



MISSING LINKS

UNDERSTANDING SEX-
AND GENDER-RELATED
IMPACTS
OF CHEMICAL AND
BIOLOGICAL WEAPONS

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A member of the Special Commission Team (UNSCOM) Verifies Iraq's Destruction of Chemical Weapons at Fallujah Chemical Proving Ground.



» EXECUTIVE SUMMARY

In recent years, interest has grown in gender as a useful analytical perspective to examine the impact of particular means and methods of warfare. Multilateral debates on chemical and biological weapons, however, have not systematically considered the relevance of sex- and age-disaggregated data on the effects of these weapons, nor knowledge of gender dynamics, in the implementation of the Biological and Chemical Weapons Conventions (BWC and CWC, respectively). Such information and perspectives, however, can contribute to States' preparedness and enhance the effectiveness of assistance under CWC article X and BWC article VII. Moreover, it could help to increase resilience and to aid recovery from chemical or biological incidents. Ultimately, a gender-responsive approach can help States to enhance the security and well-being of all their citizens.

The main findings of this paper are summarized below.

- There are indications of variation in levels of susceptibility between men and women to toxic agents and disease, as well as sex-specific problems in reproductive health and obstetric difficulties. Awareness of sex-specific differences can help to optimize public health responses to chemical or biological weapons.
- Age-specific variation may result in children being at greater risk of exposure than adults to toxic effects of chemical weapons. Age-specific differences may require adjustments in various response measures, ranging from specific triage and decontamination facilities for families with children, to medical treatment tailored to infants.
- Gender roles may result in different levels of exposure between men and women, especially when one gender is primarily responsible for caring for the sick or performing burial practices. Understanding these gendered dynamics can help to inform targeted response and assistance strategies to minimize the spread of infection.
- Gender roles can determine opportunities for formal education and, thus, result in uneven access to information. This requires consideration of how potential gendered communication barriers can be broken down and how key actors, such as primary caregivers, can be effectively engaged.
- Gender roles may result in distinct experiences of social stigma for individuals exposed to chemical or biological weapons. The threat of stigmatization can dissuade people from seeking medical assistance and reporting cases. Means of countering and minimizing stigmatization need to be considered, including in public messaging.
- In order to promote a gender-responsive approach to assistance, States could mainstream gender in public health systems, ensuring the collection of sex- and gender-disaggregated data.
- At the multilateral level, States Parties to the BWC and the CWC could further discuss gender perspectives and support research on the differentiated impacts of diseases and chemical contamination among women, men, boys and girls.



Mother washing child's hands with chlorine treated water at Ebola Prevention and Treatment facility in Guinea.



1. INTRODUCTION

In recent years, interest has grown in gender as a useful analytical perspective to examine the impact of conflict and armed violence as these phenomena can affect men and women in different ways. Researchers have employed gender analysis as a tool to understand how the attributes, opportunities, and relationships associated with a gender identity may affect, for example, the likelihood of being targeted by weapons systems, the prospects of becoming a victim/survivor of armed violence, the ability to access medical assistance in armed conflict, and the long-lasting biological and physiological impacts of weapons on individuals.¹

Research on nuclear weapons use and exposure to radiation provides well-documented examples of differentiated impacts. Studies with survivors of Hiroshima and Nagasaki, as well as with people affected by nuclear testing or accidents, have shown that the risk of developing and dying from cancer due to ionizing radiation is almost twice as high for women as for men. States and civil society organizations have considered these findings within distinct multilateral forums, such as the Nuclear Non-Proliferation Treaty (NPT) Review Process and the negotiations of the Treaty on the Prohibition of Nuclear Weapons (TPNW) in 2017.²

Multilateral discussion around chemical and biological weapons, however, has not included significant deliberation on sex- or gender-related considerations. This is in part explained by the relative limits of data on the effects of these weapons, as well as the difficulties in establishing causation between exposure and effects. Previous instances of biological and chemical weapons use have not been followed by comprehensive epidemiological studies. Moreover, past studies undertaken to examine the effects of these weapons typically involved healthy, fighting-age men.³ As such, there is limited data on the impact of these weapons upon other demographic groups, including women, boys, girls, and the elderly.

