

1 **Revisiting Ebola outbreaks in conflict related displaced** 2 **populations zones in Africa**

3 4 **Abstract**

5 Little is documented on conflict and displacement impact on West Africa Ebola Virus disease
6 (EVD) outbreaks. Findings showed that the duration and persistent of war or conflict events
7 varied within West Africa countries. Sierra Leone conflict lasted from 1991-2002, Guinea
8 recorded frequent relentless instability than Liberia with two major conflict periods from
9 1989-1996 and 1999-2003. For the first time, we established a statistical significant
10 correlation between duration of war/conflict events and Ebola outbreaks onsets in Africa
11 ($P<0.05$).Unexpectedly; the total fatality rate in Liberia or Sierra Leone only was greater than
12 the previously reported cumulative EVD cases across Africa since 1976. It is crucial to
13 intensify advocacy on conflict resolutions in fostering health and socioeconomic development
14 and growth.

15 **Key Words:** Conflict, war peace, resolution, consequence, Ebola, outbreak

16 **Introduction**

17 The worst Ebola outbreak ever in West Africa is one of the deadliest diseases in history and
18 highly unprecedented dimensions of contagious human transmission and severe to contain
19 with over almost 28,638 cases affected and more than 11,316 deaths (1). The West Africa
20 Ebola outbreaks requires further in-depth in untangling the potential drivers and issues that
21 trigger the unhealthy events and reducing life expectancy with diverse health and
22 socioeconomic consequences in different geospatial affected and non-affected communities
23 in Africa (2). The WHO declared Ebola outbreak as a public emergency of international
24 concern in West Africa early March 2014 as the number of cases and fatality rate has
25 increasing significantly with more than 6, 700 children orphans (3).

26 The resulting unsettled conflict resolution and peace agreements consequences such as,
27 human and animal displacement, food insecurity, forest and wildlife incursions, illicit hunting
28 and poaching and complex vicious cycle of poverty could be responsible for the West Africa
29 Ebola eruption and public health calamity in 2013. Africa has been home to a range of
30 conflicts and wars events since colonisation up to date, distributed across the region and

31 perpetuated by a variety of actions ranging from civil, quick changes in political leadership,
 32 ethnical and mining groups, incursions, displacements and resettlements to ethno-regional
 33 postcolonial characteristics splintering of states with few effective and stable peace and
 34 reconciliation processes (1, 4). In addition, African governments exhibit significant
 35 distinctive intra and inter country conflicts types and events as well as diverse conflict trends
 36 and patterns. Conflict and civil wars have left several marks (1, 5), such as dysfunctional,
 37 inadequacy and severely disabled in health systems, high level of illiteracy amidst
 38 populations of years without education, lack of qualified health personnel and brain drain
 39 syndrome, chronic unemployment, fluid population movement and migration; fear, anxiety
 40 and hostility, rumours and Ebolaphobia, discrimination and stigmatization, lack of water and
 41 sanitation, lack of integration of African traditional medicine in the health systems and other
 42 sociocultural factors such as traditional burials and funerals practices involving close contact
 43 with the corpses threatening the national security and international responses (3, 6). How do
 44 conflicts and resettlements events bring about Ebola outbreak in Africa? Can peacebuilding
 45 and conflict resolutions reduce or enhance disease or outbreak public health burden in
 46 Africa?

47 The relationship between conflicts events, wars, displacements and resettlements implications
 48 on the emergence and spread of Ebola outbreak in most Ebola affected communities is still
 49 poorly understood. Few previous studies have documented the infectious diseases outbreaks
 50 emergence and fatality and conflicts/wars events in Africa. Conflict and disease nature,
 51 extend and severity can further fuel the spread of disease outbreak across natural, ecological
 52 and environmental, geographic and population species interchangeably (1, 4, 7, 8).

