

African Journal of Reproductive Health

Friday Okonofua, Editor

ISSN: 1118-4841

www.ajrh.info

AJRH Editorial Office:

editor@ajrh.info

africanjournalofreproductiveH@gmail.com

BrownWalker Press

Boca Raton, Florida, USA • 2015

ISBN-10: 1-62734-573-6\ ISBN-13: 978-1-62734-573-6

www.brownwalker.com

Published by:



Women's Health and Action Research Centre

KM II Benin-Lagos Expressway

Igue-Iheya, Benin City, Edo State, Nigeria

Email: wharc@hyperia.com

www.wharc-online.org

WHARC receives core funding and support from the Ford Foundation and technical cooperation and mentorship from International Perspectives on Sexual and Reproductive Health and Studies in Family Planning

AJRH is a member of the committee on Publication Ethics

African Journal of Reproductive Health

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VOLUME 19 NUMBER 3

September 2015

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ABOUT AJRH

African Journal of Reproductive Health (AJRH) is published by the Women's Health and Action Research Centre (WHARC). It is a multidisciplinary and international journal that publishes original research, comprehensive review articles, short reports and commentaries on reproductive health in Africa. The journal strives to provide a forum for African authors, as well as others working in Africa, to share findings on all aspects of reproductive health, and to disseminate innovative, relevant and useful information on reproductive health throughout the continent.

AJRH is indexed and included in Index Medicus/MEDLINE. The abstracts and tables of contents are published online by INASP at <http://www.ajol.info/ajol/> while full text is published at <http://www.ajrh.info> and by Bioline International at <http://www.bioline.org.br/>. It is also abstracted in *Ulrich's Periodical, Feminist Periodicals African Books Publishing Records*.

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The Women's Health and Action Research Centre (WHARC) is a registered non-profit organization, committed to the promotion of women's reproductive health in sub-Saharan Africa. Founded in 1995, the centre's primary mission is to conduct multidisciplinary and collaborative research, advocacy and training on issues relating to the reproductive health of women. The centre pursues its work principally through multidisciplinary groups of national and international medical and social science researchers and advocates in reproductive health.

WHARC receives core funding and support from the Ford Foundation and technical cooperation and mentorship from International Perspectives on Sexual and Reproductive Health and Studies in Family Planning. Principal funding for the journal comes from the Consortium on Unsafe Abortion in Africa. The goal of the centre is to improve the knowledge of women's reproductive health in Nigeria and other parts of Africa through collaborative research, advocacy, workshops and seminars and through its series of publications – the *African journal of Reproductive Health, the Women's Health Forum* and occasional working papers.

ISSN: 1118-4841

Women's Health and Action Research Centre @2013

Revue Africaine de Santé de la Reproduction

Editor: Friday Okonofua

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Septembre 2015

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APROPOS AJRH

La Revue Africaine de santé de la Reproduction (RASR) est publiée par le Women's Health and Action Research Centre (WHARC). C'est une revue à la fois pluridisciplinaire et internationale qui publie des articles de recherche originaux, des articles de revue détaillés, de brefs rapports et des commentaires sur la santé de la reproduction en Afrique. La Revue s'efforce de fournir un forum aussi bien à des auteurs africains qu'à des professionnels qui travaillent en Afrique, afin qu'ils puissent partager leurs découvertes dans tous les aspects de la santé de reproduction et diffuser à travers le continent, des informations innovatrices, pertinentes et utiles dans ce domaine de santé de la reproduction.

La RASR est indexée et figure sur l'Index Medicus/MEDLINE. Les résumés et les tables des matières sont publiés en ligne par INASP sur le site web <http://www.ajol.info/ajol> tandis que le texte est publié à <http://www.ajrh.info> par Bionline International sur le site web <http://www.bionline.org.br/>. Il est également résumé dans *Ulrich Periodical, feminist Periodical et African Books Publishing Records*

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Le WHARC est une organisation non gouvernementale à but non-lucratif s'engageant dans la promotion de santé de la reproduction chez la femme en Afrique sub-saharienne. Fondé en 1995, le Centre a pour objectif principal de mener des recherches pluridisciplinaires et en collaboration, de promouvoir et de former des cadres en matières relatives à la santé de la reproduction chez la femme. Le Centre travaille surtout à travers des groupes multidisciplinaires de chercheurs aussi bien nationaux qu'internationaux en sciences médicales et en sciences économiques dans le domaine de santé de la reproduction.

Le WHARC reçoit une aide financière principale de la Fondation Ford et bénéficie de la coopération technique de l'*International Perspectives on Sexual and Reproductive Health* et de *Studies in Family Planning*. Le financement principal pour la revue vient de la part du Consortium on Unsafe Abortion in Africa. L'objectif du Centre est d'améliorer la connaissance en matière de santé de la reproduction chez la femme au Nigeria et dans d'autres régions d'Afrique à travers la recherche en collaboration, le padoyer, des ateliers et des séminaires à travers des séries de publication - *La Revue africaine de santé de la reproduction, Le Women's Health Forum* et des rapports des recherches de circonstance.

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EDITORIAL

High Prevalence of Male Infertility in Africa: Are Mycotoxins to Blame?

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There is an increase in reports indicating a continuous decline in human fertility in both developed and developing countries¹. The infertility prevalence varies between developing and developed countries. For instance, in the United States of America it is estimated to be 6%² whereas it is 10-15% in United Kingdom³. In Africa, infertility prevalence rates are higher and range from 20-35%⁴⁻⁷. The “infertility belt”, geographical regions with high infertility prevalence, is well-known to Africa, stretching from West Africa, through Central to East Africa⁷.

