Digital Health and Informatics Innovations for Sustainable Health Care Systems
J. Mantas et al. (Eds.)

doi:10.3233/SHTI240812

Impact of Terrorism on the Use of Healthcare Services in Burkina Faso Between 2015 and 2022

Sitapha KONATE[a,1], Serge M.A. SOMDA[a] and Sadouanouan MALO[b]
[a] *UFR-SEA, Université Nazi BONI, Burkina Faso*
[b] *École Supérieure d'Informatique (ESI), Université Nazi BONI, Burkina Faso*
ORCiD ID: Sitapha KONATE https://orcid.org/0009-0003-4836-9309
Serge M. A. SOMDA https://orcid.org/0000-0003-4136-9296
Sadouanouan MALO https://orcid.org/0000-0001-5867-1024

Abstract. Burkina Faso has been facing a security crisis due to terrorism since 2015. This study aims to assess the impact of the attacks on the use of healthcare services. This is a secondary study on data from the country's health data warehouse and the ACLED security data warehouse. After a description, generalized additive models were used to assess the impact of attacks on the use of health services. Between January 2015 and December 2022, 2449 kidnap/disappearance attacks, armed attacks, bombings and landmine explosions were perpetrated, causing 4965 deaths. The Sahel region was the most targeted (36.37% of attacks and 50.57% of deaths). Only population density had a significant impact on the use of health services ($p<5\%$). The models were valid. Our study has shown that, despite the persistent insecurity in Burkina Faso, people are resilient and, above all, continue to seek out the most important healthcare services. It is therefore important to work to maintain the supply of these services.

Keywords. Health Services, Terrorism, Burkina Faso

1. Introduction

Burkina Faso is facing an upsurge in both internal and external security threats linked to terrorism and instability in the sub-region [1]. As the security situation continues to deteriorate, there were over two million (2,099,325) internally displaced people in the country on June 30, 2023 [2].

Like armed conflicts, terrorist attacks can damage public health infrastructures and services, compromise water, electricity and food supplies, increase poverty, prevent vaccination campaigns and worsen sanitation and transport [3–5]. Also, these types of attacks tend to create a sense of insecurity in the general population, which has a negative impact on many health indicators [6,7]. Several studies have shown that availability and access to maternal health services, as well as family planning and contraception, are reduced under conditions of high-intensity conflict [8–10]. Over the past two decades, maternal health has remained one of Burkina Faso's main public health problems, despite the progress. In view of the above, the situation is very worrying. Indeed, difficult access

[1] Corresponding Author: Sitapha KONATE; E-mail: sitaphak48@gmail.com.

to health services has a strong influence on reproductive health and maternal, newborn's and infant's health services. Yet terrorist attacks spare neither the already inadequate public health infrastructures and services [11], nor the transport leading to them.

To the best of our knowledge, there are not enough studies in the Burkinabe literature that address exactly the impact of terrorist attacks on other sectors of the population. It is with this in mind that the present study was initiated, primarily to evaluate and predict the evolution of the use of healthcare services during periods of armed conflict between January 2015 and December 2022 in Burkina Faso. Specifically, it will assess and predict the impact of terrorist attacks firstly on newborn's consultations, secondly on infant's consultations and thirdly on hospitalization days for the overall population.

2. Methods

This is a secondary study designed to use data on both safety events and healthcare service use between January 2015 and December 2022. We are interested in the districts in the different provinces of Burkina Faso. We don't use communes because some of them don't have health districts. Furthermore, we do not use regions to maintain a certain level of detail in the results. We used two data sources: Armed Conflict Location and Event Data (ACLED) and Burkina Faso Health Data Warehouse (ENDOS-BF).

- **Security events (ACLED)**

It collects information on events that affect people's peace of mind. We were interested in kidnap/disappearance attacks, armed attacks, bombings and explosions, which were the most frequent types of attack. Data is collected in real time and published on a weekly basis according to well-developed methodological principles, ensuring up-to-date, reliable and comparable data. Data undergo several revision cycles before being published.

- **Health events (ENDOS-BF)**

This is a tool for collecting, analyzing, validating and presenting health data. Data are drawn from the activities of health facilities, the community, training and research centers and institutes, and the administration.