53 The article examines conflict related displacement events and impacts on alarming West
 54 Africa EVD outbreak consequences, and provides practical and effective evidence-based in
 55 nurturing peace-building, conflict prevention and resolutions against emerging infectious
 56 diseases outbreak within Africa towards promoting social justice, health equity and global
 57 economic prosperity.

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62 **Methods**

63 **Search strategy and scrutiny**

64 The systematic review dataset was collected from PubMed and acknowledged website
 65 searched based in West Africa region conflict events to emergence and spread of Ebola
 66 outbreak in the affected countries without restriction on language for studies published from
 67 January 1, 1960, to February 1, 2016. We used the Uppsala/PRIO Armed Conflict Dataset
 68 (ACD) and “conflict, location and resettlement event dataset [4] which contains information
 69 on the geo-location of conflict events in West African countries over the period 1997-2010
 70 and other reference United Nations (UN) reports on conflicts, peace and conflict resolutions
 71 meetings in West Africa Ebola affected countries. A unique feature of ACLED dataset is that
 72 it contains information on the type of events, as well as the characteristics of the actors on
 73 both sides of the conflicts, events trend and patterns from 1997- February 2016.

74 **Selection criteria and assessment**

75 To assess both the direct and indirect impacts of conflict/wars and Ebola outbreaks, we used
 76 the following keywords: “Ebola epidemics or outbreaks” “conflict, war, civil unrest,”
 77 “political unrest, political instability,” and “displacement, resettlement, refugees’ camps”. To
 78 assess articles that focused on Ebola outbreaks and conflicts zones we used free text and
 79 MESH terms (where available). These conflict events are obtained from various, including
 80 national annual reports, regional and local conflicts proceeding and humanitarian agencies or
 81 research publications. Records all ethic and political/civil violence, conflicts/wars including
 82 violence against civilians, rioting and protesting, without specifying battle-related deaths and
 83 linked with country trend and pattern of Ebola outbreak were screening, validated by two
 84 independents authors and included in the analysis. Exclusion criteria were determined a
 85 priori. We excluded if the articles described other disease outbreaks non-endemic populations
 86 (i.e., military, tourists), editorials, view points, articles focusing on guidelines, isolated case
 87 reports, or letters.

88

89 **Statistical analysis**

90 Data were analysed using Statistica version 12.0 software frequency of exposure, resurgence
 91 of diseases throughout the duration of conflict and post-conflict management. Analyses were
 92 two-tailored with a significant P value threshold set at less than 0.05. Correlation analyses

93 were performed between war duration, years for epidemic minus war start, years for epidemic
94 minus war end, cumulative cases (n) and cumulative fatality rate (%).

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96 **Results**

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

100

101 **3.1 Trend and pattern of political conflict/wars duration and Ebola Outbreaks in** 102 **African countries from 1960 -2015**

103 The trend and patterns of conflicts wars events in Africa countries is diverse and complex
104 ranging from ethnic, civil to mining conflicts and varied from one country to another and
105 resulting to incursion of wildlife and forest where rebels and militias or terrors capitalized on
106 wild and forest jungles to hide, plan and stage their plots against the opponents. The duration
107 of conflict/war evens varied one to forty three years. Notably the Darfur war in Sudan for 18-
108 23 years, RD Congo and Guinea incessant political and ethnical or mining conflict instability
109 repeatedly ranging between 2-6 years, Liberia and Sierra Leone 5 and 12 years conflict/war
110 events were documented. In West Africa, in Liberia the seven and four years of conflicts
111 from 1989-1996 and 1999-2003 prior to a democracy nation led by S Johnson (president).
112 Worldwide, there have been 28,639 cases of Ebola virus disease and 11,316 deaths at 15
113 February 2016. The most affected countries are Liberia and Sierra Leone and Guinea with a
114 total of 10,675 and 11,123 cases, and 4,809 and 3,956 deaths respectively (Table 1).