Several reports have shown deterioration of male sperm quality worldwide. Carlsen *et al.*⁸ carried out a meta-analysis of 61 studies published between 1938 and 1991 involving semen quality of 14,947 men with no history of infertility and showed that the sperm concentration of fertile males have dropped from a mean concentration of 133 million/mL in 1940 to 66 million/mL in 1990, indicating an average yearly decrease of 1%. Sperm morphology/motility abnormalities were also significantly increased. In addition, this report showed that sperm count declined to a mean of 71.2 million/ml in Ibadan, Nigeria, 54.6 million/ml in Lagos, Nigeria, 65.0 million/ml in Salem, Libya, 66.9 million/ml in Dar Es salaam, Tanzania and 57.4 million/ml in Copenhagen, Denmark. Swan and colleagues re-evaluated Carson's publication and confirmed that sperm concentrations in fertile males have gradually declined overtime globally⁹. Also, in 2000, Swan and colleagues¹⁰ conducted another analysis based on 101 papers published between 1934-1996, involving only English-language studies and concluded that the decline in sperm quality of fertile men were as previously reported. This continuous decline in human fertility worldwide has been attributed to many factors including activities of endocrine-disrupting chemicals (EDCs) such as mycotoxins and pesticides¹¹⁻¹⁴. Recent reports indicate that EDCs may affect the development and functioning of the reproductive system in both sexes, particularly in fetuses, causing developmental and reproductive disorders, including infertility.

Mycotoxins are pharmacologically active secondary metabolites produced by fungal species,

particularly *Aspergillus*, *Fusarium* and *Penicillium* species, which elicit some complicated toxicological effects in man and animals. More than 400 of these secondary metabolites have been identified. However, the mycotoxins of major public health concern are aflatoxins (e.g. AFB1), ochratoxin A (OTA), deoxynivalenol (DON), zearalenone (ZEN) and fumonisins (e.g. FB1) because of their prevalence in agricultural produce and their adverse health effects in animals and humans¹⁵. Mycotoxin contamination of food is a global health problem as it is estimated that more than 25% of world agricultural produce are contaminated by mycotoxins¹⁶. Due to the more conducive climatic and environmental conditions for fungal growth in developing countries, mycotoxins contamination and exposure is more common than in developed countries¹⁷. In addition, the occurrence of mycotoxins is regulated by legal limits in developed countries; however, there is little or no regulation/legislation in place for monitoring mycotoxin contamination of agricultural products and foodstuffs in most developing countries which results to higher exposure in these regions.

Studies show that mycotoxins are common contaminants of staple foods in Nigeria, including garri, beans, yam flour, cassava flour, melon, rice, plantain, red pepper, onion, maize, groundnuts, guinea corn, sorghum, and millets¹⁸. Human exposure can be either through the consumption of contaminated agricultural products, or the consumption of contaminated animal products containing residual amounts of the mycotoxin ingested by the food producing animals¹⁹. Chronic exposure of a large proportion of African population to mycotoxins is a serious problem and *in utero* exposure is a common phenomenon²⁰. Apart from contaminating agricultural products, human exposures to mycotoxins have also been reported using exposure biomarkers. High levels of single or multiple mycotoxin biomarkers have been reported in several population studies which show that humans are often simultaneously exposed to mixtures of mycotoxins²¹. Multi-mycotoxins exposures have also been reported in South Africa²², Cameroun²³ and Nigeria²⁴. Multiple exposures to mycotoxins pose a significant threat to human health since combinations

of mycotoxins could be agonistic, additive or antagonistic in nature.

The well-known adverse health effects of mycotoxins in humans include liver cancer²⁵, Balkan Endemic Nephropathy²⁵, child growth impairment²⁶, modification of immune function²⁷, esophageal cancer²⁸, neural tube defects²⁹ and death in acute exposure³⁰. In particular, there is growing evidence suggesting that mycotoxins may negatively influence human fertility.

Studies using animal and cellular models indicate that zearalenone (ZEN) and metabolites [α -zearalenol (α -ZOL), β -zearalenol (β -ZOL)], deoxynivalenol (DON), ochratoxin A (OTA) and aflatoxin B1 (AFB1) can adversely affect fertility, through damage to sex organs, gametes and disruption of steroidogenesis. For instance, studies using animal and cellular models have described that exposure to the aforementioned mycotoxins can promote adverse effects on spermatozoa, Sertoli and Leydig cell function, oocyte maturation, and uterine and ovarian development and function, both *in vivo*, *ex-vivo* and *in vitro*³¹⁻³⁵. They may also induce oxidative stress resulting in sperm DNA damage³⁶ and sperm DNA damage reduces fertilization rates and lowers embryo quality³⁷. Furthermore, mycotoxins may act as endocrine disruptors, altering the steroid hormone homeostasis and interfering with receptor signaling³⁸⁻⁴⁴. It is well known that proper steroid hormones homeostasis and oocyte/sperm quality are the major determinants of reproductive function in both humans and animals and therefore, their impairment leads to subfertility/infertility.

Interestingly, the impact of mycotoxins on reproductive function have also been reported in humans. In Benin City-Nigeria, Ibe and colleagues¹¹ reported higher concentrations of aflatoxin B1 (AFB1) in the semen of infertile men compared to the semen of fertile controls and proposed that exposure to AFB1 could be a potential contributory factor to male infertility in Nigeria. In this study, 50% of infertile men with AFB1 in their semen had a greater percentage of abnormalities in sperm count, motility and morphology compared to the fertile men (10-15%). In male rats fed with AFB1 contaminated feeds (8.5 μ g AFB1/g of feed) for 14 days, the observed effects on the sperm parameters were similar to those found in the sperm of infertile men exposed to AFB1. In another study, Uriah *et al.*¹² conducted a case-control study involving 30 infertile and 25 fertile males. Detectable levels of AFB1 were found in the semen and blood of 37% of the infertile males with abnormal sperm profile and AFB1 levels in infertile males were significantly higher than the fertile males. The levels of AFB1 ranged from

700 to 1392 ng/ml, exceeding the World Health Organisation recommended level. Although these data indicate a possible link between AFB1 and male infertility, the use of valid aflatoxin exposure biomarkers (blood aflatoxin-albumin adduct; AF-alb or urinary aflatoxin M1) and properly designed epidemiological study would certainly provide stronger evidence for establishing a causal association. Mycotoxins as endocrine disruptors may also be involved in female reproductive disorders since other EDCs have been implicated in endometriosis, premature ovarian failure (POF) and polycystic ovary syndrome (PCOS)⁴⁵. In a study in Puerto-Rico, zearalenone (ZEN) was associated with precocious puberty in girls¹³ correlating with significantly high estrogen levels (25 pg/mL).

