

Revisiting Ebola outbreaks public health emergencies in fragile conflicts zones and displaced populations in Africa

Abstract

Little is documented on conflict and displacement impact on West Africa Ebola Virus disease (EVD) outbreaks. The paper revisits Ebola outbreaks public health emergencies in fragile conflict zones and displaced populations across Africa. Findings showed that the duration of conflict/war events varied one to forty three years. Notably the Darfur war in Sudan for 18-23 years, RD Congo and Guinea incessant political and ethnical or mining conflict instability repeatedly ranging between 2-6 years, Liberia and Sierra Leone 5 and 12 years conflict/war events associated Ebola outbreaks were documented. In West Africa, in Liberia the seven and four years of conflicts from 1989-1996 and 1999-2003 prior to a democracy nation led by S Johnson (president). Worldwide, there have been 28,639 cases of Ebola virus disease and 11,316 deaths at December 2016. Ebola outbreak public health emergencies advocacy, community social mobilization and engagement, Ebola awareness and effective and culturally dignified communications, social media and mass media risk communication, community literacy and preparedness and

19 emergency response engagement and participation, access and deployment of digital technology applications (Health map) in surveillance,
20 tracking and monitoring and key traditional burial practice behaviours changes were being translated into positive successes and benefits those
21 play key roles to mount rapid and effective prevention of further spread and containment activities of West Africa Ebola outbreak. Inter-
22 humanitarian organizations, institutions and other stakeholders including government's cooperation and coordinated leadership commitment and
23 investment were laudable in supporting accountability and transparency in the overall objectives of public health emergency preparedness
24 planning, care management systems in Ebola outbreak centres, public awareness epidemic early detection and rapid response as well as effective
25 immunization programs implementation to outwit Ebola virus. Sierra Leone conflict lasted from 1991-2002, Guinea recorded frequent relentless
26 instability than Liberia with two major conflict periods from 1989-1996 and 1999-2003. For the first time, we established a statistical significant
27 correlation between duration of war/conflict events and Ebola outbreaks onsets in Africa ($P < 0.05$). Unexpectedly; the total fatality rate in Liberia
28 or Sierra Leone only was greater than the previously reported cumulative EVD cases across Africa since 1976. It is crucial to intensify advocacy
29 on conflicts/wars resolutions to disaster risk reduction framework evidence practice implementation in fostering health and socioeconomic
30 development and growth. Authors call for the urgent need for concerned commitment and engagement of all stakeholders to develop, implement
31 and strengthening local, regional and global public health emergencies evidence practice approaches and strategies including national public
32 health disaster emergency situations insurance schemes in paramount in disaster high risk prone settings and particular in Africa.

33 **Key Words:** Public health emergencies, evidence, practice, preparedness, response, conflict, war, displacement, resolution, consequence, Ebola,
34 outbreak, Africa

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37

38 Introduction

39 Given the unprecedented scale and emerging outbreaks public health emergencies with limited absorptive capacity and functional surveillance and
40 early warning systems in most African countries, the West Africa Ebola outbreak in the most affected three countries was declared as public
41 health emergency international concern (PHEIC) in early 2014. The deadliest diseases in history and highly unparalleled dimensions of human
42 contagious through diverse transmission routes dynamics and severe to contain, leading to over almost 28,638 cases affected and more than
43 11,316 deaths worldwide (1). The West Africa Ebola outbreaks requires further in-depth in untangling the potential drivers and issues that
44 trigger the unhealthy events and reducing life expectancy with diverse health and socioeconomic consequences in different geospatial affected
45 and non-affected communities in Africa (2). The WHO declared Ebola outbreak as a public emergency of international concern in West Africa
46 early March 2014 as the number of cases and fatality rate has increasing significantly with more than 6,700 children orphans. The Ebola
47 epidemic has taken a heavy toll on the already scarce health workforce including some humanitarian workers having about 21 to 32 times high
48 risk probability to be infected with Ebola (815 confirmed and probable cases reported) than people in the general population in the three most
49 affected countries (1). Several reasons of the scale West Africa Ebola outbreak public health emergency were attributable to deficiencies national
50 and regional infectious diseases surveillance-response and early warning systems, governments and stakeholders including humanitarian
51 organisations coordinated logistics and management inappropriateness, weak to lack of capability of health systems to respond to health
52 emergencies and meeting routine community healthcare needs. In addition, to local staff shortages, long working hours, unpredictable and
53 delayed health workers remuneration, community resistance and stigmatization, poor social protection, lack of preparedness capabilities
54 (workforce and infrastructure) to personal protective equipment (PPE), defective infection prevention and control (IPC) and cultural- behaviour
55 practice, and poor mastering of frontline conditions and social-anthropological determinants(1,2,3).