The limitations in both data and discussion are problematic when chemical weapons are being used against civilians. Understanding the potentially gendered consequences of an attack could help States to build more effective public health responses. This would entail considering gender-sensitive assistance under article VII of the BWC and article X of the CWC, including communication and intervention strategies that consider the differential needs of women and men, girls and boys.

As an initial step towards overcoming the knowledge gap, this paper provides an overview of existing literature relevant to understanding the linkages between gender and chemical and biological

1 See, for instance, Green, Caroline et al. 2013. "Gender-Based Violence and the Arms Trade Treaty: Reflections from a Campaigning and Legal Perspective". *Gender & Development* 21 (3): 551–562. <https://doi.org/10.1080/13552074.2013.847001>; Borrie, John et al. 2016. "Gender, Development and Nuclear Weapons". UNIDIR and ILPI. <https://www.unidir.org/files/publications/pdfs/gender-development-and-nuclear-weapons-en-659.pdf>.

2 At the 2017 NPT Preparatory Committee for the 2020 Review Conference, Ireland and Sweden organized a side event on "Gender, Development and Disarmament", addressing the issue of gendered impacts. Working papers submitted in all three Preparatory Committees also made reference to these topics, including the 2018 Chair's factual summary (working paper), NPT/CONF.2020/PC.II/WP.41, 16 May 2018, and the 2019 Recommendations by the Chair to the 2020 NPT Review Conference, NPT/CONF.2020/PC.III/WP.49, 10 May 2019. On the Treaty on the Prohibition of Nuclear Weapons, see article 6, which mandates States Parties to provide age- and gender-sensitive assistance to individuals affected by the use or testing of nuclear weapons

3 See, for example, Venables, K. M. et al. 2009. "Mortality in British Military Participants in Human Experimental Research into Chemical Warfare Agents at Porton Down: Cohort Study". *BMJ* 338 (24 2): b613–b613. <https://doi.org/10.1136/bmj.b613>.



weapons. Where possible, the paper includes historical examples of chemical and biological warfare to illustrate how these weapons affect women and men, girls and boys. In the absence of historical data, proxy indicators—for example the 1984 Bhopal gas tragedy and recent natural outbreaks of Ebola—are used to better understand the possible effects of these weapons on individuals.

The first section provides basic information on the concepts of sex and gender, as well as an analysis of how these concepts have featured in multilateral negotiations related to nuclear weapons. The subsequent sections offer an overview of relevant research on biological and chemical warfare, highlighting aspects that can improve our understanding of sex- and gender-specific impacts of those weapons with a view to better informing the provision of assistance under the BWC and CWC. The final section concludes with ideas to promote gender-responsive assistance within the biological and chemical weapons regimes, along with questions for further research.



2. BACKGROUND: SEX AND GENDER IN THE NUCLEAR WEAPONS DEBATE

Sex and gender are important concepts for understanding the effects of weapons on individuals. While sex relates to physical and biological characteristics that distinguish males and females, gender is a cultural construct referring to the roles, behaviours, activities, and attributes that a society considers appropriate or 'normal' for girls, boys, women, men, non-binary or gender-fluid persons. Gender norms function as social rules of behaviour, setting out what is desirable and possible as a man, woman or non-binary person. Gender norms are context- and time-specific. They are not fixed, but changeable.⁴

2.1 SEX-DEPENDENT EFFECTS OF IONIZING RADIATION

The long-term effects of nuclear weapons can differ between the sexes. A life-span study of survivors of the 1945 nuclear weapon attacks on Hiroshima and Nagasaki in Japan found that the risk of developing and dying from solid cancer due to ionizing radiation exposure was nearly twice as high for women as for men.⁵ Sex-specific cancers and female breast cancer seem to be the main reasons for the heightened risk for women. When

these cancers are excluded from analysis, the absolute rates were essentially equal.⁶

