

Georgia State University

ScholarWorks @ Georgia State University

Public Health Theses

School of Public Health

5-15-2020

Investigating the Dynamics of Violent Attacks on Health Care During the Ebola Outbreak in the Democratic Republic of Congo, August 2018 – January 2020

Sydney N. Adams

Follow this and additional works at: https://scholarworks.gsu.edu/iph_theses

Recommended Citation

Adams, Sydney N., "Investigating the Dynamics of Violent Attacks on Health Care During the Ebola Outbreak in the Democratic Republic of Congo, August 2018 – January 2020." Thesis, Georgia State University, 2020.

doi: <https://doi.org/10.57709/17633763>

This Thesis is brought to you for free and open access by the School of Public Health at ScholarWorks @ Georgia State University. It has been accepted for inclusion in Public Health Theses by an authorized administrator of ScholarWorks @ Georgia State University. For more information, please contact scholarworks@gsu.edu.

ABSTRACT

Investigating the Dynamics of Violent Attacks on Health Care During the Ebola Outbreak in the Democratic Republic of Congo, August 2018 – January 2020

By

Sydney Nicole Adams

April 26, 2020

Background: The Democratic Republic of Congo is actively experiencing its tenth outbreak of Ebola Virus Disease. This outbreak is the second-largest in history. This outbreak of Ebola virus is taking place in North Kivu and Ituri provinces in the eastern part of the country. The North Kivu and Ituri provinces are two of the most populous, conflict-torn, provinces in the DRC, and border three other countries, Rwanda, Uganda, and South Sudan. This current outbreak has been marked by numerous attacks against health care services and the inability to bring this outbreak to a swift end like the outbreak in Équateur province DRC.

Aim: The intent of this thesis is to quantify the frequency of attacks on health care using publicly available data in order to have a better understanding of how violent attacks towards health care are impacting the Ebola response efforts in North Kivu and Ituri provinces.

Methods: This study is a cross-sectional examination of data collected from publicly available resources to characterize the violence towards the Ebola response teams. This study includes data from the Surveillance System for Attacks on Health Care published by the World Health Organization, data collected from local media outlets, social media, international organizations, universities, and non-profit organizations.

Results: There were 102 attacks that were confirmed to have taken place in one of the two affected provinces. The peak of violence towards health care in the DRC occurred during May 2019. Health care facilities were the most affected health care resource. Also, more attacks occurred in North Kivu province compared to Ituri Province.

Conclusion: Our study, one of the first to demonstrate the prevalence and context of violent attacks related to health care resources and delivery during a health crisis, indicates the need for deliberate planning and preventative measures when mitigating an infectious disease outbreak during an active conflict.

Investigating the Dynamics of Violent Attacks on Health Care During the Ebola Outbreak in the
Democratic Republic of Congo, August 2018 – January 2020

by

Sydney N. Adams

B.S., GEORGIA STATE UNIVERSITY

A Thesis Submitted to the Graduate Faculty
of Georgia State University in Partial Fulfillment
of the
Requirements for the Degree

MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA
30303

APPROVAL PAGE

Investigating the Dynamics of Violent Attacks on Health Care During the Ebola Outbreak in the Democratic Republic of Congo, August 2018 – January 2020

by

Sydney N. Adams

Approved:

Dr. Gerardo Chowell
Committee Chair

Dr. Monica Swahn
Committee Member

April 26, 2019
Date

Author's Statement Page

In presenting this thesis as a partial fulfillment of the requirements for an advanced degree from Georgia State University, I agree that the Library of the University shall make it available for inspection and circulation in accordance with its regulations governing materials of this type. I agree that permission to quote from, to copy from, or to publish this thesis may be granted by the author or, in his/her absence, by the professor under whose direction it was written, or in his/her absence, by the Associate Dean, School of Public Health. Such quoting, copying, or publishing must be solely for scholarly purposes and will not involve potential financial gain. It is understood that any copying from or publication of this dissertation which involves potential financial gain will not be allowed without written permission of the author.

Sydney Adams

TABLE OF CONTENTS

LIST OF

TABLES.....6

LIST OF FIGURES.....7

INTRODUCTION.....9

LITERATURE REVIEW.....11

MANUSCRIPT

 Introduction.....18

 Methods.....22

 Results.....24

 Discussion26

REFERENCES.....27

FIGURES.....31

TABLES.....33

List of Tables

Table 1. Summary of literature review for attacks on health care during the Ebola outbreak in the DRC from August 2018 – January 2020

Table 2. Table 2. Summary of data sources used for dataset creation

Table 3. Number of attacks on health care by province, month and year and percent change in number of attacks for combined provinces for each month

Table 4. Types of actors perpetrating attacks on health care by province

Type 5. Number of affected health care resource during each attack on health care by province

List of Figures

Figure 1. Dataset creation process using WHO SSA and Other Data Sources

Figure 2. EVD incidence by week of illness onset and number of attacks on healthcare by week of occurrence for both provinces.

Figure 3. EVD incidence by week of illness onset in North Kivu Province and attacks on health care in North Kivu Province

Figure 4. EVD incidence by week of illness onset in Ituri Province and attacks on health care in Ituri Province

Investigating the dynamics of violent attacks on health care during the Ebola outbreak in the
Democratic Republic of Congo, August 2018 – February 2020

By

Sydney Nicole Adams

April 9, 2020

Introduction

Ebola virus disease (EVD) is a hemorrhagic fever that commonly infects humans and non-human primates. EVD is extremely fatal, with mortality rates ranging from 25 to 90%.¹ EVD belongs to the *Filoviridae* family and the *Ebolavirus* genus. Among the *Ebolavirus* genus, there are five distinct species which are: *Zaire ebolavirus* (ZEBOV), *Sudan ebolavirus* (SEBOV), *Tai Forest ebolavirus* (TEBOV), *Reston ebolavirus* (REBOV), and *Bundibuyo ebolavirus* (BEBOV). Only ZEBOV, SEBOV, and BEBOV have caused outbreaks in humans with ZEBOV having the highest fatality rates recorded in humans.² EVD was discovered in 1976 two simultaneous outbreaks occurred in Sudan and Zaire (now known as the Democratic Republic of Congo). The two outbreaks of EVD was relatively close geographically, but the viruses were not epidemiologically linked and were later identified as two distinct species of virus, SEBOV and ZEBOV respectively.¹ In the time since it was discovered in 1976, there have been 23 confirmed outbreaks of EVD, predominantly occurring in sub-Saharan Africa.^{1,2}

EVD is zoonotic with frequent spillovers into humans, non-human primates, and other animal populations. There is evidence to support the claim that the natural host for EVD is bats, particularly bats belonging to the Pteropodidae family; however, there has yet to be virus isolated from bats found in natural conditions.² Humans are likely infected by coming into close contact with bats or other deceased animals such as chimpanzees or other wild game. After the initial spillover event, the disease can be spread by human-to-human transmission via bodily fluids. Caring for those who are sick or coming into close contact with dead bodies is associated with a high risk for disease transmission because of the likelihood of coming into direct contact with bodily fluids.² Because bodily fluids are very infectious, the risk of nosocomial transmission is very high; therefore, it is essential that appropriate personal protective equipment (PPE) be used when treating EVD patients. The incubation period is 2-21 days, and there are three phases of the disease. Phase one is defined by an acute non-specific viral illness where patients will experience symptoms such as malaise, fatigue, and body aches.^{2,3} During the second phase of the disease is dominated by gastrointestinal symptoms such as nausea, vomiting, and diarrhea, at this stage many patients will become dehydrated.^{2,3} After the second week of illness, some patients will begin to recover; however some will begin to deteriorate among those who do not recover, patients will proceed to the third stage, which is shock possibly due to hypovolaemia and a systemic inflammatory response, some patients may also experience neurological manifestations

during this stage.^{2,3} At this point, some patients will begin to experience hemorrhage; however, during the 2013-2016 West Africa outbreak, this wasn't common.² Many other common diseases can have similar symptoms as EVD such as influenza, malaria, or typhoid fever.⁴

On July 28, 2018 a notification was sent from the North Kivu Provincial Health division to the Ministry of Health in the Democratic Republic of Congo detailing a cluster of acute hemorrhagic fever cases.⁵ On August 1, 2018 the Institut National de Recherche Biomédicale (INRB) in Kinshasa reported that of the six samples that were collected from the patients who were hospitalized Mabalako Health Zone in North Kivu, four tested positive for EVD.⁵ This marked the beginning of the 10th outbreak of EVD in the DRC since it's discovery in 1976. The outbreak in the North Kivu Province was officially declared on August 1, 2018 one week after the 9th outbreak in the Équateur province was declared as ending.