The data from these two sources is first combined for analysis purposes. Data are combined by province and month. In ENDOS-BF, the level of use of health services is given by month for each year and province. In ACLED, for each attack, the province and date of onset are given. Thus, we first synthesize the data by calculating the number of attacks per month for each year and province.

We begin with a descriptive analysis, mapping the scale of attacks by province. Next, we explore their evolution as well as that of health service utilization between 2015 and 2022.

Then, we run a series of generalized additive model (GAM) regressions combined with cubic spline fits to assess the impact of attacks on health service utilization. We formulate a model for each of our dependent variables (number of healthy newborn's consultations, infant's consultations and hospitalization days for the overall population).

For the effective evaluation of the impact of attacks, we use in each of our three models the number of attacks, of deaths per year, per month and per province, the density of the province and the date of the attack and province as explanatory variables.

A change of variable of the logarithmic type of our dependent variables is done beforehand given their order of magnitude in relation to the independent variables.

The estimation model is validated by graphically observing the distribution of the model's residuals.

3. Results

Between January 01, 2015 and December 31, 2022, a total of 2,449 attacks were perpetrated, resulting in 4,965 deaths. The Sahel region was most affected (36.37% of attacks and 50.57% of deaths). Within this region, the Soum and Oudalan provinces paid the heaviest price (15.03% and 10.00% of attacks nationally, and 40.98% and 27.28% regionally respectively) (figure 1).

The number of attacks and deaths has risen steadily in Burkina Faso over the years since 2015, with the exception of 2020. The year 2022 saw the highest number of attacks (32.09%). This was followed by 2021, which recorded 706 attacks or 28.83%.

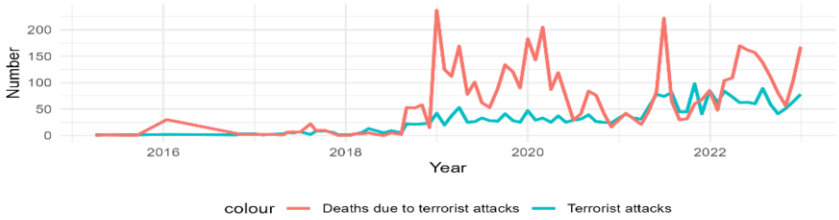

Figure 1. Evolution of attacks and deaths per year in Burkina Faso

On the other hand, we note that in the months of February and March, and August and September, attacks became increasingly rare. They were more frequent in July, October and December (figure 2). Around 30% of attacks took place during these months.

Frequency of attacks by month

Frequency of deaths by month

Figure 2. Frequency of attacks per month between January 2015 and December 2022 in Burkina Faso.

The number of consultations for healthy infants and newborns showed a downward trend during the period of our study, but this decline was more significant between June and November 2019.

We observe strong growth in the number of hospitalization days for the overall population from 2015 to 2019. However, from 2019 onwards, we observe a sharp decline in these days. This could be explained by the fact that, in 2019, health service workers in Burkina Faso observed mood swings characterized essentially by a disruption in the continuity of care and the withholding of health data [12].

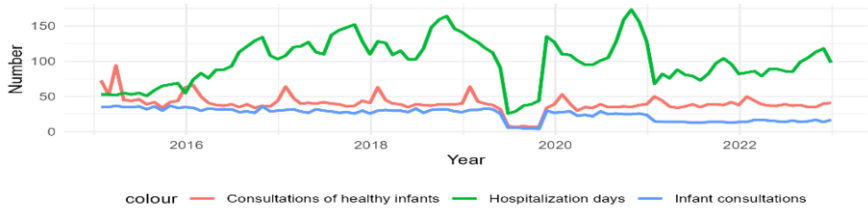

Figure 3. Evolution of healthcare service utilization between January 2015 and December 2022

The above-mentioned series of models (figure 3), shown that only population density had a significant impact, at a threshold of 5%, on the use of health services. The number of attacks and deaths had no influence on consultations of healthy infants (P-value= 0.63 and 0.82 respectively), nor on infant consultations (P-value=0.97 and 0.91 respectively), nor on hospitalization days (P-value=0.46 and 0.50 respectively). All models were valid (Table 1).