From the above data, it is plausible that mycotoxins might produce some adverse reproductive health effects in exposed individuals, and might be implicated in the declining fertility rate, especially in Africa. This constitutes a serious public health threat that should not be overlooked. Therefore, this growing body of evidence should increase public awareness of the serious implications of mycotoxin exposures in human fertility and should warrant a greater study of reproductive impacts of these mycotoxins through *in vitro* and *in vivo* bioassays and human epidemiological studies.

Conflict of Interest

None

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EDITORIAUX

Prévalence élevée de la Stérilité Masculine en Afrique: sont des Mycotoxines à Blâmer?

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Il y a une augmentation dans les rapports indiquant une baisse continue de la fécondité humaine dans les pays développés et en développement¹. La prévalence de la stérilité varie entre les pays en développement et les pays développés. Par exemple, aux États-Unis d'Amérique, il est estimé à 6%² alors qu'il est de 10-15% en Grande Bretagne³. En Afrique, les taux de prévalence de l'infertilité sont plus élevés et la gamme de 20-35%⁴⁻⁷. La «région de la stérilité», (les régions géographiques à forte prévalence de la stérilité), est bien connue en Afrique, allant de l'Afrique de l'Ouest, à travers l'Afrique Centrale jusqu'à l'Afrique de l'Est⁷.

Beaucoup de rapports ont montré la détérioration de la qualité du sperme des hommes partout dans le monde. Carlsen *et al.*⁸ ont effectué une méta-analyse de 61 études publiées entre 1938 et 1991 impliquant la qualité du sperme de 14,947 hommes sans antécédents de stérilité et a montré que la concentration de spermatozoïdes des mâles fertiles a chuté à partir d'une concentration moyenne de 133 millions / ml en 1940 au 66000000 / ml en 1990, indiquant une baisse annuelle moyenne de 1% . Les anomalies de la morphologie / de la motilité du sperme ont également augmenté de manière significative. En outre, ce rapport a montré que le nombre de spermatozoïdes a diminué à une moyenne de 71,2 millions / ml à Ibadan, au Nigeria, 54,6 millions / ml à Lagos, au Nigeria, 65,0 millions / ml à Salem, en Libye, 66,9 millions / ml à Dar Es Salam, Tanzanie et 57,4 millions / ml à Copenhague, Danemark. Swan et ses collègues ont réévalué la publication de Carson et ont confirmé que les concentrations de spermatozoïdes chez les mâles

fertiles ont progressivement diminué les heures supplémentaires globalement⁹. Aussi, en 2000, Swan et ses collègues¹⁰ ont effectué une autre analyse basée sur 101 articles publiés de 1934 à 1996, impliquant uniquement des études anglaises et a conclu que la baisse de la qualité des hommes fertiles de sperme a été comme indiqué précédemment. Cette baisse continue de la fécondité humaine dans le monde a été attribuée à de nombreux facteurs, y compris les activités de produits chimiques perturbateurs endocriniens (PE) tels que les mycotoxines et pesticides¹¹⁻¹⁴. Des rapports récents indiquent que les perturbateurs endocriniens peuvent affecter le développement et le fonctionnement du système de la reproduction chez les deux sexes, en particulier chez les fœtus, causant des troubles du développement et de la reproduction, y compris la stérilité.

Les mycotoxines sont des métabolites secondaires pharmacologiquement actives produites par des espèces fongiques, en particulier les espèces *Aspergillus*, *Fusarium* et *Penicillium*, qui provoquent des effets toxicologiques complexes chez l'homme et les animaux. Plus de 400 de ces métabolites secondaires ont été identifiés. Cependant, les mycotoxines qui constituent le problème majeur de santé publique sont les aflatoxines (par exemple AFB1), l'ochratoxine A (OTA), le déoxynivalénol (DON), la zéaralénone (ZEN) et les fumonisines (par exemple FB1) en raison de leur prévalence dans les produits agricoles et leurs effets nocifs sur la santé des animaux et des êtres humains¹⁵. La contamination des aliments par les mycotoxines est un problème mondial de santé car il est estimé

que plus de 25% de la production agricole mondiale sont contaminés par mycotoxins¹⁶. En raison des conditions climatiques et environnementales plus propices à la croissance fongique dans les pays en développement, la contamination et l'exposition mycotoxines sont plus fréquentes que dans les pays développés¹⁷. En outre, la présence de mycotoxines est réglementée par des limites juridiques dans les pays développés, cependant, il y a peu ou pas de réglementation/ législation en place pour surveiller la contamination par les mycotoxines des produits agricoles et des denrées alimentaires dans la plupart des pays en développement qui se traduit par une exposition plus élevée dans ces régions.