There are several reasons that the outbreak in North Kivu and Ituri Provinces is unique. One being that North Kivu province is one of the most populous provinces in the DRC with 8 million inhabitants and shares a border with not only four other provinces in the DRC (Ituri, South Kivu, Maniema, and Tshopo) but it also shares a border with Uganda and Rwanda.⁶ Second being that this outbreak is occurring in a conflict zone. The eastern region of the DRC has experienced sustained violence since the 1960s when the DRC gained its independence from Belgium. There were at least 40 armed groups active in the eastern DRC as of October 2013.⁷ Due to the prolonged and sustained violence there is an atmosphere of mistrust among communities of the Ebola response efforts.⁸ This mistrust and suspicion has fueled the violence in the region. Due to this violence there are an estimated 1 million internally displaced persons in the region and a continuous exodus of refugees to neighboring countries such as Uganda, Burundi, and Tanzania.⁶ Third, not only is the region experiencing an EVD outbreak it has also co-currently been experiencing a cholera, monkeypox, and vaccine-derived polio virus type 2 outbreaks.⁹

Purpose of the Study

This Ebola outbreak in the eastern DRC is unique. It is the first time an EVD outbreak has occurred in an active conflict zone. In a study done by Masumbuko Claude Underschultz and Hawkes, researchers demonstrated the pervasiveness of resistance to the EVD response and the abundance of mistrust in the community.⁸ This resistance has taken many forms but notably has manifested in violence towards health care services and workers. The amount of attacks that have targeted health care resources in some capacity is alarming. Even though there is an

effective vaccine to prevent EVD infection, it has not been enough to end this outbreak. One of the significant contributors to the continuation of this outbreak is believed to be the attacks that target health care resources. The amount of violence towards the Ebola response seen in this outbreak was not seen in such extremes in the last Ebola outbreak in the Équateur province in the Democratic Republic of Congo in 2018. In a study by Wells and colleagues, researchers demonstrated that if the ring vaccination strategy that was used to control the Ebola outbreak in the Équateur Province had been eroded or impeded in some way it would degrade the effectiveness of the vaccine campaign to control the spread of the disease.¹¹

To have a better understanding of how this violence has impacted the ability to contain this outbreak it is important to understand how often these attacks have happened, what resources are they affecting, and when these attacks reached their peak. The intent of this thesis is to quantify the frequency of attacks on health care sourced from publicly available data to have a better understanding of the dynamics of this EVD outbreak and the impact violence is having on the containment of this outbreak.

Research Questions

Characterization of the type and frequency of violent attacks towards health care in the Democratic Republic of Congo during the 2018-2020 Ebola outbreak will be achieved by answering the following questions:

1. What was the prevalence of violent attacks against health care?
2. Did the pattern and frequency of violence vary?
3. What health care resources were targeted by these violent attacks?
4. What organizations or persons were responsible for violent attacks?
5. Did violent attacks impede response activities?

Review of the Literature

This thesis will explore the dynamics of violence towards health care during outbreaks of infectious diseases. Specifically, the violence targeted towards health care during the Ebola outbreak in the Democratic Republic of Congo from 2018-2020. The literature review presented here describes the current knowledge of the violence experienced in the region before the outbreak began, and violence towards health care during other outbreaks of infectious disease in countries facing similar challenges.

Conflict in North Kivu and Ituri Provinces

The eastern DRC has been embroiled in conflict since the DRC gained its independence from Belgium in the 1960s. When the Belgium colonial rule ended, they left the country with little social or economic development.¹⁰ Shortly after the country's first national election in May 1960, Joseph Mobutu, the country's Chief of Staff of the Army, seized power in a military coup, he suspended the parliament and had the first democratically elected prime minister executed.¹⁰ Mobutu officially took control of the country in 1965. Mobutu's thirty-two-year long reign was defined by corruption and economic mismanagement; his reign would come to an end before the First Congo War.¹⁰ Prior to the First Congo War (1996-1997) there were long-standing ethnic and political tensions in the North Kivu and Ituri Region that led to other conflicts. One of the many ethnic conflicts that plagued the eastern region was the tensions between Rwandan immigrants (Hutu and Tutsi) and those who considered themselves indigenous.¹² Many of these immigrants had been brought in by the Belgians to work and continued to live in the DRC after the Belgians left. Even though the Rwandan immigrants' children were born in the DRC, they were perceived as outsiders by many. Also, because of the Rwandan Genocide many of Rwandan Tutsi refugees who were fleeing violence came to the DRC, and after the Hutu rebellion was squashed, many of the Hutu rebels also fled to the DRC. These tensions resulted in numerous conflicts and killings up to 1997.¹² After the end of the First Congo War, Laurent Kabila took power, he led the Alliance des Forces Democratiques pour las Liberation du Congo (AFDL) which was backed by Rwanda and Uganda.¹³

The Second Congo War began in 1998 and lasted until 2003. This conflict was described as Africa's first world war, and not only involved DRC based groups but was an international conflict involving neighboring countries such as Uganda, Rwanda, Angola, Chad, Sudan, Namibia, and Zimbabwe.^{10,13} The fighting was rooted in ethnic and political conflicts and the desire to harness the regions valuable natural resources.¹⁰ During this conflict the eastern part of the country was controlled by the opposition forces and the west was controlled by the DRC government. With the country de facto partitioned Kabila partnered with ex-Rwandan forces and Congolese guerillas, the Mai-Mai.¹² At this point the Rwandan-Ugandan coalition was beginning to falter and splinter into new groups. During the stalemate a humanitarian crisis was growing, and pressure began to build from outside influences, such as Libya and South Africa, to bring this war to an end. In 2002 a peace agreement was reached following the assassination of the county's leader Laurent Kabila and his son, Joseph Kabalia's assumption of power. The Second

Congo War officially ended in 2003. Throughout the First and Second Congo Wars the eastern Congo served as a battle ground for many of the fights during the war. Following the withdrawal of Ugandan and Rwandan forces after the peace agreement, new fighting started in Ituri province. There were more than 400 killed, and 75,000 people fled the region, the fighting threatened to overturn the peace agreement and threatened the new democratic government. Many were worried the fighting would result in genocide. After this, the EU voted to send in troops to provide relief.