56 The resulting unsettled conflict resolution and peace agreements consequences such as, human and animal displacement, food insecurity, forest
57 and wildlife incursions, illicit hunting and poaching and complex vicious cycle of poverty could be responsible for the West Africa Ebola
58 eruption and public health consequences and losses (2,4). Africa has been home to a range of conflicts and wars event-linked public health

59 emergencies since the era of colonisation up to date. Public health emergencies are sporadically and randomly distributed across the region and
60 perpetuated by a variety of actions ranging from conflict, wars and political leadership motivated civil unrest, ethnical genocide and mining
61 groups incursions. But also, accentuated by local insecurity and volatility linked population displacements and resettlements to regional neo-
62 colonial excitements splintering across African conflict-fragile countries with few effective and stable peace and reconciliation leadership and
63 functional competency processes and strategies (1, 4). In addition, African governments exhibit significant distinctive intra and inter country
64 conflicts types and events as well as diverse conflict trends and patterns. Conflict and civil wars have left several marks (1, 5), such as
65 dysfunctional, inadequacy and severely disabled in health systems, high level of illiteracy amidst populations of years without education, lack of
66 qualified health personnel and brain drain syndrome, chronic unemployment, fluid population movement and migration; fear, anxiety and
67 hostility, rumours and Ebolaphobia, discrimination and stigmatization, lack of water and sanitation, lack of integration of African traditional
68 medicine in the health systems and other sociocultural factors such as traditional burials and funerals practices involving close contact with the
69 corpses threatening the national security and international responses (3, 6). How do conflicts/wars and displaced populations events bring about
70 Ebola outbreak public health emergencies in Africa? Can peacebuilding and conflict resolutions reduce or enhance public health humanitarian
71 outbreak or disaster crisis / catastrophe prevention and resilience in Africa?

72 Few previous studies have documented the infectious diseases mainly Ebola virus (EVD) outbreaks public health emergency linked to
73 conflicts/wars or disaster crises events extend and severity across Africa. The relationship between conflicts/wars events, wars, populations
74 displacements and resettlements implications on Ebola outbreak emergence and spread in most Ebola affected communities is still poorly
75 understood (1, 4, 7, 8).

76 The article examines conflict/wars related displacement events impacts on alarming West Africa EVD outbreak public health emergencies
77 consequences, and provides practical and effective evidence-based in nurturing peace-building, evidence based conflict linked emerging
78 infectious diseases outbreak public health emergencies prevention and management approaches and strategies within Africa towards promoting
79 resilient health system strengthening and health equity, social justice and global economic prosperity.

Comment [JI1]: It would have been better to start with a statement like this. Start with a general picture of conflict in Africa and its consequences focusing on health issues

80

81 **Methods**

82 **Search strategy and scrutiny**

83 The systematic review dataset was collected from PubMed and acknowledged website searched based in West Africa region conflict events to
84 emergence and spread of Ebola outbreak emergencies in the affected countries without restriction on language for studies published from
85 January 1, 1960, to July 31, 2017. We used the Uppsala/PRIO Armed Conflict Dataset (ACD) and “conflict, location and resettlement/
86 displacement public health emergencies events dataset [4] which contains information on the geo-location of conflict events impacts in West
87 African countries over the period 1997-2010 and other reference United Nations (UN) reports on conflicts, peace and conflict resolutions
88 meetings in West Africa Ebola affected countries. A unique feature of ACLED dataset is that it contains information on the type of events, as
89 well as the characteristics of the actors on both sides of the conflicts, events trend and patterns from 1997- July 31, 2017.

90 **Selection criteria and assessment**

91 To assess both the direct and indirect impacts of conflict/wars and Ebola outbreaks, we used the following keywords: “Ebola epidemics or
92 outbreaks linked conflict/war, civil unrest,” “political unrest, political instability,” and “displacement, resettlement, refugees’ camps public
93 health emergencies”. To assess articles that focused on Ebola outbreaks and conflicts zones we used free text and MESH terms (where
94 available). These conflict events are obtained from various, including national annual reports, regional and local conflicts proceeding and
95 humanitarian agencies or research publications. Exclusion criteria were determined a priori such as Ebola outbreaks editorials, view point
96 or guidelines and letters in isolated case report in military or tourists.

97

98 **Statistical analysis**

99 Data were analysed using Statistica version 12.0 software frequency of exposure, resurgence of diseases throughout the duration of conflict and
100 post-conflict EVD outbreak public health emergencies prevention and management or humanitarian assistance or relief. Analyses were two-
101 tailored with a significant P value threshold set at less than 0.05. Correlation analyses were performed between war duration, years for epidemic
102 minus war start, years for epidemic minus war end, cumulative cases (n) and cumulative fatality rate (%).

103

104 **Results**

105 Of the 304 publications produced by the search strategy, 56 reported conflicts and infectious diseases and 19 reports describing conflicts-related
106 separate outbreaks were evaluated, found eligible and analysed.