Des études montrent que les mycotoxines sont des contaminants courants des aliments de base au Nigéria, notamment le gari, les haricots, la farine d'igname, la farine de manioc, le melon, le riz, la banane plantain, le poivron rouge, l'oignon, le maïs, l'arachide, Guinée maïs, le sorgho, et millets¹⁸. L'exposition humaine peut être soit par la consommation de produits agricoles contaminés, ou la consommation de produits d'origine animale contaminés contenant des quantités résiduelles de la mycotoxine ingérée par les animaux qui produisent des aliments¹⁹. L'exposition chronique d'une grande partie de la population africaine aux mycotoxines est un gros problème et l'exposition *in utero* est un phénomène commun²⁰. En dehors de la contamination des produits agricoles, l'exposition humaine aux mycotoxines ont également été signalés à l'aide de biomarqueurs d'exposition. Des niveaux élevés de biomarqueurs de mycotoxines simples ou multiples ont été signalés dans plusieurs études sur la population qui montrent que les êtres humains sont souvent exposés simultanément à des mélanges de mycotoxins²¹. Les expositions multi-mycotoxines ont également été signalées dans l'Afrique du sud²², le Cameroun²³ et le Nigeria²⁴. De multiples expositions aux mycotoxines constituent une menace importante pour la santé humaine puisque les combinaisons de mycotoxines pourraient être agonistiques, additifs ou antagonistes dans la nature.

Les effets néfastes les plus connus de mycotoxines sur la santé etres humains

comprennent le cancer²⁵ du foie, la Néphropathie Endémique des Balkans²⁵, le retard de la croissance de l'enfant²⁶, la modification de la fonction immunitaire²⁷, le cancer de l'œsophage²⁸, les défauts de neurones²⁹ et la mort dans l'exposition aiguë³⁰. En particulier, il existe de plus en plus des preuves qui suggèrent que les mycotoxines peuvent influencer négativement sur la fécondité humaine.

Des études utilisant des modèles animaux et cellulaires indiquent que la zéaralénone (ZEN) et des métabolites [α -zéaralénol (α -ZOL), zéaralénol β - (β -ZOL)], le déoxynivalénol (DON), l'ochratoxine A (OTA) et l'aflatoxine B1 (AFB1) peut nuire à la fertilité, à travers des dommages aux organes sexuels, des gamètes et des perturbations de la stéroïdogénèse. Par exemple, des études qui se servent des modèles animaliers et cellulaires ont décrit que l'exposition aux mycotoxines mentionnées ci-dessus peut favoriser des effets néfastes sur les spermatozoïdes, de Sertoli et de la fonction de Leydig cellulaire, la maturation des ovocytes, et de l'utérus et le développement et la fonction ovarienne, à la fois *in vivo*, *ex vivo* et *in vitro*³¹⁻³⁵. Ils peuvent également induire un stress oxydatif provoquant la détérioration de l'ADN du sperme³⁶ et la détérioration de l'ADN du sperme réduit le taux de fécondation et diminue la qualité de l'embryon³⁷. En outre, les mycotoxines peuvent agir comme perturbateurs endocriniens, altérer l'homéostasie des hormones stéroïdes et en interférant avec la signalisation du récepteur³⁸⁻⁴⁴. Il est bien connu que les homéostasies des hormones stéroïdes et ovocyte appropriés / la qualité du sperme sont les principaux déterminants de la fonction de la reproduction chez les êtres humains et les animaux et, par conséquent, leur déficience conduit à la sous-fécondité / stérilité.

Fait intéressant, les impacts des mycotoxines sur la fonction de la reproduction ont été également signalés chez les êtres humains. Dans la ville de Bénin-Nigeria, Ibe et ses collègues¹¹ ont rapporté des concentrations plus élevées d'aflatoxine B1 (AFB1) dans le sperme des hommes stériles par rapport à la semence de contrôles fertiles et ont proposé que l'exposition à l'AFB1 pourrait être un facteur contributif

potentiel de la stérilité masculine au Nigeria. Dans cette étude, 50% des hommes stériles avec AFB1 dans leur sperme avaient un pourcentage plus élevé d'anomalies de la numération des spermatozoïdes, la motilité et la morphologie par rapport aux hommes fertiles (10-15%). Chez les rats mâles nourris avec des aliments du bétail contaminés AFB1 (8,5 pg AFB1 / g d'aliment) pour 14 jours, les effets observés sur les paramètres du sperme étaient semblables à ceux qui s'étaient trouvés dans le sperme des hommes stériles exposés à l'AFB1. Dans une autre étude, Uriah *et al.*¹² ont mené une étude cas-témoins portant sur 30 hommes stériles et 25 hommes fertiles. Des niveaux détectables de l'AFB1 ont été trouvés dans le sperme et le sang de 37% des hommes stériles avec le profil de spermatozoïdes anormaux et les niveaux de l'AFB1 chez les hommes stériles étaient significativement plus élevés que les hommes fertiles. Les niveaux de l'AFB1 variaient de 700 à 1392 ng / ml, dépassant les niveaux recommandés par l'Organisation mondiale de la santé. Bien que ces données indiquent un lien possible entre l'AFB1 et la stérilité masculine, l'utilisation de biomarqueurs d'exposition aux aflatoxines valides (sang aflatoxine-albumine addition; AF-alb ou aflatoxine urinaire M1) et l'étude épidémiologique bien conçue fourniront certainement des preuves plus solides pour établir un lien de causalité. Les mycotoxines en tant que perturbateurs endocriniens peuvent également être impliqués dans les troubles de la reproduction chez les femmes puisque d'autres perturbateurs endocriniens ont été impliqués dans l'endométriose, l'insuffisance ovarienne prématurée (IOP) et le syndrome des ovaires polykystiques (SOPK) 45. Dans une étude à Puerto Rico, la zéaralénone (ZEN) a été associée à la puberté précoce chez les jeunes filles¹³ en corrélation avec les niveaux d'oestrogène significativement élevés (25 pg / ml).