There were many problems in the eastern country after the peace agreement was reached. Three of the main problems were 1. Militias were continuing to operate in the region and splinter even though they had agreed to lay down their arms 2. There was no national army that could defend the country from internal or external threats, and 3. there was no nationalized police force to defend civilians and enforce law and order.¹⁰ There were many civil and human rights violations that occurred during and after the fighting. Throughout the 2000s and 2010s countless rebel groups and the Congolese army (FARDC) committed numerous and widespread violations of the laws of war against civilians. The years of sustained violence had created an enormous refugee crisis. Not only was the violence in the DRC creating a refugee crisis there, but refugees from neighboring countries (such as Sudan, Rwanda, Burundi, and Angola) were also fleeing to the DRC.⁹ This prolonged violence experienced by the region has led to lawless and distrust in institutional authorities.

On top of the ongoing conflict there are significant humanitarian and public health issues facing the DRC. Between October 2017 and September 2019 there were 5.01 million internally displaced persons in this region.¹⁴ During April 2019 alone more than 100,000 people fled their homes in the North Kivu province due to insecurity.¹⁴ This insecurity was created by fighting around Kamango near the town of Beni and the Congolese Army fighting Mai-Mai armed groups in Lubero Territory. North Kivu province in the DRC remains one of the most conflict ridden, and displacement affected regions in the country. It has experienced the highest number of reported incidents of sexual and gender-based violence in the country and is now experiencing the second largest outbreak of EVD in history.^{14,15}

Attacks on Health Care

Attacks by armed actors on aspects of health care are not a phenomenon that is new to this outbreak. Recently, we have witnessed widespread attacks on health care facilities and

personnel during the Syrian and Yemen conflicts; however, this violence targeting health care responses can be traced as far back as the Bosnia and Herzegovina war (1992-1995). Even though attacks on health care can be traced back to at least 1992 it appears that these attacks have become more frequent during the Syria and Yemen conflicts.¹⁶ An example of the type of violence towards health care seen during the Syrian civil war are target attacks by the Russian government and the Syrian Government on hospitals in rebel-controlled territory.¹⁷ Even though these attacks have been denied by both the Assad Regime and Russia, there was no denying that these attacks were intentional, organized, and used major weaponry such as air-to-surface missiles, cluster munitions, barrel bombs, and incendiaries which may be difficult for other groups to obtain.

Compared to the attacks on health care during the Syrian and Yemen wars the attacks in the DRC appear to be different. The attacks on health care in the DRC appear to be perpetrated by a mixture of local militias, structured rebel groups, and community members who do not trust the Ebola response efforts. This mixture of actors involved in the violence towards health care workers can make this a more difficult problem to solve. The violence that is targeted towards health care here range from setting fire to Ebola Treatment Centers (ETCs) during an armed attack, murdering a WHO epidemiologist, to psychological threats of violence to health care staff.^{18,19} However, violence towards health care in the DRC is similar to some violence targeted towards health care staff during the 2014-2016 EVD outbreak in West Africa.

In 2015 the World Health Organization (WHO) established a surveillance system for attacks on health care under the Attacks on Health Care Initiative (AHC). The mission of this surveillance system is to systematically collect information on attacks against health care across the globe, as well as the attack's immediate impact on health care in countries facing emergencies, and to make this data available for use. The surveillance system also routinely publishes reported on data trends and analysis and makes this information publicly available. The WHO defines an attack against health care as "any act of verbal or physical violence, or obstruction that interferes with the availability, access and delivery of curative and/or preventative health services." (WHO SSA, p. 7).^{20,21} The SSA is publicly available; however, the information for the attacks in each country do not contain location specific information, it is only country wide. The information also does not include any specifics about who perpetrated the

violent attack, or the specific name of the resource affected such as the name of the health care facility.

Social Resistance to the Ebola Response efforts

Since the declaration of the Ebola outbreak in the eastern DRC on August 1, 2018, it has been fraught with resistance and violence from the community and other armed actors. This region of the DRC has experienced prolonged civil unrest and humanitarian crises. Several researchers during this outbreak have sought to explain why there is so much social resistance to the EVD outbreak response. Vinick, Pham, Bindu, and Bedford, sought to explore the association between institutional trust and the adoption of preventative measures and whether belief in misinformation related to EVD is associated with a lack of willingness to adopt preventative measures.²² Researchers conducted a population-based survey one month after the outbreak was declared. The survey took place in two cities that were affected by the outbreak Beni and Butembo. Researchers found that overall, there was a lack of trust in administrative leaders with the most trust in local leaders, and then decreasing amounts of trust in city, provincial, to national leaders. Most participants had heard some form of misinformation related to the EVD response such as Ebola does not exist (86.5%), Ebola is fabricated for financial gains (84.7%), Ebola is fabricated to destabilize the region (86.1%). One-fourth of respondents believed in the statement that Ebola does not exist (25.5%), 32.6% believed that it was fabricated for financial gain, and 36.4% believed it was fabricated to destabilize the region. However, most participants reported that they would seek some sort of formal care if they believed they had contacted EVD instead of informal care. In conclusion, researchers reported that the adherence to preventative measures was high, highlighting the importance of the mass communication campaigns initiated at the beginning of the outbreak. Researchers also highlighted that their study reinforces the importance of community trust and that the best way to ensure the community trusts the response efforts is to make sure that there is community buy-in and community engagement.

Masumbuko Claude and colleagues also conducted a similar study to examine the social resistance to EVD control efforts during the outbreak in the eastern DRC.⁸ They conducted a mixed methods study using focus group discussions (FGDs) and a 18 item survey questionnaire. The participants in the FGDs were selected from a convenience sample of people living in the regions affected by the outbreak, participants were 18 years or older, and the FGDs were

conducted during the fourth month of the epidemic. The questionnaire was developed using past questionnaires that were used in Guinea and the DRC and were also informed by the results from the FGDs. The survey participants were also selected from a convenience sample, participants were selected by the surveyors, who were leaders among medical students at a local university in Butembo. The questionnaire collected participant demographic information as well as several key domains related to social resistance to EVD control efforts. These domains were: perceived risk of EVD, denial of biomedical discourse, dissatisfaction and mistrust of EVD response team, vaccine acceptability and community engagement, support for incidents of overt hostility, and intentions to comply with control efforts in case of EVD illness or death in family. Researchers concluded that their survey results suggested that a substantial minority of respondents supported views suggestive of resistance, and that resistance was associated with denial of the biomedical discourse and dissatisfaction/mistrust of the EVD response team. And that this mistrust and resistance may lead to a decreased willingness to comply with EVD control efforts such as isolation and vaccination.

This, however, is not the first Ebola outbreak to encounter social resistance. During the 2013-2016 EVD outbreak in west Africa there was increased social resistance to EVD response efforts in Guinea compared to Sierra Leone.²³ Researchers noted that even though Guinea and Sierra Leone share several cultural similarities there were stark differences in the social resistance to the EVD response. Researchers concluded that these differences in response to the EVD outbreak can be explained by their contrasting political practices and the legacies that French direct rule and British indirect rule made on the countries.

Social resistance to outbreak response activities is not something new. In an article by Cohn and Kutalek researchers examined the parallels between Cholera epidemics in Europe during the 19th century and the EVD outbreak in West Africa.²⁴ They cite the lack of community trust and failures in communication, lack of engagement with local communities, adverse publicity, and strained relationships between local populations, governmental authorities, and outside agencies as drivers for violence in the present and in the past. The summary of articles used in this literature review can be found in Table 1.