107

108 **3.1 Trend and pattern of political conflict/wars duration and Ebola Outbreaks in African countries from 1960 -2015**

109 The trend and patterns of conflicts events related public health emergencies in Africa countries were diverse and complex ranging from civil
110 unrest and wars associated displacement, diseases outbreaks (Ebola, Cholera, Polio, meningitis, rift valley fever, dengue), natural disaster events
111 (climate change and global warming impact, Droughts related hunger and famine, deforestation and intense mining, flooding and mud-
112 /landsliding, volcanic eruptions and coast sea rise or *el-nino*). The pattern of these situations were multifaceted and complicated by where rebels
113 and militias or terrors capitalized on wild and forest jungles to hide, plan and stage their plots against the opponents to mining conflicts linked
114 population displacement and forest incursions and wildlife those varied from one fragile country to another. The duration of conflict/war events
115 varied one to forty three years. Notably the Darfur war in Sudan for 18-23 years, RD Congo and Guinea incessant political and ethnical or
116 mining conflict instability repeatedly ranging between 2-6 years, Liberia and Sierra Leone 5 and 12 years conflict/war events were documented.
117 In West Africa, in Liberia the seven and four years of conflicts from 1989-1996 and 1999-2003 prior to a democracy nation led by S Johnson

118 (president). Worldwide, there have been 28,639 cases of Ebola virus disease and 11,316 deaths at December 2016. The most affected countries
119 are Liberia and Sierra Leone and Guinea with a total of 10,675 and 11,123 cases, and 4,809 and 3,956 deaths respectively (Table 1).

120 Interestingly, the total Ebola outbreaks fatality rate in Liberia and Sierra Leone alone was greater than the documented cumulative fatality rate in
121 Sudan, DR Congo, Congo, Gabon, Uganda, South Africa, Nigeria and Mali. The geopolitical ethnic rebels and militias or terrors conflicts,
122 repression and fragility showed to influence greatly Ebola geographical distribution in the region in addition to ethnic, religious and economic
123 divisions to gain control of political power, and natural resources. Conflict and war events appear to be directly linked to persisting emergence of
124 Ebola outbreaks (e.g., DR Congo) in most affected communities in Africa (Table 1).

125

126 **3.2 Correlation between conflict/war event duration displacement impact on geographical distribution of EVD across affected countries**

127 The duration of conflict/war events in fragile conflict zones and displaced populations varied weeks to years across community and country. The
128 longest duration was recorded in Sudan 2 with 17 years (1955-1972) prior the first Ebola outbreak in Sudan in 1976 Uganda (1979-1986 prior to
129 their first Ebola episode in 2000, and 1993-2003 with the 2007 and 2012 Ebola outbreaks respectively. Guinea in West Africa also recorded the
130 constant instability with Liberia 7 and 4 years conflicts and wars from 1989-1996 and 1999-2003 respectively. As well as conflict in Sierra
131 Leone broke out from 1991-2002 (10 years) with the cumulative resulting effect and emergence of West Africa Ebola outbreak. Conflicts/wars
132 fragile African zones have also lasted longer, on average they lasted from averagely weeks to eight years. There was a strong and statistically
133 significant correlation between conflict/war event duration, years of Ebola epidemic minus war onset and cumulative cases and cumulative
134 fatality rate to Ebola outbreak in Africa ($R=0.57$, $P=0.0016$; $R=0.74$, $P=0.000$). Also, there was a weak negative correlation between the
135 conflict/war event duration and years of Ebola epidemic minus conflict/war end. Our findings showed the duration of conflict/war could be
136 responsible for the human displacement, forest and wildlife incursions and hunting as the source of food (Table 1).Community or national/sub-
137 regional instability was documented at different time points across Africa and probably the epicentres were areas of former resettlement,

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138 neighbouring districts or communities where wildlife have been chased or hunters away then rendering the next communities more susceptible to
139 EVD outbreak due to exposure to wildlife animals reservoirs and cultural practices.

140

141 3.3 Building and strengthening early public health preparedness and response resilience capacity to future public health emergencies

142 Promoting and strengthening Public Health Emergency Response (PHER) Framework implementation as recommended by,
143 the WHO and adopted the Africa Union is needed to accelerate local and regional public health emergency preparedness and
144 response benefits and gains compared to the existing reluctance and inaction.

145 West Africa EVD outbreaks has taught us that WHO Grade 3 PHEIC declaration delaying an announcement imperils lives and
146 health systems and more economic losses, and undermine domestic political legitimacy those motivate responses to international
147 emergencies and establishment of a US\$100 million contingency fund for rapid response WHO, UN and other humanitarian
148 organizations including NGOs commitment remains and rely on mobilizing funding from member states and other partners. yet,
149 2014-2016 West Africa Ebola outbreaks pledges remain unfulfilled and need can be fulfilled for sustained investment by global
150 partners in strengthening establishment and functioning of a global emergency fund in public health emergencies capacity
151 development and training of local health workers in knowledge, skills and abilities that can be deployed rapidly in preparedness,
152 planning, prevention and control of potential emergencies situations including diseases outbreak. Moreover boosting the local,
153 national and regional capacity with public health emergencies know-how and expertise ranging from integrated early detection and
154 surveillance, timely risk communication, community awareness and engagement, insourcing and outsourcing supply chain
155 procurement processes and quality management in accordance with International Health regulations, Human Rights and upholding
156 global health security Alma Mata and principles in future public health emergency situations.