D'après les données ci-dessus, il est plausible que les mycotoxines peuvent produire des effets néfastes sur la santé de la reproduction chez les individus qui y sont exposés, et pourraient être impliqués dans la baisse de la fécondité, surtout en Afrique. Cela constitue une menace

grave de santé publique qui ne doit pas être négligée. Par conséquent, cette masse croissante de preuves devrait sensibiliser le public à la gravité des conséquences de l'exposition aux mycotoxines dans la fertilité humaine et devrait justifier la nécessité d'une plus grande étude des effets de ces mycotoxines sur la reproduction à travers les essais biologiques *in vitro* et *in vivo* ainsi que des études épidémiologiques humaines.

Conflit d'intérêts:

Aucun

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REVIEW ARTICLE

The Ebola Virus and Human Rights Concerns in Africa

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Abstract

In the wake of the Ebola virus disease (EVD) that is ravaging parts of Africa certain measures are being taken by governments to prevent the spread of the epidemic within their borders. Some of these measures are drastic and may likely have implications for the fundamental rights of individuals. The EVD outbreaks have brought to the fore again the tension between public health and human rights. This article discusses the origin and mode of transmission of the EVD and then considers the human rights challenges that may arise as a result of states' responses to the disease in Africa. (*Afr J Reprod Health* 2015; 19[3]: 18-26).

Keywords: Ebola, Public Health, human right.

Résumé

Dans le sillage de la maladie à virus Ebola (MVE) qui ravage certaines parties de l'Afrique sont les mesures prises par les gouvernements pour prévenir la propagation de l'épidémie au sein de leurs frontières. Certaines de ces mesures sont drastiques et peuvent vraisemblablement avoir des implications pour les droits fondamentaux des individus. Les épidémies de la MVE ont mis en évidence à nouveau la tension entre la santé publique et les droits humains. Cet article traite l'origine et le mode de transmission de la MVE, puis il examine les défis des droits humains qui peuvent survenir à la suite des réponses des Etats à la maladie en Afrique. (*Afr J Reprod Health* 2015; 19[3]: 18-26).

Mots clé : Ebola, de santé publique, droit humain.

Introduction

Anyone listening or watching news media in the past few months can affirm the deadly spread of the Ebola virus disease (EVD). The current outbreak has been lethal and has claimed many lives ever recorded. It is highly contagious and is currently not under control. According to the World Health Organization (WHO), the outbreak of EVD, formerly known as Ebola haemorrhagic fever, in West Africa has continued to escalate with over 27 748 suspected, probable, and confirmed cases in Guinea, Liberia and Sierra Leone¹ and more than 11 279 reported deaths² but many go unrecorded. EVD is a severe and sometimes fatal illness with death rate of about 90%. In recent times some countries in West Africa such as Nigeria, Senegal and Mali have been able to curtail the spread of EVD; nonetheless, infection rates in other parts of West African remain a source of concern².

It is believed that EVD outbreaks often occur in rural and tropical areas, particularly in Central and Western parts of Africa³. The virus is believed to be transmitted to people through wild animals and then spreads among humans through human-to-human contact. Infected persons require urgent and intensive care as no vaccines has currently been approved for treatment in humans and animals⁴. In the wake of the EVD that is ravaging parts of West Africa certain measures are being taken by governments to prevent the spread of the epidemic within their borders. Some of these measures are drastic and may likely have implications for the fundamental rights of individuals. The EVD outbreaks have brought to the fore again the tension between public health and human rights. This article discusses the origin and mode of transmission of the EVD and then considers the human rights challenges that may arise as a result of states' responses to the disease.

The Origin and Mode of Transmission of EVD

According to WHO, the origin of Ebola virus is unknown; however, fruit bats are thought to be the likely host of the virus⁵. The first reported cases of Ebola virus occurred in 1976 during two outbreaks in Nzara Sudan and in Yambuku, Democratic Republic of Congo (DRC)⁶. The incident in DRC occurred in a village close to the Ebola River, from where the disease takes its name. Since then the EVD has been found in Uganda, Gabon, Guinea, Liberia, Sierra Leone and Nigeria.

As a communicable disease, Ebola can be transmitted among human population through contact with the blood, secretions, organs or other bodily fluids of infected animals. Although scientists are still investigating how victims are infected, it is believed that the transmission has occurred through the handling of infected chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines found ill or dead or in the rainforest⁷. As noted earlier the spread of Ebola within the population is usually through human-to-human transmission as a result of infection from direct contact (through broken skin or mucous membranes) with the blood, secretions, organs or other bodily fluids of infected people, and indirect contact with environments contaminated with such fluids. In some situations infection may occur from contact (through broken skin or mucous membranes, including the nose, eyes and mouth) with environments that are contaminated with an Ebola patient's infectious blood or body fluids, such as soiled clothing, bed linen, or used needles⁸.

Worse still, it is believed that transmission can occur during burial ceremonies if mourners have direct contact with the contaminated body of a deceased person⁹. A person that has recovered from the disease can still transmit the virus through their semen for up to 7 weeks after recovery from illness¹⁰. Weak information and communication networks, community suspicion and mistrust of health care workers, populace reluctant and unwilling to receive treatment have been highlighted as some of the issues that have

further compounded and exacerbated the spread of EVD.

More importantly, health care providers are said to be highly susceptible to infection in the cause of treating a patient with EVD. Recently, two American doctors that provided treatment to a patient with EVD are said to have been infected with the virus¹¹. Also, a Liberian national who travelled by air in July 2014 to Nigeria was admitted to hospital with symptoms of EVD and died a few days later. Two of the nurses that were involved in providing medical care to the Liberian patient later died of the disease¹². This highlights the ease with which the disease could spread. While for now there is no official case of EVD in some countries such as South Africa, there has been one imported case of EVD documented in the country. In 1996, a Gabonese doctor working with EVD patients in Libreville, Gabon, was admitted to a hospital in Johannesburg. A nurse caring for the patient became infected and died¹³. Stopping the transmission has been emphasised by WHO as the key to curbing the spread of EVD. Healthcare workers like foot soldiers have been at the forefront. Although death toll is not the only way to assess deadliness of the EVD, as at May 2015, there were a total of 880 health worker reported infections in the 3 intense-transmission countries (namely Guinea, Liberia, and Sierra Leone), with 510 reported deaths¹⁴.