Table 1. Summary of literature review for attacks on health care during the Ebola outbreak in the DRC from August 2018 – January 2020

Author(s)	Year	Location	Important Points or Findings
Afzal & Jafar	2019	Multiple Countries	-Researchers aimed to explore what is known of the impacts of attacks on health care
Briody et al.	2018	Multiple Countries	-Researchers sought to identify if the number of attacks targeting health care in Syria and Yemen were more frequent than in past conflicts -They examined conflicts in six middle- and high-income countries over the past 30 years -Researchers concluded that the number of facilities attacked was the highest in Syria suggesting that these types of attacks had increased compared to previous conflicts.
Czuperski et al.	2017	Syria	-Overview of attacks on health care in Syria during the civil war
Cohn & Kutalek	2016	West Africa; Europe	-Community mistrust to EVD outbreak is not a new phenomenon -Community mistrust in countries affected by EVD outbreak mirror mistrust in Europe of Cholera from 1830 – 20 th century
Dobbins, et al.	2008	Multiple Countries; DRC	-Exploration of the history of European intervention in the DRC since the civil war in 1997 -Researchers look at some of the precursors of war and challenges that are faced today in a post-conflict DRC
Masumbuko Claude et al.	2019	DRC	-Researchers explored social resistance to EVD control measures implemented during the 2018-2019 EVD outbreak in the Eastern DRC -Qualitative data was collected through focus group discussion. Quantitative data was collected through survey. - Significant proportion of those surveyed backed views suggestive of resistance, and that this was associated with mistrust of EVD response -Resistance to response may provide opportunity for continuing transmission of EVD
Vinck et al.	2019	DRC	-Researchers wanted to gain a better understanding on if institutional trust is associated with the adoption of preventative measures and whether belief in EVD misinformation is associated with lower adoption of EVD preventative measures -One in four respondents believed in the statement Ebola does not exist, a higher proportion believed that the outbreak was fabricated for financial gains or to destabilize the region

			<ul style="list-style-type: none"> - Low levels of trust in government institutions and widespread belief in misinformation -Local authorities were more trusted than city, provincial, or national authorities -Researchers concluded that low institutional trust and belief in misinformation are indicators of a low likelihood of adherence to EVD preventative measures
Wilkinson & Fairhead	2017	Sierra Leone & Guinea	<ul style="list-style-type: none"> -When the epidemic hit the chiefs in Sierra Leone had legitimacy that the leaders in Guinea did not have and they were better able to facilitate trust between the community and international humanitarian organizations -The differences in French direct rule and British indirect rule may be a contributing factor as to why Guinea had more instances of over resistance compared to Sierra Leone
Stearns	2012	DRC; North Kivu Province	<ul style="list-style-type: none"> -Prolonged violence experienced in the region since liberation in 1960 -There has been long standing conflict between ethnic groups such as those who consider themselves “indigenous,” and Hutu and Tutsi immigrants from Rwanda -Armed actors in the region have been backed by local elite and foreign governments

Manuscript

Introduction

EVD is zoonotic with frequent spillovers into humans, non-human primates, and other animal populations. There is evidence to support the claim that the natural host for EVD is bats, particularly bats belonging to the Pteropodidae family; however, there has yet to be virus isolated from bats found in natural conditions.² Humans are likely infected by coming into close contact with bats or other deceased animals such as chimpanzees or other wild game. After the initial spillover event, the disease can be spread by human-to-human transmission via bodily fluids. Caring for those who are sick or coming into close contact with dead bodies is associated with a high risk for disease transmission because of the likelihood of coming into direct contact with bodily fluids.² Because bodily fluids are very infectious, the risk of nosocomial transmission is very high; therefore, it is essential that appropriate personal protective equipment (PPE) be used when treating EVD patients. The incubation period is 2-21 days, and there are three phases of the disease. Phase one is defined by an acute non-specific viral illness where patients will experience

symptoms such as malaise, fatigue, and body aches.^{2,3} During the second phase of the disease is dominated by gastrointestinal symptoms such as nausea, vomiting, and diarrhea, at this stage many patients will become dehydrated.^{2,3} After the second week of illness, some patients will begin to recover; however some will begin to deteriorate among those who do not recover, patients will proceed to the third stage, which is shock possibly due to hypovolaemia and a systemic inflammatory response, some patients may also experience neurological manifestations during this stage.^{2,3} At this point, some patients will begin to experience hemorrhage; however, during the 2013-2016 West Africa outbreak, this wasn't common.² Many other common diseases can have similar symptoms as EVD such as influenza, malaria, or typhoid fever.⁴

On July 28, 2018 a notification was sent from the North Kivu Provincial Health division to the Ministry of Health in the Democratic Republic of Congo detailing a cluster of acute hemorrhagic fever cases.⁵ On August 1, 2018 the Institut National de Recherche Biomédicale (INRB) in Kinshasa reported that of the six samples that were collected from the patients who were hospitalized Mabalako Health Zone in North Kivu, four tested positive for EVD.⁵ This marked the beginning of the 10th outbreak of EVD in the DRC since it's discovery in 1976. The outbreak in the North Kivu Province was officially declared on August 1, 2018 one week after the 9th outbreak in the Équateur province was declared as ending.

There are several reasons why the outbreak in North Kivu and Ituri Provinces is unique. One being that North Kivu province is one of the most populous provinces in the DRC with 8 million inhabitants and shares a border with not only four other provinces in the DRC (Ituri, South Kivu, Maniema, and Tshopo) but it also shares a border with Uganda and Rwanda.⁶ Second being that this outbreak is occurring in a conflict zone. The eastern region of the DRC has experienced sustained violence since the 1960s when the DRC gained its independence from Belgium. There were at least 40 armed groups active in the eastern DRC as of October 2013.⁷ Due to the prolonged and sustained violence there is an atmosphere of mistrust among communities of the Ebola response efforts.⁸ This mistrust and suspicion have fueled the violence in the region. Due to this violence there are an estimated 1 million internally displaced persons in the region and a continuous exodus of refugees to neighboring countries such as Uganda, Burundi, and Tanzania.⁶ Third, not only is the region experiencing an EVD outbreak it is also co-currently experiencing cholera, monkeypox, and vaccine-derived polio virus type 2 outbreaks.⁹

The purpose of this study is to have a better understanding of how this violence towards health care services has impacted the country's ability to contain this outbreak. It is important to understand how often these attacks are happening, what resources are they affecting, and when these attacks reached their peak. The intent of this thesis is to quantify the frequency of attacks on health care sourced from publicly available data to have a better understanding of the dynamics of this EVD outbreak and the impact violence is having on the containment of this outbreak.

Methods

Study Design

This study was a cross-sectional examination of data collected via multiple publicly available resources.

Data Sources

The data was obtained from several publicly available resources and then matched to incidents reported in the Surveillance System for Attacks on Health Care (SSA) provided publicly by the World Health Organization (WHO). Incidents were matched based on the date of the incident, time the incident occurred, affected resources, and any injuries/deaths. Sources used to gather incidents can be broken down into five categories listed below. If incidents were unable to be matched to an incident reported in the SSA, they were still included in the data set if they affected any aspect of the EVD response. Figure 1. Displays the dataset creation process and Table 2. Displays the breakdown of sources used.

Search Process and Dataset Creation Process

The search process for data began by pulling data from the WHO SSA. Next a review of all publicly published DRC Ministry of Health (MoH) reports since the declaration of the outbreak in August 2018. The MoH published reports on the EVD outbreak from August 2018 – July 20, 2019 when the Ebola response efforts were handed over to the office of the President of the DRC. After this, a detailed review was also conducted of Helen Branswell's twitter feed for Ebola related tweets from August 2018 – January 2020. An extensive search for Ebola Related Articles took place on three local media outlets websites: Actulite.CD, Radio Moto, and Afrique la libre, news articles were translated from French to English using google translate. Data was also extracted from Kivu Security Project that was accessed multiple times from August 2019 – February 2020. Data was also extracted from The Armed Conflict Location & Event Data

Project; data was pulled during the month of January 2020.²⁵ Insecurity Insight’s attacks on Ebola Response Monthly News Briefs were also reviewed from August 2018 – January 2020.²⁵⁻³⁹ A search was also done on ProMed-Mail for Ebola related entries from August 2018 – January 2020. All external WHO situation reports published from August 2018 – January 2020 were reviewed, as were Weekly Bulletin’s on Outbreaks and Other Emergencies published by the WHO Africa Office. A search was also done for all EVD related articles published by CIDRAP from August 2018 – January 2020.