Comment [J13]: add: By the

Comment [J14]: Too many idea in a statement.
Edit

Comment [J15]: The long statement is incomplete. It does not add anything to the write up

157 Increasing public health emergency partnership and collaboration with local institutions, researchers and private sectors to rapidly
158 identify, investigate, track or map and define contextual acceptable response approaches and strategies development and
159 implementation is crucial. Efforts in more granularity, development of public health emergencies quality monitoring indicators and
160 metrics, guidelines and best practices is important in risk stratify geographic settings susceptible to disease outbreaks and earlier
161 responses to localized epidemics before they reach epidemic proportions and great potential of fund for the global public health
162 community. Improving our global health solidarity and collective capabilities to plan, detect, investigate and respond early
163 documented prolonged periods of civic unrest and suffering from decimated health systems with limited human resource capacity
164 compared to Nigeria successful EVD outbreak containment response in Guinea, Sierra Leone, and Liberia are all recovering from,
165 Albeit limited, public health infrastructure resulted in timely and effective efforts in public education, isolation, quarantine, contact
166 tracing, and case identification to control an epidemic after only 20 cases and 8 deaths in a little over a month in 2014 West Africa
167 EVD outbreak compared to recent DR Congo Ebola outbreak in forest with challenging access and humanitarian assistance and
168 response delivery using UN humanitarian helicopters.

169 Investing in Public health emergencies preparedness and response capabilities in conflict prone settings in Africa is core in and
170 require the establishment of robust and resilience local and regional public health emergency health policies, and integration into
171 national health agenda. While exploring local public health disaster insurance schemes and life emergency fund from all
172 stakeholders. where routine weak health systems, limited diagnostic tools and resources for structured surveillance and data
173 transmission are lacking to stem the Ebola virus disease epidemic is laudable but should not encourage complacency in our efforts
174 to improve the global public health infrastructure concerted international response is required to prevent urgent natural,
175 technological and others hazards and disasters occurrence and emergence before they become catastrophic.

176

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177 Discussions

178 The devastating effects and the aftermath of political violence, civil war and ethnic conflicts have generated millions of displacement and
179 resettlement with unbelievable pictures of suffering and unnecessary associated persistence of Ebola outbreaks and emerging infectious diseases
180 mortality and disability across the African continent (4, 9, 12, 13). During times of armed conflict, civil disturbance, and state repression and the
181 basic critical right deteriorated. Attacks on and interference with health care providers, facilities, and services pose enormous challenges to
182 effective health care delivery where it is most needed (4). Yet, Africa still remains the land of complex conflicts environment and instability
183 where the vast majority of conflicts experienced on a daily or yearly basis is as a result of civil wars, ethnic divisions, civil conflict, battle for
184 local natural resources due to international commodity pricing and demand, fragile institutions and systems (4, 14, 15). African populations
185 continue to suffer from many different consequences of violent conflict, wars and forced mass migration since the early day of colonization up to
186 the contemporary neo-imperialism facets. They are challenged by highly significant risk and impact of poverty related disease outbreaks
187 including Ebola, cholera and HIV/AIDS pandemics, unemployment, low and loss of income owing to mortality and disability, and disruption in
188 economic activity and uncertainties that increased cost of doing business, and capital flight leading to socio-economic consequences and
189 humanitarian crises (6).

190 Since 2003 the Integrated Disease Surveillance and Response (IDSR) existed in Sierra Leone, but just like in most African countries remain
191 dormant until when Ebola hit. The extent, to which Ebola spreads, therefore, depends on the actions of politicians, doctors, and patients and on
192 how much those who are not infected trust their governments. At the very basic level, the local governments of Guinea, Sierra Leone, and
193 Liberia need to focus on building a proper healthcare infrastructure, training medical professionals, and sending a unified clear message about
194 Ebola to the masses (14). In addition to the basic steps that West Africa needs to take to contain Ebola, is the need to encourage regional
195 cooperation and cross-border collaboration in effective control as the strength of health systems varies across countries and an increase in health
196 standards within each country is necessary for successful assistance and mutual trust in effective and timely cross-country information
197 communication (1, 6).

Comment [J17]: Edit this statement

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There is no follow between this statement and the previous one

198 Public health epidemic preparedness measures to be taken should involve training staff to use surveillance tools and manage cases of epidemic-
199 prone diseases and equipping them with reliable means of communication. Isolation facilities and high containment biosafety laboratories for
200 pathogen confirmation must be identified in advance, and support must be provided to local institutions regarding training and supplying
201 equipment and reagents. Data should be analyzed locally and regular feedback provided (e.g., a weekly bulletin) to health partners. A rapid
202 response mechanism for investigation alerts and implementation of control measures as outlined in outbreak preparedness plans (e.g., by an
203 interagency outbreak control committee) are also crucial. Diseases threat and outbreak surveillance systems rely on close partnerships with
204 NGOs, international organizations, and community groups and are built on resources and capacities of all organizations present. Effective
205 surveillance systems in emergencies have involved selecting a small number of syndrome-based priority events, using standard surveillance
206 forms, simplifying case definitions, health facilities weekly reporting of data, immediate reporting if set alert thresholds are passed. Establishing
207 community-based programs and mechanisms for identifying disease clusters. Improving detection and control of infectious diseases pre, during
208 and post-conflict situations in any disaster risk and emerging infectious diseases primarily require a functional healthcare system, preparedness
209 and response systems. It is imperative that the technical capacity of all humanitarian health partners and ministries of health regarding disease
210 surveillance, prevention, and control in conflict-affected countries be enhanced to ensure effective implementation of infectious disease
211 interventions. Such implementation can be achieved through availability of internationally accepted standards, guidelines, and tools adapted to
212 conflict situations, which can be supported by specific training of health planners and health facility staff, and rapid mobilization of international
213 experts to provide technical field support as required. In poor resource settings such as Africa and elsewhere, building local, national and
214 regional capacity peace and conflict resolutions, and disease prevention and control should be an integral part of programs implementation.