Research on rates of solid cancers following local fallout from Soviet atmospheric nuclear weapon testing in Kazakhstan also indicates higher rates of certain kinds of cancer, for example of the esophagus or stomach, in women.⁷ Moreover, studies of the effects of the 1986 Chernobyl nuclear power plant disaster, in which ionizing radiation was released into the surrounding environment, found elevated levels of thyroid cancer in children and adolescents in which diagnosis was significantly higher in females.⁸

Pregnancy-related complications comprise another set of sex-specific effects. Pregnant women exposed to high doses of ionizing radiation are at risk of harm to their children, including malformations and mental health issues.⁹ The risk of spontaneous abortion and stillbirth is also heightened if pregnant women are exposed to a certain level of radiation.¹⁰

There are also indications of an impact of ionizing radiation on men's reproductive health. For example, loss of fertility due to abnormal sperm has been reported in people who worked in the clean-up of the Chernobyl nuclear disaster.¹¹

4 For the definition of gender, see Gender Equality Glossary, UN Women Training Centre, <https://trainingcentre.unwomen.org/mod/glossary/view.php?id=36>.

5 Risk here referring to Excess Relative Risk per Gray (ERR/Gy). See Ozasa, Kotaro et al. 2012. "Studies of the Mortality of Atomic Bomb Survivors, Report 14, 1950–2003: An Overview of Cancer and Noncancer Diseases". *Radiation Research* 177 (3): 229–243. <https://doi.org/10.1667/RR2629.1> p. 232.

6 Preston, D. L. et al. 2007. "Solid Cancer Incidence in Atomic Bomb Survivors: 1958–1998". *Radiation Research* 168 (1): 1–64. <https://doi.org/10.1667/RR0763.1> p. 55.

7 Bauer, Susanne et al. 2005. "Radiation Exposure Due to Local Fallout from Soviet Atmospheric Nuclear Weapons Testing in Kazakhstan: Solid Cancer Mortality in the Semipalatinsk Historical Cohort, 1960–1999". *Radiation Research* 164 (4): 409–419. <https://doi.org/10.1667/RR3423.1>.

8 United Nations Scientific Committee on the Effects of Atomic Radiation. 2008. "Report to the General Assembly with Scientific Annexes, 'Sources and effects of ionizing radiation'". Volume II—Scientific Annexes C, D and E. UNSCEAR. p. 61, figure VIII on health effects due to radiation from the Chernobyl accident.

9 See Valentin, J. 2003. "Biological Effects after Prenatal Irradiation (Embryo and Fetus)". *Annals of the ICRP* 33 (1–2): 1–206. [https://doi.org/10.1016/S0146-6453\(03\)00021-6](https://doi.org/10.1016/S0146-6453(03)00021-6).

10 Dimmen, Anne Guro. 2014. "The Humanitarian Impacts of Nuclear Weapons from a Gender Perspective", ILPI-UNIDIR Vienna Conference Series, paper No 5. ILPI-UNIDIR. p. 2.

11 Cheburakov, Iu and Cheburakova, O. P. n.d. "Disorders of Spermatogenesis in People Working at the Clean-up of the Chernobyl Nuclear Power Plant Accident". *Radiationa Biologia, Radioecologia* 33 (6): 771–74. <http://www.ncbi.nlm.nih.gov/pubmed/8293101>.