Table 2. Summary of data sources used for dataset creation

Type	Sources
International and national news	-Actualite.CD -Radio Moto -Afrique la libre
Non-profit organizations	-Kivu Security Project -The Armed Conflict Location & Event Data Project (ACLED) -Insecurity Insight -ProMed-Mail
Public health organizations	-WHO Situation Reports -Weekly Bulletin on Outbreaks and Other Emergencies, WHO Africa Office -DRC Ministry of Health
Social Media	-STAT news contributor Helen Branswell’s twitter feed
Universities	-University of Minnesota, Center for Infectious Disease Research and Policy (CIDRAP)

Variables

For this analysis there were four main variables of interest: date, province, affected health care resource, and perpetrator of attack. Date of the incident was assigned as the date in which the attack took place. If the attack took place overnight and lasted into the next day, the date in which the attack began was used as the date of the attack. Province was assigned according to which province the attack took place in.

Affected health care resource was a variable assigned by the SSA. For attacks that could be matched to attacks in the SSA, the affected health care resource for that assigned attack was used. If the attack could not be matched to any attack that was recorded in the SSA, that attack was still included in the data set and was assigned an affected health care resource based on the description of the attack. For example, if looters stole supplies and set on fire a treatment center

it was assigned the health care facilities affected health care resource. If there was no mention of health care personnel directly being impacted by the event, they were not included in the affected health care resource.

Perpetrators of attacks on healthcare were broken up into six groups which were defined as: Allied Democratic Forces (ADF), Community Members, Mai-Mai Militia, and Unknown Perpetrators. Attacker identity was assigned according to the details provided by the source of the information. If the source indicated ADF was behind the attack, ADF was, therefore, identified as the attacker. If any Mai-Mai Militia was responsible for an attack they were grouped as Mai-Mai Militia. Because of the amount of different Mai-Mai Militias in the region they were all grouped together for simplicity. If there was indication that the perpetrators of the attack were family members of an EVD victim, or just general community members that attack was assigned to the Community Members group. If the group was classified as unknown in the source details the attacker was classified as unknown. This is because based on the information available the perpetrator cannot be classified as belonging to a group. Unknown perpetrators could be armed or unarmed groups.

Statistical Methods

Microsoft Excel was used to create the data set, organize data and create graphs. SAS 9.4 was used for performing statistical analysis.

Results

There were 425 attacks on healthcare reported to the WHO SSA in the DRC from August 2018 – January 2020. Of those 425 attacks on health care 65 (15.29%) were suspected to have been towards the EVD response. Outside of accounts reported to the WHO SSA an additional 37 attacks were added to this dataset for a total of 102 attacks on health care. These attacks were focused on the EVD response and could not be assigned to any reports in the SSA. North Kivu province experienced the most attacks with 80 (78.43%) attacks, Ituri had 22 (21.57%) attacks. Between August 1, 2018 and January 31, 2020 there were an average of 1.26 attacks per week (SD 1.55, median 1), and an average of 5.67 attacks per month (SD 3.58, median 6). For the 12 months that had reported attacks between August 2018 – January 2020, there was an average 18.60% increase in attacks each month Table. 3 shows the percent increase or decrease in reported incidents for each month, as well as the number of reported cases each month.

The peak of violent attacks occurred in May 2019 with 14 attacks being confirmed during that month, followed by February 2019 with 10 attacks confirmed during that month. For Ituri Province there was two peaks of violent attacks, the first peak was in June 2019, 4 (18.18%), the second was in October 2019, 4 (18.18%). For North Kivu Province the peak occurred during May 2019, 13 (16.25%) attacks. The peak of attacks per week for both provinces was during week 42 (October 14 – 20, 2019), with 7 (6.86%) attacks. For Ituri Province the violent attacks peaked during week 42 (14 – 20 October 2019) with 4 (18.18%) attacks. For North Kivu Province there were two weeks, the first week was week 9 (February 25 – March 3, 2019) with 5 (6.25%) attacks, the next peak was during week 52 (December 23 – 29, 2019) with 5 (6.25%) attacks as well.

There were several different attackers that were noted as perpetrators of this violence during this outbreak and they were broken down into six groups which are: Allied Democratic Forces (ADF), Community Members, Mai-Mai Militia, and Unknown Perpetrators. The main force behind the violent attacks for both provinces was the Unknown Perpetrators Group with 39 (38.24%) attacks. However, the main force behind attacks in Ituri province was both the general population with 8 (36.36%), and Mai-Mai Militia 8 (36.36%) compared to North Kivu Province, where the main force behind attacks was overwhelmingly the Unknown Perpetrator Group 34 (42.50). The entire breakdown of perpetrators of violence can be found in Table 4. There was no evidence of violent attacks towards the EVD response in South Kivu province from August 2018 – January 2020. Figures 1 – 3 show the distribution of attacks against health care and EVD cases by date of illness onset for August 2018 – January 2020.

There were several resources that were impacted by attacks on health care. In each attack more than one resource could be affected. The frequency of all affected resources is displayed in Table 5. The three most affected resources were health care facilities 56 (37.09%), followed by health care personnel 50 (33.12%), and health care transport 17 (11.26%).

Out of 102 confirmed incidents there were 15 reported deaths, 31 reported injuries (one injury occurred among a healthcare worker's spouse), 22 abductions (4 of these abductions were of patients). Ituri province accounted for 4 (26.67%) deaths, while North Kivu province had 11 (73.33%) deaths. Ituri province accounted for 11 (35.48%) injuries, while North Kivu province accounted for 20 (64.52%) injuries, including one civilian injury.

To assess how long EVD response operations were delayed after major attacks on health care, all the above sources were used to identify times in which some aspect of the response stopped. Because the response efforts are so complex and multi-faceted, any event that impacted any aspect of the response was counted. If there was no date mentioned in which response efforts resumed it was assumed that the response was impacted one day only. All together the response was halted for 103 days between August 2018 – January 2020.

Discussion

The amount of attacks against health care services in the DRC during this EVD outbreak has had a substantial impact on bringing this outbreak to an end. In a study by Wells and colleagues, researchers attempted to evaluate the spatial dynamics of Ebola transmission and to quantify the impact of vaccination on the Ebola outbreak in Équateur province DRC. Researchers concluded that the ring vaccination helped bring the outbreak under control.⁴⁰ Wells and colleagues stated that if the vaccination campaign had been delayed by one week, the reduction in risk in the area where the outbreak occurred would have dropped from a 70.4% reduction to 33.3% reduction.⁴⁰ The study conducted by Wells and colleagues highlights the importance of being able to implement vaccine campaigns in an appropriate amount of time to reduce the risk of EVD. During the outbreak in North Kivu and Ituri provinces the same vaccine was used as in the Équateur province outbreak, recombinant vesicular stomatitis virus (rVSV)-vectored vaccine for Ebola Virus Disease (rVSV-ZEBOV).⁴⁰ However, even though the same vaccine and vaccination strategy, ring vaccination, were used this outbreak has lasted substantially longer than the Équateur province outbreak and has lead to more cases and deaths.