After an exposure to EVD, there is an incubation period of 2 – 21 days (on average, 8 – 10 days), after which the person begins to manifest some of the symptoms. These may include fever, weakness and lethargy, muscle pain, headache and sometimes sore throat¹⁵. At a later stage these may lead to vomiting, diarrhoea, abdominal pain, and sometimes a rash. In other situations, infected persons may experience bleeding inside and outside of the body; this is the most serious complication. As such EVD is highly communicable disease. In an effort to take precaution when providing healthcare for potentially infectious patients, health care workers (nurses and doctors) treating patients of EVD now wear protective body-suits similar to those worn by personnel dealing with toxic chemicals.

Currently, there is no approved vaccine or treatment for EVD, however, some experimental drugs are currently undergoing human clinical trials¹⁶. This has heightened fears and concerns about the deadly disease. Given the high fatality rate of the EVD it is quite understandable the drastic steps and measures being taken by states to curb its spread. The Ebola incident has further reminded us how closely connected we are in this world and how vulnerable we could all be. Aginam has argued that given the global nature of some diseases, the rich countries as well as poor countries both have the duty to ensure that appropriate measures are taken to address a public health emergency¹⁷.

Failure to do so will put the entire world in danger. The largest concern is the spread of the disease to other countries. Some of the measures adopted by countries to curtail EVD include quarantine (preventative), isolation (reactive), refusal of entry into a country's border and forcible testing to ascertain Ebola infection, cremation of a dead body of Ebola victim. Although noble, such efforts can easily violate a wide range of human rights if imposed and enforced unjustly. The questions that may arise regarding these measures include: how consistent with human rights principles and standards are these measures? Or will individual rights be sacrificed at the altar of public good?

Public Health and Human Rights

It has been observed that public health responses to an epidemic or diseases may have implications for human rights in one way or another¹⁸. This is often so because the aim of public health is to protect the community as a whole, while human rights principles are more concerned with securing individual rights. This tension is further illustrated by the decision of the US court in *Jacobson v Massachusetts*¹⁹. The bone of contention in that case was whether a state, in applying a public health measure to prevent the spread of small pox, could forcibly vaccinate an individual against his will. The plaintiff had argued that such a measure would erode his fundamental right to liberty.

In upholding the conviction of the plaintiff, the US Supreme Court noted that based on the

principle of paramount necessity, a state or community has the right to protect itself against an epidemic of a disease that threatens the safety of its members²⁰. Implicit in this decision is that in some situations the need to protect the well-being of the community may override respect for individual rights. In essence, public health emergencies may necessitate the need to strike a balance between communal good and individual rights. Such an approach is by no means easy.

Human rights are fundamental rights inherent in human beings by virtue of their humanity. Human rights are guaranteed in international, regional and national laws and documents. Examples of human rights instruments at the United Nations level include the Universal Declaration on Human Rights of 1948, the International Covenant on Civil and Political Rights (ICCPR)²¹ and the International Covenant on Economic, Social and Cultural Rights (ICESCR)²². The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW)²³ and the Convention on the Rights of the Child²⁴. At the African Regional level, human rights are guaranteed in documents such as the African Charter on Human and Peoples' Rights²⁵, the African Charter on the Rights and Welfare of the Child²⁶, and Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women in Africa²⁷.

The Bill of Rights in chapter 2 of the South African Constitution of 1996 is an example of the entrenchment of human rights in national law²⁸. Human rights are said to be universal, interdependent, indivisible and interrelated. According to Mother Theresa, 'human rights are not a privilege confers by government. They are every human being's entitlement by virtue of his humanity'²⁹. They cover many aspects of human existence such as the right to life, dignity, privacy, equality, health, shelter, food and family life. In addition, human rights are founded on core principles such as universality, fairness, dignity, equality, autonomy and participation. It should be noted that human rights are not absolute and may sometimes be limited. However, the scope and extent of such limitations is often a subject of contention. Generally, limitations of rights are permitted in certain

circumstances such as for the protection of public health, order or morals; the national interest; national security, public safety or the wellbeing of the country; public order; the prevention of disorder or crime; or the protection of the rights and freedoms of others³⁰. But in accordance with the Siracusa Principles, rights can only be restricted if it is in accordance with the law, serves a legitimate objective of general interest, is strictly necessary in a democratic society, no less intrusive or restrictive means exist to achieve similar ends and restrictions are not arbitrarily imposed³¹.

Also, some provisions of national constitutions such as section 36 of the South African Constitution allow for limitation of rights only by laws of general application, and only to the extent that the restriction is reasonable and justifiable in 'an open and democratic society based on human dignity, equality and freedom'. It should be noted, however, that certain rights are non-derogable and are therefore not subject to limitation. These include the rights to life and dignity, freedom from torture and freedom from non-discrimination³².

Given that no cure currently exists for the Ebola disease, it has become necessary for governments to adopt drastic preventive or precautionary measures to reduce the spread of the disease. These include using the military to enforce quarantined zones, imposing curfews and lockdowns, forcible medical test, screening people entering major towns and cities and cremation of body of Ebola victim. While these preventive measures are essential, it is important that they do not unduly undermine individual human rights. In one of its statements in response to the EVD, the African Commission on Human and People's Rights (African Commission) notes with concern that 'the current spread of the Ebola virus is unprecedented and has indescribable consequences of suffering and prevention from fully enjoying economic, social and cultural rights³³.