2.2 GENDER-RELATED EFFECTS OF NUCLEAR BOMBINGS AND ACCIDENTS

In addition to biological differences, researchers have explored how socially constructed characteristics and relationships led to differentiated experiences of a nuclear bombing or accident. For instance, there are indications that mothers with children had a higher prevalence of mental health problems after the nuclear accidents of Three Mile Island (1979, United States) and Chernobyl (1986, USSR).¹²

Moreover, images and beliefs related to women's bodies and marriage or reproduction seem to contribute to the intensified discrimination experienced by women exposed to radiation. Across different cultures, women are often blamed for sterility and abnormalities in offspring—even though, in the general population, infertility problems tend to affect men and women at virtually equal rates.¹³

Women survivors of the atomic bombings in Japan experienced this type of stigmatization and discrimination; they were deemed 'contaminated' and treated with fear and suspicion by some others in

Japanese society.¹⁴ Similarly, in the Marshall Islands, following exposure due to US nuclear weapons tests, women reported experiencing shame and stigmatization during the relocation process, particularly when they were subjected to examinations while naked in the presence of their male relatives.¹⁵ Many of these women feared the prospect of marriage and motherhood, worrying that the radiation would continue to compromise successive generations.¹⁶

In Marshallese society, where land is passed from mother to child, women displaced from their land were denied "their right to exercise their cultural and other rights as custodians of land in society".¹⁷ Marshallese men, on the other hand, were hurt by the restrictions placed on fishing and gathering food in the aftermath of nuclear tests. This undermined their traditional roles as food provider for their families and impacted their economic status, as well as their perceptions of self-worth.¹⁸

2.3 RESEARCH UPTAKE IN MULTILATERAL PROCESSES

Over the past five years, references to the disproportionate impact of ionizing radiation on women and girl's health have featured in national statements and

12 On Three Mile Island, see Yamada, Michiko and Izumi, Shizue. 2002. "Psychiatric Sequelae in Atomic Bomb Survivors in Hiroshima and Nagasaki Two Decades after the Explosions". *Social Psychiatry and Psychiatric Epidemiology* 37 (9): 409–415. <https://doi.org/10.1007/s00127-002-0572-5>. p. 414. See also Dew, M. A. and Bromet, E. J. 1993. "Predictors of Temporal Patterns of Psychiatric Distress during 10 Years Following the Nuclear Accident at Three Mile Island". *Social Psychiatry and Psychiatric Epidemiology* 28 (2): 49–55. <https://doi.org/10.1007/BF00802091>. p. 54. On Chernobyl, see Havenaar, J. M. et al. 1996. "Mental Health Problems in the Gomel Region (Belarus): An Analysis of Risk Factors in an Area Affected by the Chernobyl Disaster". *Psychological Medicine* 26 (4): 845–55. <https://doi.org/10.1017/S0033291700037879>.

13 Héritier, Françoise. 1984. "Le Sang Du Guerrier et Le Sang Des Femmes". *Les Cahiers Du GRIF* 29 (1): 7–21. <https://doi.org/10.3406/grif.1984.1629>.

14 Todeshini, Maya. 1999. "Illegitimate Sufferers: A-Bomb Victims, Medical Science, and the Government", *Daedalus*, 128 (2). p. 73.

15 Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes. Addendum: Mission to the Marshall Islands (27-30 March 2012) and the United States of America (24-27 April 2012). 3 September 2012. A/HRC/21/48/Add.1. <https://documents-dds-ny.un.org/doc/UNDOC/GEN/G12/163/76/PDF/G1216376.pdf>.

16 Johnston, Barbara Rose. 2013. "Nuclear Weapons Tests, Fallout, and the Devastating Impact on Marshall Islands Environment, Health and Human Rights", in Fihn, Beatrice (ed.). *Unspeakable Suffering*. Geneva: Reaching Critical Will of the Women's International League for Peace and Freedom. p. 91. See also Bagshaw, Simon. 2014. "Population Displacement : Displacement in the aftermath of nuclear weapon detonation events", ILPI-UNIDIR Vienna Conference Series, paper No 4. ILPI-UNIDIR. <https://www.unidir.org/files/publications/pdfs/population-displacement-en-619.pdf>

17 Report of the Special Rapporteur. A/HRC/21/48/Add.1. p. 9.

18 Johnston, Barbara Rose. 2013. "Nuclear Weapons Tests, Fallout, and the Devastating Impact on Marshall Islands Environment, Health and Human Rights".