There were several instances during the North Kivu and Ituri province of the EVD response being halted because of attacks. This halt of the response efforts resulted in some aspects of the response being put on hold, and in some circumstances, vaccination of contact (ring vaccination) was put on hold. Altogether, there were 103 days of delayed response efforts. Time and time again, in the MoH reports, and in the WHO reports, there has been a commentary on community reluctance – specifically reluctance of contacts to get vaccinated, and sometimes this reluctance has resulted in violence.²⁴ There were also numerous examples of violence toward safe and dignified burial teams. Safe and dignified burials are essential to stop the spread of EVD because the body is so contagious after death.²⁴⁻³⁹

Not only were the response efforts severely delayed it was clear that health care facilities were also significantly impacted with 37.09% of all affected resources being health care facilities. It is essential that during an Ebola outbreak patients' have adequate access health care facilities to reduce the amount of community spread. It is also important to note that the peak month, and the peak week varied when comparing Ituri and North Kivu provinces, and the amount of deaths, abductions, and injuries were greater in North Kivu province than in Ituri province.

Limitations

This study has several limitations. One limitation is that there is no way that there can be absolute certainty that an attack that was matched to an incident in the WHO's Surveillance System for Attacks on Health care is in fact that incident. The WHO only provides country level information on each incident; therefore, there is no way to be certain that an event reported in the surveillance system happened to the EVD response teams in the eastern part of the country.

Second limitation is that even though 102 attacks were identified, there is likely to be more attacks than reported here. Numerous attacks against health care personnel were recorded in the WHO's Surveillance System for Attacks on health care as psychological threats of violence. It is very rare to see any sort of threat or intimidation reported on in the sources used to gather information. There were mentions of threats against health care workers but not specific incidents, therefore, the estimates made here are likely to be an underestimation of the actual magnitude of violence towards health care during this outbreak.

Third, there were several assumptions made here during this analysis and they will surely have a significant impact on the results shown here. One of the assumptions made during the attempt to assess the impact that major violent events had on the EVD response was that if there was not a date that could be found in which response operations resumed it was assumed that the response was only delayed for one day. This is likely an underestimation of the impact of attacks on the response.

Conclusion

While the outbreak currently appears to be coming to an end, this EVD outbreak has shown that the world is underprepared for an outbreak of such a virulent disease in an area experiencing active conflict. It also demonstrates that even though there have been massive efforts to educate the public on the lethality of EVD and the importance of seeking prompt care,

there is still some reluctance in the population to seek care. This reluctance can result in violence towards health care workers participating in the response efforts. Violence that targets response efforts hampers the ability to contain the outbreak.

Our study, one of the first, to demonstrate the prevalence and context of violent attacks related to health care resources and delivery during a health crisis indicate need for deliberate planning and preventative measures when mitigating an infectious disease outbreak during an active conflict.

References

1. Weyer J., Grobbelaar, A., & Blumberg L. (2015). Ebola Virus Disease: History, Epidemiology and Outbreaks. *Current Infectious Disease Reports*, 17(5).
<https://doi.org/10.1007/s11908-015-0480-y>
2. Malvy, D., McElroy, A. K., de Clerck, H., Günther, S., & Johan, v. G. (2019). Ebola virus disease. *The Lancet*, 393(10174), 936-948. doi:http://dx.doi.org/10.1016/S0140-6736(18)33132-5
3. Beeching, N., Fenech, M., & Houlihan, C. (2014). Ebola virus disease. *BMJ: British Medical Journal*, 349. Retrieved March 27, 2020, from www.jstor.org/stable/26518974
4. Centers for Disease Control and Prevention. (2019). Ebola (Ebola Virus Disease). Retrieved from: <https://www.cdc.gov/vhf/ebola/symptoms/index.html>
5. World Health Organization. (2018). Ebola virus disease – Democratic Republic of Congo. Retrieved from: <https://www.who.int/csr/don/4-august-2018-ebola-drc/en/>
6. World Health Organization. (2018). Ebola Virus Disease, Democratic Republic of the Congo External Situation Report 1. Retrieved from:
https://apps.who.int/iris/bitstream/handle/10665/273640/SITREP_EVD_DRC_20180807-eng.pdf?ua=1
7. The New Humanitarian. (2013, October 13). Armed groups in eastern DRC. Retrieved from: <http://www.thenewhumanitarian.org/news/2013/10/31/armed-groups-eastern-drc>
8. Masumbuko Claude, K., Underschultz, J., & Hawkes, M. (2019). Social resistance drives persistent transmission of Ebola virus disease in Eastern Democratic Republic of Congo: A mixed methods study. *PLoS ONE*. 14(9): e0223104.
<https://doi.org/10.1371/journal.pone.0223104>
9. World Health Organization. (2018). Ebola Virus Disease, Democratic Republic of Congo External Situation Report 3. Retrieved from:
https://apps.who.int/iris/bitstream/handle/10665/274258/SITREP_EVD_DRC_20180820-eng.pdf?ua=1
10. Dobbins, J., Jones, S., Crane, K., Chivvis, C., Radin, A., Larrabee, F., . . . Goldsmith, B. (2008). Democratic Republic of the Congo. In *Europe's Role in Nation-Building: From the Balkans to the Congo* (pp. 101-138). RAND Corporation. Retrieved February 12, 2020, from www.jstor.org/stable/10.7249/mg722rc.14
11. Wells CR, Pandey A, Parpia AS, et al. Ebola vaccination in the Democratic Republic of the Congo. *Proc Natl Acad Sci U S A*. 2019;116(20):10178–10183.
doi:10.1073/pnas.1817329116

12. Usanov, A., De Ridder, M., Auping, W., Lingemann, S., Espinoza, L., Ericsson, M., . . . Liedtke, M. (2013). *Coltan, Congo & Conflict: POLINARES CASE STUDY* (pp. 29-41, Rep.). Hague Centre for Strategic Studies. Retrieved March 27, 2020, from www.jstor.org/stable/resrep12571.6
13. Sterns, J. (2012). North Kivu: the background to conflict in North Kivu province of eastern Congo. *Rift Valley Institute*. 1-46.
14. United Nations High Commissioner for Refugees. 2020. DR Congo emergency. Retrieved from: <https://www.unhcr.org/en-us/dr-congo-emergency.html>
15. United Nations High Commissioner for Refugees. (2019). Attacks in Congo's North Kivu Province push tens of thousands to flee – UNHCR. Retrieved from: <https://www.unhcr.org/en-us/news/briefing/2019/5/5ccbf72f4/attacks-congos-north-kivu-province-push-tens-thousands-flee-unhcr.html>
16. Briody, C., Rubenstein, L., Roberts, L., Penney, E., Keenan, W., & Horbar, J. (2018). Review of attacks on health care facilities in six conflicts of the past three decades. *Conflict and health*, 12, 19. <https://doi.org/10.1186/s13031-018-0152-2>
17. Czuperski, M., Itani, F., Nimmo, B., Higgins, E., & Beals, E. (2017). *Breaking Aleppo* (pp. 21-30, Rep.). Atlantic Council. Retrieved March 17, 2020, from www.jstor.org/stable/resrep03700.9
18. Reuters. (2019). Congo Ebola center set on fire after armed attack. Retrieved from: <https://www.reuters.com/article/us-health-ebola-congo-violence/congo-ebola-center-set-on-fire-after-armed-attack-idUSKCN1QG2KR>
19. Soucheray, S. (2019). WHO: ‘Notable escalation’ of violence in DRC Ebola outbreak. *CIDRAP*. Retrieved from: <http://www.cidrap.umn.edu/news-perspective/2019/04/who-notable-escalation-violence-drc-ebola-outbreak>
20. World Health Organization (2018). Surveillance system for attacks in health care (SSA): methodology. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.
21. World Health Organization. Surveillance System for Attacks on Health Care. 2020. Retrieved from: <https://publicspace.who.int/sites/ssa/SitePages/PublicDashboard.aspx>
22. Vinck, P., Pham, P., Bindu, K., Bedford, J., & Nilles, E. (2019). Institutional trust and misinformation in the response to the 2018-19 Ebola outbreak in North Kivu, DR Congo: A population-based survey. *The Lancet Infectious Diseases*, 19(5), 529-536. 10.1016/S1473-3099(19)30063-5