215 It is worth noting that major humanitarian international and local non-governmental organizations (NGOs) have been created, with the purpose
216 to improve the effectiveness of relief operations and to alleviate the suffering of these vulnerable populations. However, humanitarian aid
217 logistics and coordination during previous decade had remained mainly justified on the basis of humanitarian geopolitical strategies and its
218 charitable nature of emergency response, rather than its effectiveness (15). More detailed investigations are required to establish the links

219 between Ebola outbreak emergence and transmission dynamics pre, in or post conflict events. Such will include assessing the role of population
220 displacement, forest and wildlife encroachment, ecological and environmental consequences. Conflict may lead to the displacement of large
221 populations into temporary settlements or camps with overcrowding and rudimentary shelters, inadequate safe water and sanitation, and
222 increased exposure to disease vectors during the acute phase of the emergency. In protracted and post-conflict situations, populations may have
223 high rates of illness and mortality due to breakdown of health systems, flight of trained staff, failure of existing disease control programs, and
224 destroyed infrastructure. With the purpose of providing an evidence base for actions aimed at reducing the number of conflict consequences,
225 spatio-temporal trends conflict epidemiology and knowledge of the impact of conflicts on public health, and its ensuing impact on outbreaks
226 deaths or lifelong health disabilities. Thus, informed policy-making through the provision of reliable evidence based knowledge and information
227 for emergency decision making and response including rapid diagnosis, case isolation and management, contact tracing, safe burials, and the
228 identification of transmission chain implementation and performance (6, 16, 17).

229
230 Our findings showed that conflict/war events affect the spatial and temporal patterns of Ebola outbreaks both in a quantitative and qualitative
231 ways across affected African countries (Table1). The history of conflict in the region and noted that after decades of civil wars in West Africa
232 outsiders and authorities are widely distrusted as result in Guinea, Sierra Leone, and Liberia, the response to the Ebola outbreak has been highly
233 politicized, with political factions pointing fingers at each other, further contributing to the social instability. Similar trends are beginning to be
234 seen in the case of Ebola in West Africa. Violence against civilians in Guinea where a crowd attacked an Ebola isolation centers and threw rocks
235 at aid workers, likely stemming from fear and misinformation about the disease, was seen as early as April 5, 2014 with the first official
236 diagnosis of the disease probably as result of three instances of violence against civilians occurring in Guinea in 2014 thus far (1, 4, 14, 15).
237 Conflict prevention, peace and security training and awareness could provide several opportunities to civil society, and citizens highly vulnerable
238 to the influence, governments and conflict early warning in Africa and elsewhere as capacity to respond to these complex challenges remains
239 weak with structural weaknesses, requisite institutional capacity and frameworks and significant economic growth albeit obvious democratic
240 government and development gains. Some explanations have been given by Jonathan and colleagues (2008), however it can be directly

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241 established that the emergence of Ebola outbreak can be linked with years of conflicts, displacements, forest and wildlife insurgences as well as
242 human hunt for food for survival in the wild Africa forest. It has also been shown that mining activities have direct and indirect implications on
243 the wildlife and ecosystems leading to emergence and resurgence of known and emerging infectious diseases outbreaks (19, 20).

244 In contrast to central Africa, DR Congo persistent conflict/war events instability in the Mobutu Sese Seko military ruling era, the 1990s and
245 2000s periodic conflicts witnessed the highest second after Congo with more than 7 times episodes of Ebola outbreak in 1977, 1995, 2005, 2007,
246 2008, 2012 and 2014 compared to the first West Africa cases in 2014 (Table 1). In West Africa, Liberia had a long civil conflict / wars from
247 1989-1996 and 1999-2000 respectively. Only this total fatality in Liberia is greater than the cumulative fatality rate in Sudan, Congo, Gabon,
248 Uganda, South Africa, and Nigeria (Table 1). It could be demonstrated that DRC, Liberia and Sierra Leone's violence supports the notion that
249 more events drive increase in locations and actors vulnerability to Ebola outbreaks and psychosocial challenges. The WHO is working with the
250 governments of EVD affected countries to strengthen the health system, including bolstering the capacity of public laboratories to detect most
251 existing infectious likely to cause epidemics (20,21). Since the middle 1990s, wars and political instabilities in West Africa (Liberia, Sierra
252 Leone, Côte d'Ivoire), Great Lakes and East regions (DR Congo, Uganda, Burundi, Rwanda, Ethiopia, Eritrea, Somalia) have forced millions of
253 people to flee their homes or communities within and across their own borders stretching from northern Mali through Southern Algeria to Libya
254 into Egypt. Nowadays, recent outbreaks on Cholera and Polio, Meningitis and Influenza to famine and malnutrition/food insecurity have been
255 reported sporadically in conflict zones in South Sudan, Central Africa Republic (CAR) and Nigeria insurgency-related activity of Boko
256 Haram and associated actors, DR Congo recent Ebola outbreak and Somalia continue to be worrisome due to high rate of displacement of
257 indigenous populations and casualty attacks relatively bleak. Interestingly, in Uganda, more than half of the 1.8 million of internal displaced
258 populations in 2005 returned homes by December 2009, similar to Burundi from 800,000 displaced in 1999 to 100,000 at the end 2009. With
259 considerable decreased in recent years, strengthening African leaders political commitment is the most important factor in increasing financial
260 resource capacity and peace building instilling national patriotism and resilience, disarmament and reintegration post conflicts programs.