115 Interestingly, only this total fatality rate in Liberia or Sierra Leone was greater than the
116 documented cumulative fatality rate in Sudan, Congo, Gabon, Uganda, South Africa, Nigeria
117 and Mali. The geopolitical conflicts, repression and fragility showed to influence greatly
118 Ebola geographical distribution in the region in addition to ethnic, religious and economic
119 divisions to gain control of political power, and natural resources. Conflict and war events
120 appear to be directly linked to Ebola outbreak in most affected communities in Africa (Table
121 1).

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3.2 Ebola reservoirs, displacement impact on epicentre geographical distribution of EVD across conflict /wars communities in affected countries

The duration of conflict/war events varied weeks to years across community and country. The longest duration was recorded in Sudan 2with 17 years (1955-1972) prior the first Ebola outbreak in Sudan in 1976 Uganda (1979-1986 prior to their first Ebola episode in 2000, and 1993-2003 with the 2007 and 2012 Ebola outbreaks respectively. Guinea in West Africa also recorded the constant instability with Liberia 7 and 4 years conflicts and wars from 1989-1996 and 1999-2003 respectively as well as conflict in Sierra Leone from 1991-2002 (10 years) with the cumulative resulting effect and emergence of ongoing Ebola December 2013 Ebola worst outbreak(Table 2). African political unrest and/or conflicts/wars have also lasted longer, on average they lasted from averagely weeks to eight years from Liberia, Guinea, Sierra Leone, DR Congo, South Sudan, Uganda, Nigeria and Ivory Coast. There was a strong and statistically significant correlation between conflict/war event duration and occurrence/resurgence of years of Ebola epidemic cumulative cases and cumulative fatality rate in Africa. Likewise, there was a weak negative correlation between the conflict/war event duration and years of Ebola outbreak minus political conflict/war cessation. Our findings showed the duration of conflict/war could be responsible for the human displacement, forest and wildlife incursions and hunting as the source of food. Local community or national/sub-regional instability was documented at different time points across Africa overtime and the epicentres were linked to areas or close incursion of former resettlement(s), neighbouring districts or communities with wildlife or hunting/poaching risk exposure activities to wildlife/animals reservoirs and cultural practices with increasing communities' vulnerability to EVD outbreak.

Discussions

The devastating effects and the aftermath of political violence, civil war and ethnic conflicts have generated millions of displacement and resettlement with unbelievable pictures of suffering and unnecessary associated persistence of Ebola outbreaks and emerging infectious diseases mortality and disability across the African continent (4, 9, 12, 13). During times of armed conflict, civil disturbance, and state repression and the basic critical right deteriorated. Attacks on and interference with health care providers, facilities, and services pose enormous challenges to effective health care delivery where it is most needed (4). Yet, Africa still

remains the land of complex conflicts environment and instability 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 local natural resources due to international commodity pricing and demand, fragile institutions and systems (4, 14, 15). African populations continue to suffer from many different consequences of violent conflict, wars and forced mass migration since the early day of colonization up to the contemporary neo-imperialism facets. They are challenged by highly significant risk and impact of poverty related disease outbreaks including Ebola, cholera and HIV/AIDS pandemics, unemployment, low and loss of income owing to mortality and disability, and disruption in economic activity and uncertainties that increased cost of doing business, and capital flight leading to socio-economic consequences and humanitarian crises (6).

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

Threat and outbreak surveillance systems rely on close partnerships with NGOs, international organizations, and community groups and are built on resources and capacities of all organizations present. Effective surveillance systems in emergencies have involved selecting a small number of syndrome-based priority events, using standard surveillance forms, simplifying case definitions, health facilities weekly reporting of data, immediate reporting if set alert thresholds are passed, and establishing community mechanisms for identifying disease clusters. Epidemic preparedness measures to be taken should involve training staff to use surveillance tools and manage cases of epidemic-prone diseases and equipping them with reliable means of communication. Isolation facilities and high containment biosafety laboratories for pathogen confirmation must be identified in advance, and support must be provided to local institutions regarding training and supplying equipment and reagents. Data