23. Wilkinson, A., Fairhead, J. (2017) Comparison of social resistance to Ebola response in Sierra Leone and Guinea suggests explanations lie in political configurations not culture, *Critical Public Health*, 27:1, 14-27, DOI: 10.1080/09581596.2016.1252034
24. Cohn S., & Kutalek R. (2016). Historical Parallels, Ebola Virus Disease and Cholera: Understanding Community Distrust and Social Violence with Epidemics. *PLOS Currents Outbreaks*. Doi:10.1371/currents.outbreaks.aa1f2b60e8d43939b43fd93e1a63a94
25. Raleigh, Clionadh, Andrew Linke, Håvard Hegre and Joakim Karlsen. (2010). "Introducing ACLED-Armed Conflict Location and Event Data." *Journal of Peace Research* 47(5) 651-660.
25. Insecurity Insight. 2018. The Safeguarding Healthcare Monthly News Brief, October 2018. Switzerland: Insecurity Insight, Safeguarding Healthcare Project.
26. Insecurity Insight. 2018. The Aid in Danger Monthly News Brief, November 2018. Switzerland: Insecurity Insight, Aid in Danger Project.
27. Insecurity Insight. 2018. The Safeguarding Healthcare Monthly News Brief, December 2018. Switzerland: Insecurity Insight, Safeguarding Healthcare Project.
28. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, January 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project
29. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, February 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.
30. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, March 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.
31. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, April 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.
32. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, May 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.
33. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, June 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.
34. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, July 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.
35. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, August 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.
36. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, September 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.

37. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, October 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.

38. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, November 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.

39. Insecurity Insight. 2019. Attacks on Health Care Monthly News Brief, December 2019. Switzerland: Insecurity Insight, Attacks on Health Care Project.

Figure 1. Dataset creation process using WHO SSA and other data sources

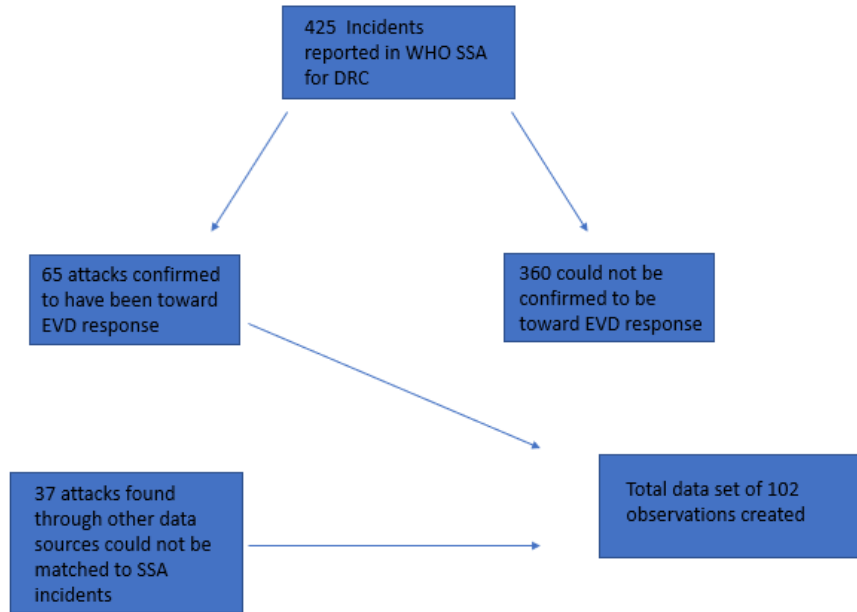


Figure 2. EVD incidence by week of illness onset and number of attacks on healthcare by week of occurrence for both provinces.

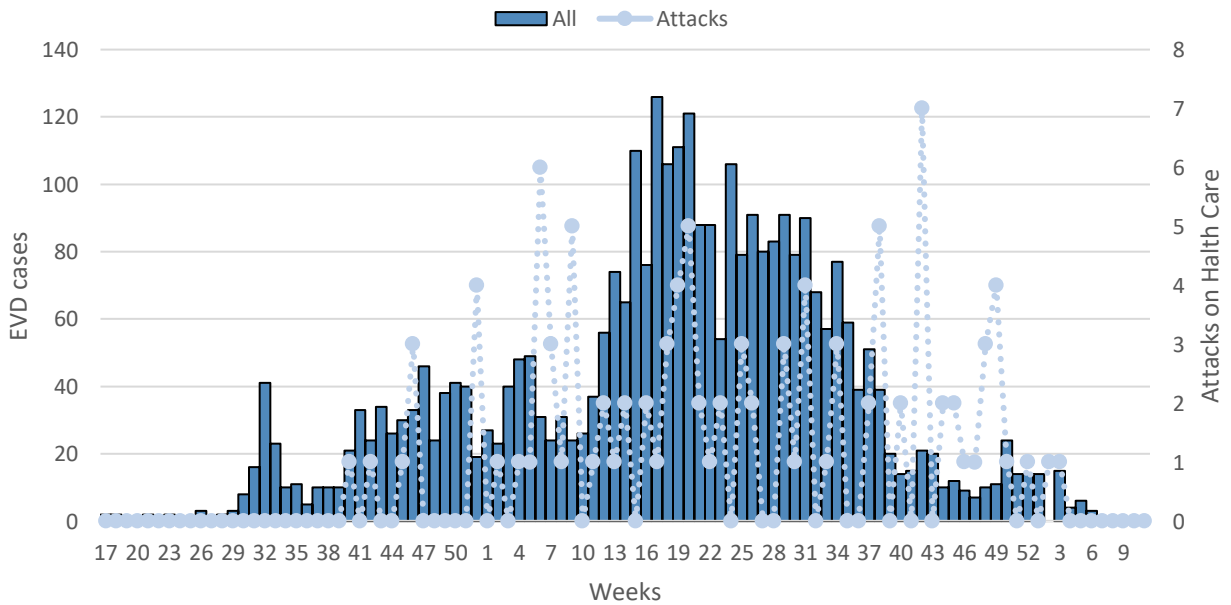


Figure 3. EVD incidence by week of illness onset in North Kivu Province and attacks on health care in North Kivu Province