Table 1. Non-parametric coefficients of models

Variable	EDF	P-value	R^2
Healthy newborn's consultations			76.6%
s(Attacks)	1.53	0.63	
s(Deaths)	0.53	0.82	
s (Density)	4.13	<1%	
Infant's consultations			60.1%
s(Attacks)	1.73	0.95	
s(Deaths)	2.73	0.90	
s (Density)	3.03	<1%	
Hospitalization days			53.1%
s(Attacks)	0.5	0.58	
s(Deaths)	0.5	0.58	
s (Density)	1	<1%	

We have developed an interactive application that provides an estimate of the use of health services based on the number of attacks, deaths, province and a date provided. The application's estimation is based on the results of modelling. This application can be accessed via the following link: https://sitapha.shinyapps.io/memoiredashboard-1/.

4. Discussion

We assessed the impact of insecurity on the use of healthcare services by the Burkinabe. This evaluation showed us that the impact of terrorist attacks, as well as the number of deaths caused by them, were not statistically significant either on healthy newborn's consultations, or on infant's consultations, or on hospitalization days for the overall population. We found that the level of this utilization was statistically linked at the 1% threshold to provincial density and measurement period.

We did not find enough studies on this subject in the literature. However, with regard to the hospitalization days, Lital Goldberg et al. in Israel and Ygal Plakht et al. in Syria found different results to ours [12,13]. In their studies, the relationship between terrorist attacks and hospital days was quite positive. Terrorist attacks were said to increase the number of hospital days. But this result was not statistically significant.

5. Conclusions

We presented a spatiotemporal description of the terrorist attacks and the deaths they caused. We then assessed and predicted their impact on the use of health services.
This enabled us to determine that the Sahel region was the most affected by this crisis. The evaluation of the impact of attacks and deaths using GAM modeling showed that these have a negative impact on the use of health services. But the influence is not statistically significant at the (5%) threshold. As a result, the authorities are being urged to do their utmost to combat this terrorist hydra and maintain the supply of healthcare services.

References

[1] Burkina Faso: Stopping the Spiral of Violence [Internet]. Crisis Group. 2020 [cited 2022 Jul 29]. Available from: https://www.crisisgroup.org/africa/sahel/burkina-faso/287-burkina-faso-sortir-de-la-spirale-des-violences.
[2] Burkina Faso [Internet]. [cited 2022 Jul 29]. Available from: https://reports.unocha.org/fr/country/burkina-faso/.
[3] Verma AA, Jimenez MP, Tangermann RH, et al. Insecurity, polio vaccination rates, and polio incidence in northwest Pakistan. Proc Natl Acad Sci U S A. 2018;115:1593–1598.
[4] Dureab F, Al-Sakkaf M, Ismail O, et al. Diphtheria outbreak in Yemen: the impact of conflict on a fragile health system. Confl Health. 2019;13:19.
[5] McNeilly B, Jasani G, Cavaliere G, et al. The Rising Threat of Terrorist Attacks Against Hospitals. Prehospital Disaster Med. 2022;37:223–229.
[6] Kadir A, Shenoda S, Goldhagen J. Effects of armed conflict on child health and development: A systematic review. PloS One. 2019;14:e0210071.
[7] Keasley J, Blickwedel J, Quenby S. Adverse effects of exposure to armed conflict on pregnancy: a systematic review. BMJ Glob Health. 2017;2:e000377.
[8] Svallfors S, Billingsley S. Conflict and Contraception in Colombia. Stud Fam Plann. 2019;50:87–112.
[9] Kotsadam A, Østby G. Armed conflict and maternal mortality: A micro-level analysis of sub-Saharan Africa, 1989-2013. Soc Sci Med 1982. 2019;239:112526.
[10] Savadogo S, Ouoba PA. EXTRACTION DES PFNL ET MENACE SUR LES ESPÈCES POURVOYEUSES AU BURKINA FASO : CAS DE KOKOLOGHO ET TENADO DANS LA RÉGION DU CENTRE-OUEST. 2019;
[11] rapport_annuel_performance_2019.pdf [Internet]. [cited 2024 Jan 29]. Available from: https://www.sante.gov.bf/fileadmin/user_upload/storages/rapport_annuel_performance_2019.pdf.
[12] Goldberg L, Dreiher J, Friger M, et al. Health services utilization under Qassam rocket attacks. Isr Med Assoc J IMAJ. 2013;15:414–418.
[13] Rn YP, Shiyovich A, Bn FLR, et al. The Emergency Department in a Region under Missile Attack: Utilization Patterns during Operation Cast Lead. 2011;13.