The discussion that follows examines from human rights perspective the justification or otherwise of some of these measures.

Justif Ying quarantine, isolation or ex-communication

As noted above EVD is a communicable disease that spreads easily through mere contact with body fluids or materials of an infected person. Thus, it becomes necessary for an infected person to be isolated in the interest of others. In some countries such as Liberia and Sierra Leon individuals or communities have been quarantined or clamped down due to fear of EVD. 'Kabia explains that 'in August 2014 attempts by Liberian security forces to quarantine residents of the West Point district in Monrovia descended into violence. The outbreak has also led to serious stigmatization of individuals and whole communities suspected or confirmed to be infected or to have survived Ebola'³⁴. Actions as these can undermine the right to liberty guaranteed in numerous human rights instruments. Most human rights instruments guarantee an individual's right to liberty or freedom of movement. This implies that an individual's right to move around should not be unduly restricted.

While quarantine or ex-communication of persons suspected to be with EVD may likely infringe the right to liberty or movement of an individual, such an infringement may be justified based on the mode of transmission and fatal nature of EVD. This situation may be contrasted with the earlier stage of HIV where a similar approach was wrongly adopted to prevent the spread of the epidemic. Human rights institutions are unanimous in condemning such an approach as a gross violation of human rights since HIV is not transmissible through casual contact³⁵.

HIV can only be transmitted through unprotected sexual intercourse with an infected person, blood transfusion or from a pregnant woman to an unborn child. In the case of EVD, mere contacts with clothing or other external materials of an infected person may expose others to infection. Indeed, it is believed that touching a corpse of a person who died of EVD may also lead to the transmission of EVD³⁶. The question may be asked are there no other less intrusive

ways of preventing the spread of the virus? From scientific evidence available so far, it would seem isolation of an infected person is the most reasonable way to minimize or prevent the spread of the virus to others.

Besides, the right to liberty is a derogable right and can therefore be limited under certain circumstances. Indeed, human rights instruments such as articles 12 of the ICCPR and 12 of the African Charter permit reasonable limitations to the right to liberty and movement. Recent developments have shown that health care workers that were involved in providing medical care to EVD patients have themselves been exposed to the virus and even some have lost their lives³⁷. This clearly underlines the fatal nature of EVD and further justifies the drastic measures, including quarantine, being adopted by states to prevent its spread. It is important to note however, that persons quarantined are neither in 'detention' nor accused persons and therefore they are entitled to be treated with utmost respect and assured of their other fundamental rights. They are already paying a big price for the society for being isolated from family members and friends; they must not be treated as 'culprits'. It is also important to state that people should not be quarantined based on mere suspicion of EVD, 'rather isolation must only be adopted where a person has been exposed to EVD or there exist real risks of transmission to others'. Under no circumstances should quarantine be used as a routine measure or be targeted at certain groups of people. Therefore, the recent lockdowns in some countries such as Liberia and Sierra Leone, as 'laudable' as they may seem, constitute serious threats to enjoyment of the human rights in general and the right to liberty in particular³⁸. There is no evidence to show that such measures will reduce the spread of EVD. As noted by Eba the unabated spread of EVD in these countries attest to the ineffectiveness of such measures and may further erode the enjoyment of other human rights such as access to food and health care³⁹.

With regard to the travel restrictions being contemplated by some countries on individuals from countries where EVD is prevalent, this should be approached with caution. Unlike HIV/AIDS which cannot be easily 'imported'

into a country unless there is direct contact with the blood or semen of an infected person, EVD can be imported to a country since mere presence of an infected person in another country poses great risk to the host population. This is particularly so if the person begins to exhibit some of the symptoms of the virus. Indeed, the first reported case of Ebola in Nigeria was imported by a Liberian by name Sawyer who died shortly after he was diagnosed with EVD. His presence in the country had further exposed about 8 other persons to the virus and has even claimed the life of one of the nurses that provided medical care to him.

Restrictions on travel

Although there have been no formal bans on international travel, some airlines have suspended flights to the West African region⁴⁰. Due to its infectious potential and the ease at which the EVD spreads, theoretically it is just a plane flight or bus ride away. While a travel restriction on a person infected with or exposed to EVD may be justified it is doubtful if a blanket ban or restriction on citizens from countries where EVD is prevalent can be justified. Though it would make no economic sense, it is also an undue restriction on the right to movement if every Guinean, Liberian or Sierra Leonean is banned from entering South Africa or any other country for that matter.

From the statistics so far provided by WHO, which indicate that about 26, 000 cases of EVD have so far been confirmed in some countries in West Africa, this would seem to be a very small fraction of the population of these countries. Moreover, WHO has advised that for now there is no need for any travel or trade restrictions as a result of the EVD⁴¹. This is the same position taken by some developed countries. In essence, available fact and scientific evidence do not seem to support an imposition of a blanket travel ban on citizens from countries with prevalence of EVD. Thus, countries contemplating travel bans must carefully think through this and ensure that a balance is struck between the human rights implications and quest to prevent spread of EVD.

Forcible testing for EVD

Another measure being contemplated by states is to subject some individuals to forcible testing for EVD. The argument behind this approach is to enable an early detection of EVD and be able to prevent spread to others. Recently a US nurse returning to her country after a trip to West Africa was quarantined and made to undergo EVD test before she could be released⁴². Subjecting people to EVD test may likely erode the right to autonomy guaranteed in human rights instruments. Although the right to autonomy is not explicitly guaranteed in any human rights instrument this right is directly linked to the rights to privacy, security of persons and dignity. Article 9 of the ICCPR guarantees the right to liberty and security of persons. This implies that no intrusion to the body of a person is permitted unless the person has consented to it. Also, section 12 of the South African Constitution guarantees the right to bodily integrity, and reproductive rights.