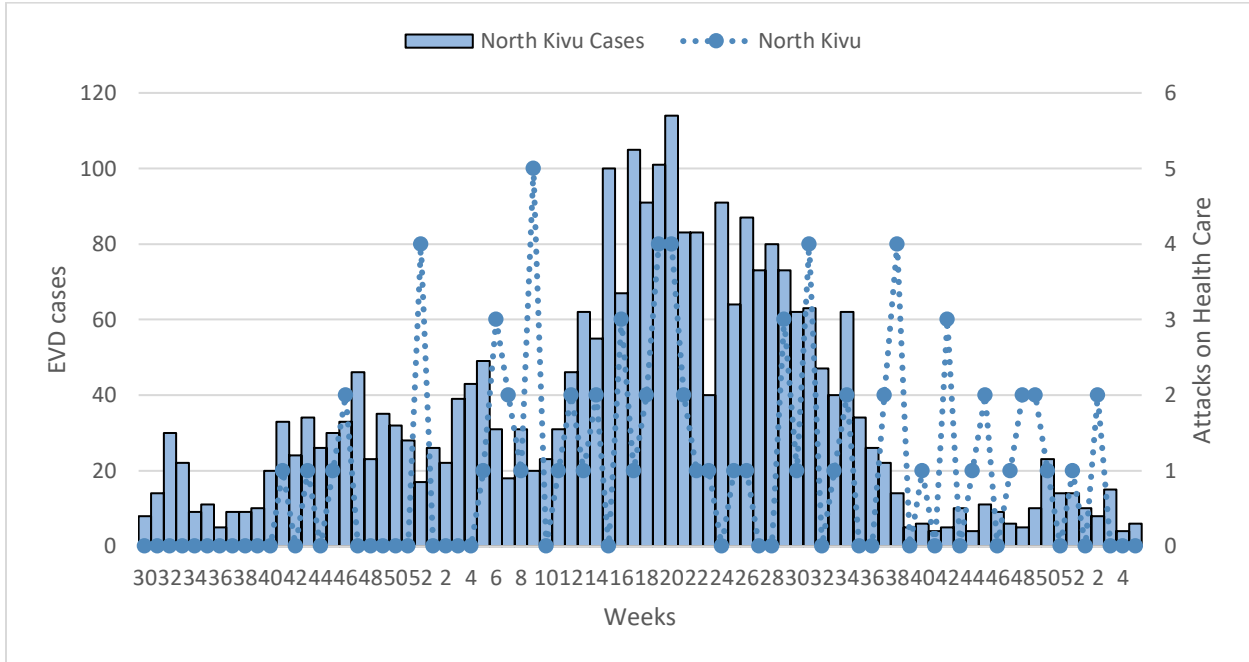


Figure 4. EVD incidence by week of illness onset in Ituri Province and attacks on health care in Ituri Province

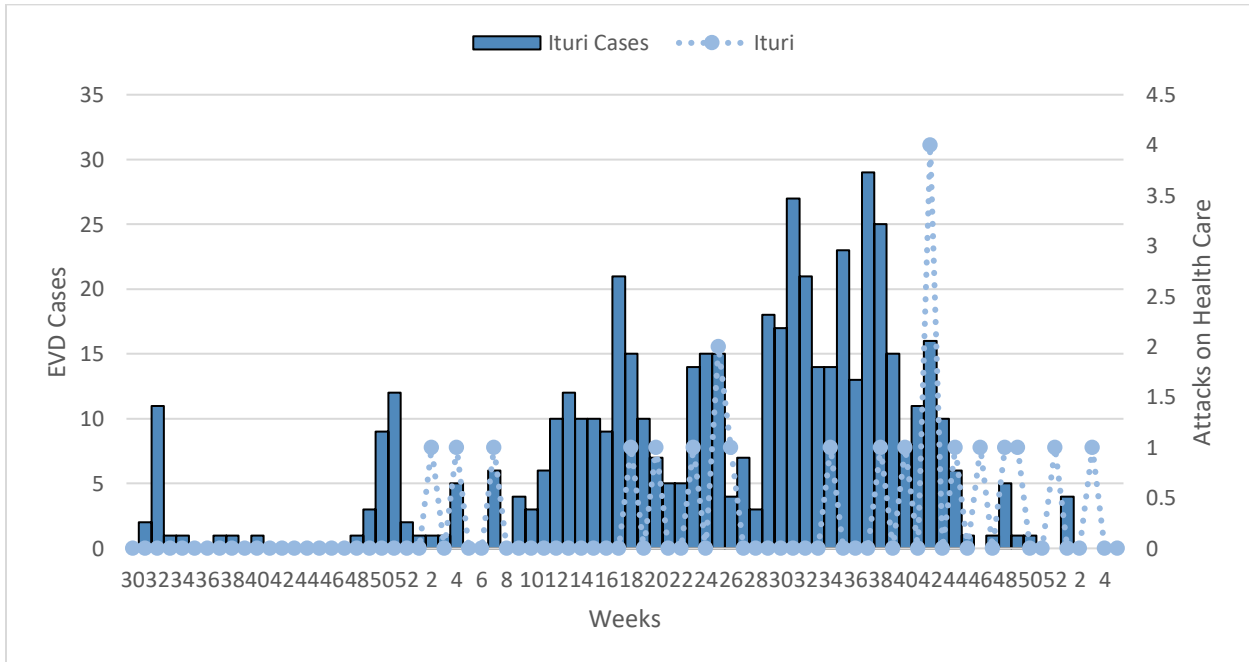


Table 3. Number of attacks on health care by province, month and year and percent change in number of attacks for combined provinces for each month

Year	Month	Province (N) (%)		Total (N) (%)	Percent Change
		Ituri	North Kivu		
2018	August	0 (0.00)	0 (0.00)	0 (0.00)	-
	September	0 (0.00)	0 (0.00)	0 (0.00)	-
	October	0 (0.00)	2 (1.96)	2 (1.96)	-
	November	0 (0.00)	3 (2.94)	3 (2.94)	+50.00
	December	0 (0.00)	4 (3.92)	4 (3.92)	+33.33
	January	2 (1.96)	1 (0.98)	3 (2.94)	-25.00
	February	1 (0.98)	9 (8.82)	10 (9.80)	+233.33
	March	0 (0.00)	6 (5.88)	6 (5.88)	-40.00
2019	April	1 (0.98)	6 (5.88)	7 (6.86)	+16.67
	May	1 (0.98)	13 (12.75)	14 (13.73)	+100.00
	June	4 (3.92)	3 (2.94)	7 (6.86)	-41.18
	July	0 (0.00)	5 (4.90)	5 (4.90)	-28.57
	August	1 (0.98)	6 (5.88)	7 (6.86)	+40.00
	September	2 (1.96)	6 (5.88)	8 (7.84)	+14.29
	October	4 (3.92)	5 (4.90)	9 (8.82)	+12.50
	November	3 (2.94)	5 (4.90)	8 (7.84)	-11.11
2020	December	2 (1.96)	4 (3.92)	6 (5.88)	-25.00
	January	1 (0.98)	2 (1.96)	3 (2.94)	-50.00
Total		22 (21.57)	80 (78.43)	102 (100.00)	

Table 4. Types of actors perpetrating attacks on health care by province

Attacker	Province (N) (%)		Total (N) (%)
	Ituri	North Kivu	
Allied Democratic Forces	1 (0.98)	5 (4.90)	6 (5.88)
Community Members	8 (7.94)	22 (21.57)	30 (29.41)
Mai Mai Militia	8 (7.92)	19 (18.63)	27 (26.47)
Unknown Perpetrators	5 (4.90)	34 (33.33)	39 (38.24)
Total	22 (21.57)	80 (78.43)	102 (100)

Type 5. Number of affected health care resource during each attack on health care by province

Resource	Province (N) (%)		Total* (N) (%)
	Ituri	North Kivu	
Health care facilities	14 (9.15)	46 (30.07)	60 (39.22)
Health care personnel	13 (8.50)	40 (26.14)	53 (34.64)
Health care transport	4 (2.61)	15 (9.80)	19 (12.42)
Health care supplies/assets	6 (3.92)	11 (7.19)	17 (11.11)
Health care warehouse/storage	0 (0.00)	1 (0.65)	1 (0.65)
Health care patients	1 (0.65)	2 (1.31)	3 (1.96)
Total	38 (24.84)	115 (75.16)	153 (100.00)

*More than one health care resource can be impacted during every attack