should be analyzed locally and regular feedback provided (e.g., a weekly bulletin) to health partners. A rapid response mechanism for investigation alerts and implementation of control measures as outlined in outbreak preparedness plans (e.g., by an interagency outbreak control committee) are also crucial. Improving detection and control of infectious diseases in conflict situations of many emerging infectious diseases primarily require a functional healthcare system. It is imperative that the technical capacity of all humanitarian health partners and ministries of health regarding disease surveillance, prevention, and control in conflict-affected countries be enhanced to ensure effective implementation of infectious disease interventions. Such implementation can be achieved through availability of internationally accepted standards, guidelines, and tools adapted to conflict situations, which can be supported by specific training of health planners and health facility staff, and rapid mobilization of international experts to provide technical field support as required. In poor resource settings such as Africa and elsewhere, building local, national and regional capacity peace and conflict resolutions, and disease prevention and control should be an integral part of programs implementation.

It is worth noting that major humanitarian international and local non-governmental organizations (NGOs) have been created, with the purpose to improve the effectiveness of relief operations and to alleviate the suffering of these vulnerable populations. However, humanitarian aid logistics and coordination during previous decade had remained mainly justified on the basis of humanitarian geopolitical strategies and its charitable nature of emergency response, rather than its effectiveness (15). More detailed investigations are required to establish the links between Ebola outbreak emergence and transmission dynamics pre, in or post conflict events. Such will include assessing the role of population displacement, forest and wildlife encroachment, ecological and environmental consequences. Conflict may lead to the displacement of large populations into temporary settlements or camps with overcrowding and rudimentary shelters, inadequate safe water and sanitation, and increased exposure to disease vectors during the acute phase of the emergency. In protracted and post-conflict situations, populations may have high rates of illness and mortality due to breakdown of health systems, flight of trained staff, failure of existing disease control programs, and destroyed infrastructure. With the purpose of providing an evidence base for actions aimed at reducing the number of conflict consequences, spatio-temporal trends conflict epidemiology and knowledge of the impact of conflicts on public health, and its ensuing impact on outbreaks deaths or lifelong health disabilities. Thus, informed policy-

making through the provision of reliable evidence based knowledge and information for emergency decision making and response including rapid diagnosis, case isolation and management, contact tracing, safe burials, and the identification of transmission chain implementation and performance (6, 16, 17).

Our findings showed that conflict/war events affect the spatial and temporal patterns of Ebola outbreaks both in a quantitative and qualitative ways across affected African countries (Table1). The history of conflict in the region and noted that after decades of civil wars in West Africa outsiders and authorities are widely distrusted as result in Guinea, Sierra Leone, and Liberia, the response to the Ebola outbreak has been highly politicized, with political factions pointing fingers at each other, further contributing to the social instability. Similar trends are beginning to be 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 at aid workers, likely stemming from fear and misinformation about the disease, was seen as early as April 5, 2014 with the first official 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). Conflict prevention, peace and security training and awareness could provide several opportunities to civil society, and citizens highly vulnerable to the influence, governments and conflict early warning in Africa and elsewhere as capacity to respond to these complex challenges remains weak with structural weaknesses, requisite institutional capacity and frameworks and significant economic growth albeit obvious democratic government and development gains. Some explanations have been given by Jonathan and colleagues (2008), however it can be directly established that the emergence of Ebola outbreak can be linked with years of conflicts, displacements, forest and wildlife insurgences as well as 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 the wildlife and ecosystems leading to emergence and resurgence of known and emerging infectious diseases outbreaks (19, 20).