261 Conflict-affected countries represent one of the weakest links in global health security and should be prioritized by the international community
262 in provision of technical and operational support to implement core capacities for detection and response to epidemics. The trend and patterns of
263 conflicts war events in Africa countries is diverse and complex ranging from ethnic, civil to mining conflicts and varied from one country to
264 another and resulting to incursion in wildlife and forest where rebels and militias or terrorists capitalized on wild and forest jungles to hide, plan
265 and stage their plots against the opponents. Consequentially, insidious and spread of rape and sexual violence against girls and women, lack of
266 food, shelter and medical access to forced recruitment of children into armed groups (e.g. BokoHarram in Northern Nigeria) have been
267 documented. BokoHarram in Nigeria eight years conflict left more than 20,000 deaths and 2.6 million displaced in Nigeria, with spilled out
268 violence in Cameroon, Chad and Niger, and creating major humanitarian catastrophes in refugees' camps in recent times. Military humanitarian
269 forces (local, US, UK) were been deployed in most affected Ebola outbreak West Africa countries emergency humanitarian responses in 2014-
270 2015 and slow down during recovery and rebuilding programs amongst survivors and affected populations (22,23). These programs have a
271 crucial role and are valuable resource in health systems development and socioeconomic growth. However, military humanitarian assistance in
272 outbreak has not been fully elucidated and requires further attention in terms of neutrality, community liaisons, and cooperation, consistent and
273 transparent policy and humanitarian interventions especially in previous war zones. Also, it might be of importance in avoiding resurgence of
274 geopolitical conflicts, repression and fragility showed to influence greatly Ebola geographical distribution in the region. In addition to ethnic,
275 religious and economic divisions, conflicts to gain control of political power, and natural resources appears to be directly linked to Ebola
276 outbreak in most affected communities in Africa (4, 20). Although the difficulty to access communities, security problems and poor
277 communications and transport infrastructure, weak health systems and human health resources, poor leadership and the delay in international
278 emergency response contributed to the worsening situation in the ongoing Ebola crisis in West Africa.

279 Based on the historical trends and dynamics patterns of instability and emerging outbreak in these countries, others countries worldwide
280 suffering from similar challenges and issues in Africa such as central Africa Republic, Sudan, Libya, Burundi, Nigeria, Mali, Kenya, Rwanda,
281 Niger, Somalia, Egypt, Tunisia, Algeria, Mozambique, Senegal, Madagascar, and Malawi can simply take the right steps in the right direction to
282 avoid the horrors of Ebola and other emerging infectious diseases (18,19, 20). Again, lessons learnt from EDV outbreaks and conflict related

283 public health emergencies consequences can serve in early warning alert and mitigation on incessant Middle East and Asia-Pacific countries
284 whirling in the same dilemma and perpetual state of fragility including Syria, Iraq, Lebanon, Pakistan-Kashmir, Palestine, Myanmar, Sri Lanka,
285 Thailand, as well as Latin America countries including Colombia, Guatemala, in Europe Northern Ireland and Western Balkans. Our findings
286 provide evidence and information insights to leaders, organizations such as mining, policy makers and other stakeholders especially
287 communities on their importance and role in seeking and undertakings rebuilding strategies pre-/post conflict events, and advocating on
288 protection of environment and wildlife in Africa and elsewhere on sustainable national and global health, socio-economic and environment
289 development and growth (3,22, 23, 24,25). In 2016, the growth in displacement figures was largely driven by the conflicts, gender violence,
290 hunger and human rights violations in Middle Eastern countries such as Syria, Yemen, Iraq and India-Pakistan border. But conflicts in sub-
291 Saharan Africa also forced millions of people to flee their homes in countries such as South Sudan, the Central African Republic, Burundi, the
292 Democratic Republic of Congo, and Sudan. The region also hosted a large and growing number of refugees, which continued to exert enormous
293 pressure on public services and local infrastructure in neighboring countries far-reaching political implications. African governments and local
294 and multinational actors including humanitarian organizations should agree to shoulder primary responsibility for preventing forced
295 displacement, access to the displaced and delivery of relief supplies. Recent Cholera outbreak in Yemen requires detailed outbreak investigation
296 and rapid assessment is currently ongoing due to limited local capacity. The source of this cholera infection needs to be quickly established to
297 facilitate appropriate strategies and interventions for rapid containment. There is an urgent need to strengthen the cholera case management
298 system as the current treatment centre falls short of the minimum standard. There is also a need to secure personal protective equipment, stock of
299 medical supplies and dedicated personnel, in case of an influx of patients; likewise mudsliding and flooding related public health emergency
300 disaster with potential cholera outbreaks threat in Sierra Leone that led to over 1,000 deaths in August 2017. Therefore, both public health
301 emergencies events require urgent local and international requisite resources (mobilization and technical support in recovery and rebuilding
302 (mental, food and social, human capacity, funds and logistics) efforts as well as urban planning laws and reforms are critical to strengthening
303 Sierra Leone and other prone disasters countries public health emergencies preparedness and response capabilities. The insufficiencies in national
304 and regional surveillance and early warning and emergency response systems showed to favor Ebola outbreaks in both urban and rural areas