Member States representatives gather for the opening session of the 2018 Preparatory Committee for the 2020 NPT Review Conference.

NPT working papers.¹⁹ The Chair's factual summary from the 2018 Preparatory Committee for the 2020 NPT Review Conference noted the disproportionate impact of ionizing radiation on women, and suggested that this issue should be factored into the discussions in the current review cycle.²⁰ The Chair of the following Preparatory Committee proposed that the 2020 NPT Review Conference should recognize the disproportionate impact of ionizing radiation on women and girls.²¹

The recently negotiated Treaty on the Prohibition of Nuclear Weapons, which seeks to ban nuclear weapons, acknowledges in its preamble the disproportionate impact of nuclear weapons on women and girls, "including as a result of ionizing radiation". Correspondingly, the Treaty contains an operational clause (article 6.1) mandating States Parties to provide

age- and gender-sensitive assistance to individuals under its jurisdiction affected by the use or testing of nuclear weapons. Such assistance includes medical care, rehabilitation, and psychological support, as well as promoting social and economic inclusion.²²

These examples illustrate the value of producing research and generating gender-disaggregated data that can better inform the development of arms control and disarmament measures. Otherwise, there is a risk that gender-blind or gender-neutral arms control and disarmament programmes will inadvertently reinforce existing gender inequalities.

19 See Ireland. 2017. "Gender, Development and Nuclear Weapons". 2017 Preparatory Committee for the 2020 Review Conference of the NPT. NPT/CONF.2020/PC.I/WP.38. 10 May 2017; Ireland. 2018. "Impact and Empowerment: The Role of Gender in the Non-Proliferation Treaty". 2018 Preparatory Committee for the 2020 Review Conference of the NPT. NPT/CONF.2020/PC.II/WP.38. 24 April 2018; Australia, Canada, Ireland, Namibia, Sweden and the United Nations Institute for Disarmament Research. 2019. "Integrating Gender Perspectives in the Implementation of the Treaty on the Non-Proliferation of Nuclear Weapons". 2019 Preparatory Committee for the 2020 Review Conference of the NPT. NPT/CONF.2020/PC.III/WP.27. 18 April 2019; Ireland. 2019. "Gender in the NPT: Recommendations for the 2020 Review Conference". 2019 Preparatory Committee for the 2020 Review Conference of the NPT. NPT/CONF.2020/PC.III/WP.48. 7 May 2019.

20 NPT. 2018. "Chair's Factual Summary". 2018 Preparatory Committee for the 2020 Review Conference of the NPT. NPT/CONF.2020/PC.II/WP.41, 16 May 2018.

21 NPT. 2019. "Recommendations by the Chair to the 2020 NPT Review Conference". 2019 Preparatory Committee for the 2020 Review Conference of the NPT. NPT/CONF.2020/PC.III/WP.49. 10 May 2019.

22 Treaty on the Prohibition of Nuclear Weapons, available at: <https://undocs.org/A/CONF.229/2017/8>.



Vaccination against Ebola.



3. WHAT DO WE KNOW ABOUT SEX-SPECIFIC AND GENDERED EFFECTS OF CHEMICAL AND BIOLOGICAL WEAPONS?

Several States have developed and used chemical weapons, including in attacks on civilian populations in the Rif War, the Italian–Abyssinian conflict, the North Yemeni civil war, the Iran–Iraq conflict and, most recently, in the ongoing Syrian conflict.²³ Non-State actors have also used chemical weapons. For example, the Japanese cult Aum Shinrikyo released Sarin in the Tokyo subway in 1995.²⁴

Some State and non-State actors are known to have initiated biological weapons programmes. However, there is only a small number of recorded cases where States or terrorists have actually used biological weapons. One of those instances, the so-called ‘Amerithrax’ attack in 2001, involved the distribution of Anthrax through the US postal system.