In contrast to central Africa, DR Congo persistent conflict/war events instability in the Mobutu Sese Seko military ruling era, the 1990s and 2000s periodic conflicts witnessed the highest second after Congo with more than 7 times episodes of Ebola outbreak in 1977, 1995, 2005, 2007, 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 1989-1996 and 1999-2000 respectively. Only this total fatality in Liberia is greater than the cumulative fatality rate in Sudan, Congo, Gabon, Uganda, South Africa, and Nigeria (Table 1). It could be

demonstrated that DRC, Liberia and Sierra Leone's violence supports the notion that more events drive increase in locations and actors vulnerability to Ebola outbreaks and psychosocial challenges. The WHO is working with the governments of EVD affected countries to strengthen the health system, including bolstering the capacity of public laboratories to detect most existing infectious likely to cause epidemics (20,21).

Conflict-affected countries represent one of the weakest links in global health security and should be prioritized by the international community in provision of technical and operational support to implement core capacities for detection and response to epidemics. The trend and patterns of conflicts war events in Africa countries is diverse and complex ranging from ethnic, civil to mining conflicts and varied from one country to another and resulting to incursion in wildlife and forest where rebels and militias or terrorists capitalized on wild and forest jungles to hide, plan and stage their plots against the opponents. Military humanitarian forces are increasingly been implemented in West Africa aid programs for Ebola-affected populations. These programs have a crucial role and are a valuable resource. However, military humanitarian aids in outbreak has not been fully elucidated and require further attention in terms of neutrality, community liaisons, and cooperation, consistent and transparent policy and humanitarian interventions especially in previous war zones. Also it might be of importance in avoiding resurgence of geopolitical conflicts, repression and fragility showed to influence greatly Ebola geographical distribution in the region. In addition to ethnic, religious and economic divisions, conflicts to gain control of political power, and natural resources appears to be directly linked to Ebola outbreak in most affected communities in Africa (4, 20). Although the difficulty to access communities, security problems and poor communications and transport infrastructure, weak health systems and human health resources, poor leadership and the delay in international emergency response contributed to the worsening situation in the ongoing Ebola crisis in West Africa.

Based on the historical trends and dynamics patterns of instability and emerging outbreak in these countries, others countries worldwide suffering from similar challenges and issues in Africa such as central Africa Republic, Sudan, Burundi, Nigeria, Mali, Niger, Somalia, Egypt, Kenya, Rwanda, Tunisia, Algeria, Mozambique, Senegal, Madagascar, and Malawi can simply take the right steps in the right direction to avoid the horrors of Ebola and other emerging infectious diseases (18,19, 20). Again this serve as early warning alert and drawn lessons learnt to Asia Pacific countries whirling in the same dilemma and perpetual state of fragility including Syria, Iraq, Lebanon, Pakistan, Israel, Kashmir, Palestine, Myanmar, Sri

Lanka, Thailand, as well as South America and Europe countries including Colombia, Guatemala, in Europe Northern Ireland and Western Balkans (. These findings provide insights, evidences and information to leaders, organizations such as mining, policy makers and other stakeholders especially communities on their importance and role in seeking and undertakings rebuilding strategies pre-/post conflict events, and advocating on protection of environment and wildlife in Africa and elsewhere on sustainable national and global health, socioeconomic and environment development and growth (3,22, 23, 24,25).

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 cannot rule out the possibility that the reporting of conflicts is biased towards certain types of countries, regions or events, as some regions might in particular have better media coverage. An event dataset such as ACLED cannot, by definition, be exhaustive.

Conclusion and recommendations

This paper provides the first evidence-based information on the implications of conflict and wars events on Ebola outbreaks in Africa and practically useful knowledge based information on potential programmes and activities in full restoration of peacekeeping, peacebuilding, conflict resolution, healthy outbreak recovery, wellbeing and productivity. The importance of implementation of effective and timely outbreak early warning alert, surveillance and emergency response systems is recognised, but there is a scarcity of evidence on optimal ways to detect these outbreaks in most conflict eventful countries in Africa where routine weak health systems, limited diagnostic tools and resources for structured surveillance and data transmission are lacking.