305 under natural and human made conditions. The central Africa of DR Congo neighbourhood area had been affected by civil war since 1997 and
306 was controlled by Congolese rebels. Moreover, an estimated 850,000 children of 1.4 million indigenous populations have been forcefully
307 displaced and horrific atrocities of committed with over 3,383 deaths in over 20 ethnic (Luba and Lulua) groups villages completely destroyed
308 in Kasai provinces, DR Congo in due to constitutional crisis by violation of presidential term limits set out in the constitution, succession deal
309 brokered and Bana Mura government-backed militia versus Kamuina Nsapu militia factions uprising since March 2016 to date. Likewise Boko
310 Haram terrorism and insurgence has been linked to political instability and insecurity in Nigeria threatening Cameroon, Chad and Niger. CAR
311 and Burundi on neighbouring Uganda, South Sudan, Angola and other civil unrest in African countries remain of regional and global public
312 health concerns. African leaders have limited peace-building technical capacity and leadership competencies, peace-conflict resolution to public
313 health laboratory know-how capacities, facilities and lack of technical expertise require an urgent attention. For example, in South Sudan, the
314 situation has led to continued food insecurity as no tangible agricultural activities have taken place. The armed conflict has resulted in massive
315 population displacement, disrupted people's livelihoods, trade and access to humanitarian assistance, which remains the main source of food and
316 livelihood in the conflict areas. The situation is being compounded by the high food prices and economic meltdown, which has eroded household
317 purchasing power. High levels of severe acute malnutrition remain a serious public health concern across South Sudan, being driven by
318 widespread fighting, displacement and poor access to services, disease outbreaks, extremely poor diet and extremely critical levels of acute
319 malnutrition, putting 45,000 people at risk of famine (in terms of both quality and quantity), low coverage of sanitation facilities, provision of
320 healthcare services have been severely compromised, and poor hygiene practices. WHO and other aid agencies will continue providing
321 humanitarian assistance to the populations humanitarian crisis needs. The recent upsurge of cholera in the populous cosmopolitan Nairobi city
322 and refugee setting in the north-eastern part of Kenya remains a challenge. The resurgence is being driven by factors such as high population
323 density in peri-urban and camp settings, mass gatherings, low access to safe water and proper sanitation, and mass population movements within
324 the country and with neighbouring countries. High level I multisectoral engagements and advocacy to tackle humanitarian public emergencies
325 crises across Africa including nutrition screening and treatment, vaccination (polio, measles and tetanus), vegetable seeds, fishing tools, NFIs,
326 WASH and borehole repair kits to 1,600 vulnerable households for cumulative socio-economic and public health impact. Strengthening local

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327 and regional outbreaks and conflicts early detection, surveillance and monitoring implementation is crucial evidence-based outbreak associated
328 conflicts prevention and control countermeasures may be hampered by fighting, impeded access to populations, destroyed infrastructure, limited
329 coverage of healthcare services, poorly trained health staff, and difficult logistics that prevent delivery of drugs. Hence, strengthening public
330 health emergencies events surveillance, knowledge and abilities is crucial in investigating and monitoring invasive pest, vector and associated
331 diseases threats or outbreaks for effective prevention and control programs, improving access, to safe water and proper sanitation in the camps.
332 Recognizing the need to investing in proactive and resilient behaviour social mobilisation and resilience activities in sensitizing the local
333 population mainly the youths is imperative against disasters or catastrophic crises in the region.

334 However, it should be noted that the geo-coding of the events in the ACLED dataset is not immune from potential biases and measurement. We
335 cannot rule out the possibility that the reporting of conflicts is biased towards certain types of countries, regions or events, as some regions might
336 in particular have better media coverage. An event dataset such as ACLED cannot, by definition, be exhaustive.