Despite these occurrences there are serious gaps in data on the effects of these weapons.²⁵ Epidemiological information on past incidents of biological and chemical weapons use has largely been poorly recorded.²⁶ Moreover, data acquired through past human experimentation involving these weapons may be misleading as they typically focused on healthy fighting-aged men.²⁷ Consequently, much of the available data is poorly suited to understanding the effects of these weapons among untrained and ill-prepared civilian populations.

Given the limitations in reliable historical data on the consequences of chemical and biological weapons, the analysis will employ proxy indicators, such as the 2014–2016 natural outbreak of Ebola Virus Disease in West Africa and the 1984 Bhopal, India, chemical accident. These experiences can help in understanding the potential sex-specific and gendered impacts of biological and chemical weapons and their relevance to the provision of assistance under the BWC and CWC.

3.1 SEX-SPECIFIC EFFECTS

Caution is required when analysing evidence of sex-specific effects of chemical or biological agents. Statistical correlations cannot be equated with causation.

3.1.1 REPRODUCTIVE HEALTH EFFECTS

Exposure to chemical and biological weapons has been associated with harm to the reproductive health of men and women, as well as birth defects and long-term health consequences for children born to exposed parents. For example, following the recent use of chemical weapons in

23 For example, on the Rif War, see Balfour, Sebastian. 2002. “The Secret History of Chemical Warfare Against Moroccans”, in *Deadly Embrace—Morocco and the Road to the Spanish Civil War*. Oxford University Press; On the Italian–Abyssinian conflict, see Duggan, Christopher. 2012. *Fascist Voices: An Intimate History of Mussolini’s Italy*. The Bodley Head; On the North Yemeni civil war, see Orkaby, Asher. 2013. “Forgotten Gas Attacks in Yemen Haunt Syria Crisis”. *Bloomberg*, 15 September 2013. <https://www.bloomberg.com/view/articles/2013-09-15/forgotten-gas-attacks-in-yemen-haunt-syria-crisis>; On the Iran–Iraq conflict, see Russell, Richard L. 2005. “Iraq’s Chemical Weapons Legacy: What Others Might Learn from Saddam”. *Middle East Journal*, 59 (2): 187–208.

24 Danzig, Richard et al. 2012. “Aum Shinrikyo Insights into How Terrorists Develop Biological and Chemical Weapons”. https://s3.amazonaws.com/files.cnas.org/documents/CNAS_AumShinrikyo_Danzig_1.pdf?mtime=20160906080509

25 OPCW. 2018. “International Symposium on Medical Treatment of Chemical Warfare Victims: Challenges and Hopes”.

26 Revill, James. 2017. “Past as Prologue? The Risk of Adoption of Chemical and Biological Weapons by Non-State Actors in the EU”. *European Journal of Risk Regulation* 8 (2). <https://doi.org/10.1017/err.2017.35>; Perry Robinson, Julian. 2016. “Gaps and Lies in Information on the Ghouta Event”. HSPOP Syria Collection.

27 Okumura, Tetsu et al. 2015. “The Tokyo Subway Sarin Attack”, in *Handbook of Toxicology of Chemical Warfare Agents*, 27–35. <https://doi.org/10.1016/B978-0-12-800159-2.00004-X>



Syria, studies report a higher incidence of miscarriages among women exposed to a chemical attack. Data collected from 211 pregnant women who visited the Al Ghouta Hospital during September, October, and November of 2014 suggests a 45 per cent a rate of miscarriages among the exposed group compared with 14 per cent in the non-exposed women.²⁸ Similarly, the use of chemical weapons in the Iraqi al-Anfal campaign against the Kurds is reported to have had significant effects causing “stillbirths and childhood malformations and deaths”.²⁹

Concern over reproductive health and birth defects is supported by research into chemical accidents. Studies on the impact of the Bhopal incident of 1984, when methyl isocyanate was accidentally released into the surrounding area killing an estimated 3,800 people, found persistent, long-term gynecological problems among the exposed population, with over 40 per cent of pregnancies resulting in stillbirths and miscarriages.³⁰