While advocating for an effective implementation of outbreaks and emerging tropical diseases surveillance response systems in Africa, Surveillance systems are often weak in conflict situations, which results in delays in detection and reporting of epidemics. Limited laboratory facilities and lack of expertise in specimen collection may delay confirmation of the causative organism. Outbreak investigation and implementation of control measures may be hampered by fighting, impeded access to populations, destroyed infrastructure, limited coverage of healthcare services, poorly trained health staff, and difficult logistics that prevent delivery of drugs. The inadequate surveillance and early warning and response systems

showed to favor Ebola outbreaks in both urban and rural areas under natural and human made conditions. The area had been affected by civil war since 1997 and was controlled by Congolese rebels, Boko Haram and terrorism to insurgence linked political instability and insecurity in Nigeria threatening Cameroon, Chad, Niger, DR Congo, RCA, Burundi on neighbouring Uganda, Angola and other African countries remain of regional and global public health concerns.

Conflict of interests

The authors have no competing interests

References

1. WHO, 2014. WHO Ebola virus disease outbreak -West Africa 2015. http://www.who.int/csr/don/2015_03_27_ebola/en/ accessed on 15 March 2015.
2. Ernest Tambo, Emmanuel Chidiebere Ugwu and Jeane Yonkeu Ngogang. Need of surveillance response systems to combat Ebola outbreaks and other emerging infectious diseases in African countries. *Inf Dis Poverty* J, **3**:29. 27th July 2014b
3. WHO, 2014b. WHO Statement on the Meeting of the International Health Regulations Emergency Committee Regarding the 2014 Ebola Outbreak in West Africa (accessed 10 September 2014).<http://www.who.int/mediacentre/news/statements/2014/ebola-therapies-consultation/en/>
4. Loretta A, Tegegn Y. Disasters in Africa: old and new hazards and growing vulnerability. *World Health Stat Q*. 1996;49(3-4):179-84.
5. Kalipeni E1, Oppong J. The refugee crisis in Africa and implications for health and disease: a political ecology approach. *Soc Sci Med*. 1998 Jun;46(12):1637-53.
6. E. Tambo. Non-Conventional Humanitarian Interventions in Ebola Outbreak Crisis in West Africa: Health, Ethics and Legal Implications. *Infectious Diseases of Poverty* 2014, **3**:42 (25 November 2014)

- 347 7. Morse SS. Factors and determinants of disease emergence. *Rev Sci Tech.* 2004;23:443–51
- 348 8. Wakabi W. Health situation remains grave in southern Sudan. *Lancet.* 2008 Jul
- 349 12;372(9633):101-2. No abstract available.
- 350 9. Völkl-Kernstock S, Karnik N, Mitterer-Asadi M, Granditsch E, Steiner H, Friedrich MH,
- 351 Huemer J. Responses to conflict, family loss and flight: posttraumatic stress disorder among
- 352 unaccompanied refugee minors from Africa. *Neuropsychiatr.* 2014;28(1):6-11. doi:
- 353 10.1007/s40211-013-0094-2.
- 354 10. Lalis A, Leblois R, Lecompte E, Denys C, Ter Meulen J, Wirth T. The impact of human
- 355 conflict on the genetics of *Mastomys natalensis* and Lassa virus in West Africa. *PLoS One.*
- 356 2012;7(5):e37068. doi: 10.1371/journal.pone.0037068. Epub 2012 May 15.
- 357 11. Betancourt TS, Agnew-Blais J, Gilman SE, Williams DR, Ellis BH. Past horrors, present
- 358 struggles: the role of stigma in the association between war experiences and psychosocial
- 359 adjustment among former child soldiers in Sierra Leone. *Soc Sci Med.* 2010 Jan;70(1):17-26.
- 360 doi: 10.1016/j.socscimed.2009.09.038. Epub 2009 Oct 28
- 361 12. Ernest Tambo, Clarence S. Yah, Chidiebere E. Ugwu, Oluwasogo A. Olalubi, Isatta
- 362 Wurie, Jeannetta K. Jonhson and Jeane Y. Ngogang. Fostering prevention and care delivery
- 363 services capability in Human Immunodeficiency virus and Ebola outbreak symbiosis in
- 364 African vulnerable populations. *J Infect Dev Ctries* 2016; 10(1):001-012.
- 365 doi:10.3855/jidc.6875
- 366 13. Roddy P, Weatherill D, Jeffs B, Abaakouk Z, Dorion C, Rodriguez-Martinez J,
- 367 Palma PP, de la Rosa O, Villa L, Grovas I, *et al.*: The Medecins Sans Frontieres
- 368 intervention in the Marburg hemorrhagic fever epidemic, Uige, Angola, 2005. II.
- 369 lessons learned in the community. *The Journal of infectious diseases* 2007, 2:S162-
- 370 167.
- 371 14. Enserink M: Crisis of confidence hampers Marburg control in Angola. *Science*
- 372 2005, 308(5721):489
- 373 15. Roberts B, Damundu EY, Lomoro O, Sondorp E. Post-conflict mental health needs: a
- 374 cross-sectional survey of trauma, depression and associated factors in Juba, Southern Sudan.
- 375 *BMC Psychiatry.* 2009 Mar 4;9:7. doi: 10.1186/1471-244X-9-7.