337

338 **Conclusionand recommendations**

339 This paper provides the first comprehensive evidence-based conflict and wars public health emergencies associated Ebola outbreaks events
340 implications in Africa and provide practical and effective approaches, programs and activities in full rebuilding processes (peacekeeping, peace-
341 building, conflict resolution, healthy outbreak recovery) for wellbeing and productivity. Authors call for the urgent need for concerned
342 commitment and engagement of all stakeholders to develop, implement and strengthening local, regional and global public health emergencies
343 evidence practice approaches and strategies including national public health disaster emergency situations insurance schemes in paramount in
344 disaster high risk prone settings and particular in Africa is imperative to fostering health and socioeconomic development and growth. The
345 importance of implementation of effective and timely outbreak early warning alert, surveillance and emergency response systems is recognised,
346 but there is a scarcity of evidence on optimal ways to detect these outbreaks in most conflict eventful countries in Africa. Building positive

347 legacy through investing in evidence-based and effective public health emergencies partnerships strengthening by financing community-based
348 programmes in championed by the Africa CDC centres core public health laboratory infrastructure and Human resources capacity development
349 and targeted training, and epidemiologic surveillance expertise are all urgently needed in West Africa and beyond. Global funding and local
350 public-private commitment and investment including disaster insurance schemes capabilities could be assets to deploy resources successfully
351 and in a timely fashion to prevent and respond to disaster emergencies. The collective public health emergencies benefits is vital in health
352 systems strengthening including substantial resource expenditures and routine full functioning health services successful implementation in line
353 with IHR, 2005 and global community agenda against international infectious disease threats. While advocating for an effective implementation
354 of outbreaks and emerging tropical diseases surveillance response systems in Africa, Surveillance systems are often weak in conflict situations,
355 which results in delays in detection and reporting of epidemics.

356

357 **Competing interests**

358 The authors declare that they have no conflict interests

359

360 **Author's contributions**

361 ET conceived the study and designed methodological search strategy and assessment. ET performed the review search and wrote the primary
362 draft of the paper. OAO, ECU, MF and JYN provided additional country information. ET provided extensive revision and update. All authors
363 read and approved the final manuscript

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365 **Acknowledgments**

366 We are grateful for the support and cooperation institutions and collaborators.

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431 **Table 1: Trend and pattern of political conflict/wars events and Ebola Outbreaks in African countries from 1976 -2016**

Country	Conflict/War start year	Conflict/War end year	Conflict/War duration	Ebola species	Ebola epidemic year	Years for Epidemic minus war start	Years for Epidemic minus war end	Cumulative cases(n)	Cumulative deaths(n)	Cumulative fatality rate(%)
Guinea	2009	2010	2	Zaire ebolavirus	2014	5	4	3,804	2,536	66%
Liberia	1999	2003	5	Zaire ebolavirus	2014	15	11	10,675	4,809	45%
Sierra Leone	1991	2002	12	Zaire ebolavirus	2014	23	12	11,123	3,956	32%
Nigeria	1967	1970	4	Zaire ebolavirus	2014	47	44	20	8	40%
Mali	1960	2012	2	Zaire ebolavirus	2014	2	2	8	6	75%
Senegal	2010	2012	3	Zaire ebolavirus	2014	4	2	1	0	0%

South Sudan	1955	1972	18	Sudan ebolavirus	1976	21	4	284	151	53%
South Sudan	1955	1972	18	Sudan ebolavirus	1979	24	7	34	22	65%
South Sudan	1983	2005	23	Sudan ebolavirus	2004	21	-1	17	7	41%
Gabon	1960	1963	3	Zaire ebolavirus	1994	34	31	52	31	60%
Gabon	2000	2000	1	Zaire ebolavirus	2002	2	2	65	53	82%
Congo	1996	1997	2	Zaire ebolavirus	2002	6	5	59	44	75%
Congo	1996	1997	2	Zaire ebolavirus	2003	7	6	143	128	90%
Congo	1998	2003	6	Zaire ebolavirus	2003	5	0	35	29	83%
Congo	1998	2003	6	Zaire ebolavirus	2005	7	2	12	10	83%
Uganda	1998	2003	6	Zaire ebolavirus	2000	2	-3	425	224	53%
Uganda	1998	2003	6	B. ebolavirus	2007	9	4	149	37	25%
Uganda	1998	2003	6	Zaire ebolavirus	2011	13	8	149	37	25%
Uganda	1998	2003	6	Sudan ebolavirus	2012	14	9	7	4	57%
DR Congo	1960	1965	6	Zaire ebolavirus	1976	16	11	318	280	88%
DR Congo	1960	1965	6	Zaire ebolavirus	1977	17	12	1	1	100%
DR Congo	1960	2017		Zaire ebolavirus	2017	8	4	4	813	
DR Congo	1960	1965	6	Zaire ebolavirus	1995	35	30	315	254	81%
DR Congo	2005	2006	2	Zaire ebolavirus	2007	2	1	264	187	71%
DR Congo	2005	2006	2	Zaire ebolavirus	2008	3	2	32	14	44%
DR Congo	2008	2008	1	Zaire ebolavirus	2012	4	4	57	29	51%
DR Congo	2008	2008	1	Zaire ebolavirus	2014	6	6	82	50	61%
				Tai Forest						
Ivory Coast	2008	2011	4	ebolavirus	1994	-14	-17	1	0	0%

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South Africa	1948	1994	47	Zaire ebolavirus	1996	48	2	1	1	100%
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