) free health care does not seem to largely affect the overall quality of care in Burkina Faso [17, 18]; ii) there is a documented improvement on quality of care in the management of febrile illnesses based on use of malaria RDTs [64, 65]; iii) the free healthcare policy is total and is part of a national strategy to improve access to health care [66]; and iv) the CSPSs involved in the study are from the country's capital urban areas, for which geographical access and patients transportation do not seem to be a major challenge as in rural areas [67].

Our study has some limitations. Several criteria were used to ascertain NMFI in this study. Although these criteria were applied with caution, rigour and under researcher's supervision, it would have been necessary to discriminate all NMFI cases on the basis of valid biological tests (malaria RDT, thick blood), which was not done in all cases due to the nature of the data collection (retrospective and prospective) and lack of financial means. An increase in the number of data points or equal distribution between the pre- and post-intervention period could have increased the power of statistical analyses and contribute to provide information on the long-term effect of the policy intervention [39, 68]. However, the variability of the data and the non-change in the procedure for filling the CSPS' registers during the study period are in favour of unbiased results. Although our results could be extrapolated to other CSPS with similar conditions in Ouagadougou, our results should be interpreted solely on the access to health care (seeking healthcare attention for the presence of fever as symptom), not at quality or type of care, which were not evaluated by our study.

Conclusion

Using a solid and appropriate quasi-experimental design to analyse the effect of free healthcare policy implemented in Burkina Faso for children under five years, our study showed a positive and sustained effect of the policy on the use of care for non-malarial febrile illnesses. These results are consistent indicating that free health care is essential for reducing barriers to health care and favouring health care seeking for febrile patients. However, to sustain and ensure positive effects over time, it will be necessary to ensure consistency on its long-term implementation and ensuring quality of care. Larger studies including more healthcare facilities, longer post-intervention periods and covering both rural and urban areas would be necessary to confirm our results.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Figure S1. Residuals and partial residuals autocorrelation from the model.

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