16. Roberts B, Felix Ocaka K, Browne J, Oyok T, Sondorp E. Factors associated with the health status of internally displaced persons in northern Uganda. *J Epidemiol Community Health*. 2009 Mar;63(3):227-32. doi: 10.1136/jech.2008.076356. Epub 2008 Nov 21.
17. Neuner F, Onyut PL, Ertl V, Odenwald M, Schauer E, Elbert T. Treatment of posttraumatic stress disorder by trained lay counselors in an African refugee settlement: a randomized controlled trial. *J Consult Clin Psychol*. 2008 Aug;76(4):686-94. doi: 10.1037/0022-006X.76.4.686.
18. Obilom RE, Thacher TD. Posttraumatic stress disorder following ethnoreligious conflict in Jos, Nigeria. *J Interpers Violence*. 2008 Aug;23(8):1108-19. doi: 10.1177/0886260507313975. Epub 2008 Fe
19. Catherine Bruckner and Francesco Checchi Detection of infectious disease outbreaks in twenty-two fragile states, 2000-2010: a systematic review. *Conflict and Health* 2011, **5**:13 doi:10.1186/1752-1505-5-13
20. Feldmann H, Czub M, Jones S, Dick D, Garbutt M, Grolla A, Artsob H. Emerging and re-emerging infectious diseases. *Med Microbiol Immunol*. 2002 Oct;191(2):63-74. Epub 2002 Sep 3. Review.
21. Parpia AS, Ndeffo-Mbah ML, Wenzel NS, Galvani AP. Effects of Response to 2014-2015 Ebola Outbreak on Deaths from Malaria, HIV/AIDS, and Tuberculosis, West Africa. *Emerg Infect Dis*. 2016 Mar;22(3):433-41. doi: 10.3201/eid2203.150977.
22. Cohn S, Kutalek R. Historical Parallels, Ebola Virus Disease and Cholera: Understanding Community Distrust and Social Violence with Epidemics. *PLoS Curr*. 2016 Jan 26;8. pii: ecurrents.outbreaks.aa1f2b60e8d43939b43fbd93e1a63a94. doi:
23. Oluwasogo A. Olalubi, Abdulrasheed A. Adio, Shola K. Babatunde, Henry O. Sawyerr, Taofiq Ajara, Ernest Tambo. Response of undergraduates to institutional emergency strategies on Ebola virus disease in Kwara State University, Nigeria. *Journal of Public Behaviour*, 2017, Feb. Vol 7 4-21-28
24. Ernest Tambo. Improving disaster risk reduction preparedness and emergency response readiness and resilience in Africa. *Intl J of Public Health Science*, Vol.6, No.2, June 2017, pp. 183-191