One of the essential elements of the right to health is freedom from non-consensual medical treatment or experimentation⁴³. It is a fundamental principle of medical ethic that no medical treatment can be conducted on a patient without his/her informed consent freely and willingly given. It was reported recently that the government of Hong Kong detained and tested a Nigerian for EVD after he manifested some symptoms of the virus. He was only released when he tested negative to the virus⁴⁴. This incident clearly exemplifies likely threats to human rights, which may occur as a result of drastic public health measures aim at protecting the community. Undoubtedly, the aim of the government of Hong Kong is to protect their citizens from being exposed to EVD.

However, there is need for caution so that this does not become an excuse to trample on individuals' fundamental rights. Resorting to routine or mandatory testing of individuals or passengers from other countries simply on the suspicion of EVD cannot be justified. An individual should only be made to undergo EVD test if there is a justified reason for so doing. In other words, unless a person has exhibited or

manifested symptoms of EVD, it might amount to an intrusion to the right to autonomy for an individual to be detained and compelled to undergo EVD test. Indeed, appropriate preventive measures can be put in place at the airport to ensure screening of travellers entering the country. This may seem to be a more realistic and cost effective measure than resorting to mandatory testing of passengers entering the country. Moreover, Ebola virus has an incubation period of about 8 days so resorting to mandatory testing may not really help in detecting if a passenger is already infected.

Non-availability of treatment

Since the first reported case of EVD in 80s, it remains a cause for concern to note that no cure exists nor has there been a vaccine⁴⁵ to prevent transmission of the disease. Since its outbreak the EVD has spread sporadically mainly in West and Central Africa. In all its incidences, it has been highly contagious with high mortality rates⁴⁶. The fact that pharmaceutical companies in developed countries have been slow in developing a cure or vaccine for Ebola merely confirms the fact that these companies hardly invest in tropical or neglected diseases that may benefit millions of people in poor regions. This can compromise the right to health guaranteed in numerous human rights instruments. The recent renewed efforts by pharmaceutical companies to develop a vaccine for EVD may have been attributed to the fact that developed countries are not immune from the virus. Reports from worst affected countries (Liberia, Guiana and Sierra Leone) show that the health care systems are overwhelmed by the incidence of EVD and lack both infrastructural and human capacity to handle the situation⁴⁷. This in turn has led to inability of these countries to respond to other health challenges such as maternal and child health. Indeed, reports have shown people dying from treatable diseases due to the fact that several health care centres have closed down⁴⁸.

Article 12 of the ICESCR, is by far the most comprehensive provision on the right to health. It guarantees the right to highest attainable standard of physical and mental health of every

individual. In addition, it recognises states obligation in relation to social determinant of health including ensuring a healthy environment and adopting preventive measures to address epidemic. The Committee on Economic Social and Cultural Rights responsible for monitoring the implementation of the ICESCR has noted that the enjoyment of the right to health requires states to take appropriate measures to ensure that people have access to goods and services, including relevant medicines and drugs⁴⁹. The former United Nations Special Rapporteur on Health has noted that failure of pharmaceutical companies to invest in medicines needed by people in poor regions is a matter of social injustice and a human rights issue as the rights to health and life of people in poor regions may be undermined⁵⁰. The slow response from pharmaceutical companies in developed countries to Ebola ravaging poor regions of the world exemplifies little regard for lives in Ebola-stricken countries. As Gostin and Madison rightly argue;

“A failure to act expeditiously and with equal concern for all citizens, including the poor and less powerful, harms the whole community by eroding public trust and undermining social cohesion. It signals to those affected and to everyone else that the basic human needs of some matter less than those of others, and it thereby fails to show the respect owed to all members of the community⁵¹.”

Implicit in this statement is that every nation, in the interest of justice, has the duty to act in order to address EVD irrespective of where it occurs. This is because justice is not bound by national borders but binds the human community around the globe. Echoing Donne, ‘every man is a piece of the continent and a part of the main’ therefore the death of a human being in any part of the world diminishes us all⁵². The African Commission has called on member states of the African union to ‘mobilize the necessary human and financial resources for an appropriate

response and the search for an effective treatment for the deadly virus⁵³.

One question may be asked: if a vaccine were to exist will it be justified to compel every individual to be vaccinated? Given the fatal nature of EVD and the fact that it is highly contagious, compelling individuals to be vaccinated will not only protect them from possible infection but will also be to the benefits of the community as a whole. Moreover, from economic point of view, it is reasonable and cost effective. As the saying goes prevention is better than cure. To that extent such a measure may be justified even though it may interfere with an individual’s right to autonomy.

Indeed, in the *Jacobson* case discussed earlier the plaintiff had argued that compelling him to undergo immunization against small pox was a violation of his right to liberty. The US Supreme Court, however, rejected this argument claiming that respect for individuals’ rights will need to be balanced with common good of the society. Also, the European Court of Human Rights had the chance to rule on Article 8 and compulsory vaccination in 2012 in *Solomakhin v Ukraine*⁵⁴. The court found that even though compulsory vaccination evidently interfered with the applicant’s bodily integrity and therefore fell under Article 8, the interference was justified in a democratic society as it ‘could be said to be justified by the public health considerations and necessity to control the spreading of infectious diseases in the region.’

Conclusion

The Ebola outbreak has further reminded us of the fact that we live in a global village where we cannot afford to be complacent about the fates of others in any part of the world. More importantly, attempts by the international community to address public emergency and epidemic must take into consideration implications for human rights. But it should be borne in mind that human rights are never absolute and may be limited in certain justified circumstances, including the common good of society. While some of the measures currently adopted by states to combat

the Ebola virus may be justified, there is need for caution so that individuals' rights are not sacrificed at the altar of common good.

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