410 25. Ernest Tambo; Chryseis F. Chengho; Chidiebere E Ugwu; Isatta Wurie; Jeannetta K
411 Johnson; Jeanne Y Ngogang. Rebuilding transformation strategies in post-Ebola epidemic in
412 Africa. J. Infectious Diseases of Poverty. Vol 6:71
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420 **Table 1: Trend and pattern of political conflict/wars events and Ebola Outbreaks in African countries from 1976 -2016**

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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%
Ivory Coast	2008	2011	4	Taï Forest ebolavirus	1994	-14	-17	1	0	0%
South Africa	1948	1994	47	Zaire ebolavirus	1996	48	2	1	1	100%

Table 2: Geographical resettlement, distribution of EVD and conflict events in affected countries

Countries	Types or Causes of conflict/war	Duration of conflict/war events	Ebola Non primate reservoir	Ebola outbreak Epicentres and year	Ebola outbreak communities affected	Year of end of conflicts /wars	Resettlement
Sudan	Civil/political	1955-1972 1983-2005	Bat	Nzara, 1976, Maridi and around 1979 and Yambio, 2004	Nzara, Maridi and around, Yambio	2012	Unstable
Gabon	Civil/political	Nov. 1840 Feb 1961	Macaque chimpanzee Gorilla	Mayibout, 1996 Mendemba 2001/02	Mayibout, 1996 Mendemba 2001/02	1962 2000	Stable

Congo	Civil/political/war	1667-1709 1996-1997 1998-2003	Bat macaque chimpanzee Gorilla	Mbomo MMbomo-kelle, 2003 and Etumbi, 2005	Yambuku,1976 Kikwit, 1995	2003	Stable
Uganda	Civil/political	1970 1979-1986 1998-2003	bat, macaque chimpanzee Gorilla	Gulu Nanyunja Kibaalemasindi, mbarara and bundibugyo,	Kabale, Kampala, Ibanda, Mbarara, Kabarole and Luwero	1993	Stable
DRC	Two civil wars Post-civil war but multiple and persistent threats	-1963, Rwanda civil war -1996- 1997 (6months 3 weeks) Genocide -1998-2003(4 years 11months) 2 nd Congo war 2013UN FIB	Bat macaque chimpanzee Gorilla	Kampungu, 2005,2007-08, Mweka, 2007 Lokolia, and Boende 2014	Yambuku,tandana ,Equateur, Kikwit.,kasaimwe ka, and leubo and Lokolia, Bas Uele	2004	Unstable
Ivory Coast	Civil/political	2011-2013	*	Tai national park, 1994	Tai national Park, 1994	2012	Unstable
South Africa	Apartheid	Apartheid 1948-2004	*-	Johannesburg, 1996,	Johannesburg, 1996	1994	Stable

Guinea	Civil/political	2009 2010	Bat macaque Chimpanzee Gorilla	Kenema, Gueckedou, and Kailahun, 2014	All counties	1998	Unstable
Liberia	Civil/political	1989-1996 1999-2003	Bat macaque Chimpanzee Gorilla	West point and neighbouring districts, Monrovia, 2014	14 of 15 communities	2007	Stable
Sierra Leone	Civil/political	1991-2002	Bat macaque Chimpanzee Gorilla	Lockdown,Blomberg	7 districts and Punjehun	2002	Stable
Nigeria	Multiple types of actors, activities and goals throughout a densely populated state	1979, 1997-2001 2002-2006 2007-2011 Ongoing terrors attacks in Northern Nigeria	*	Lagos and Port Harcourt, 2014	Lagos, Port Harcourt	2013*	Unstable
Senegal	Civil/political	Cassamance war	*	Dakar, 2014		2012	Stable

425 * Imported Ebola case

		Political/ethnic conflict					
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