Studies have also found an association between exposure to certain biological agents and reproductive health complications. For example, Anthrax, which has been prominent in past biological weapons programmes, is “associated with maternal and fetal death”.³¹ Whereas the World Health Organization (WHO) has reported that Ebola “in pregnancy is associated with a high rate of obstetric complications and poor maternal and

perinatal outcomes, with neonatal mortality approaching 100%”.³²

Chemical and biological incidents—regardless of origin—have also historically correlated with obstetric complications among those exposed to infectious disease or toxic chemicals. This correlation should be taken into account in the provision of assistance, including through the development of follow-up protocols for pregnant women. There are already recommendations in this regard. For example, WHO guidelines propose counselling and close clinical follow-up, including antenatal and nutritional care, for pregnant women affected by Ebola.³³

Prenatal exposure to certain toxic chemicals has also been associated with birth defects. Studies showed altered brain activation in adolescents whose mothers were exposed to organophosphate pesticides—the chemical family to which the highly toxic nerve agents belong—during pregnancy.³⁴ Sex differences for organophosphates and brain activation during a language comprehension task were also observed, with more activation seen in areas of the brain in males than in females.

At present the significance of this activation is unclear and it may mean that more areas of the brain need to be activated to enable specific tasks to be carried out.³⁵ Studies of this kind are important for identifying areas

28 Hakeem, Omar and Jabri, Sawzan. 2015. “Adverse Birth Outcomes in Women Exposed to Syrian Chemical Attack”. *The Lancet Global Health* 3 (4): e196. [https://doi.org/10.1016/s2214-109x\(15\)70077-x](https://doi.org/10.1016/s2214-109x(15)70077-x).

29 Gosden, Christine et al. 1999. “Examining Long-Term Severe Health Consequences of CBW Use Against Civilian Populations”. *Disarmament Forum* 3 (Open Forum).

30 Amnesty International. 2004. “Clouds of Injustice: Bhopal Disaster 20 Years On”; Varma, D. R. 1987. “Epidemiological and Experimental Studies on the Effects of Methyl Isocyanate on the Course of Pregnancy”. *Environmental Health Perspectives* 72: 153–57. <https://doi.org/10.1289/ehp.8772153>.

31 Meaney-Delman, Dana et al. 2014. “Special Considerations for Prophylaxis for and Treatment of Anthrax in Pregnant and Postpartum Women”. *Emerging Infectious Diseases* 20 (2). <https://doi.org/10.3201/eid2002.130611>.

32 WHO. 2016. “Clinical Care for Survivors of Ebola Virus Disease”. <https://www.who.int/csr/resources/publications/ebola/guidance-survivors/en/>. p. 21.

33 Ibid.

34 Sagiv, Sharon K. et al. 2019. “Prenatal Exposure to Organophosphate Pesticides and Functional Neuroimaging in Adolescents Living in Proximity to Pesticide Application”. *Proceedings of the National Academy of Sciences* 116 (37): 18347–18356. <https://doi.org/10.1073/pnas.1903940116>.

35 Ibid.



of research to explore, but the findings also need to be treated with caution as there are many factors between in utero existence and adolescence which could influence brain activity.

Male Infertility

Exposure to chemical and biological agents has also been associated with male infertility and other reproductive health issues. For example, infertility due to defects in sperm production has been shown to be twice as frequent in men exposed to mustard gas than in the general population. In a study of 91 couples, in which the men were suspected of being exposed to mustard gas during the Iran–Iraq war, 40 of the couples were reported to have difficulty conceiving children and some 80 per cent of the infertility problems were male-related. In the general population the figure was some 40–50 per cent, that is, where infertility problems are roughly equal between the sexes.³⁶ In order to confirm and strengthen the validity of these results, it is worth repeating this type of observational study, including a larger cohort and more details on exposure to mustard gas.³⁷

Men who survived Ebola have also reported erectile dysfunction and testicular pain.³⁸ According to the WHO, erectile dysfunction is a particularly frequent complaint. Again, it should be noted that a causal link of these conditions with Ebola—as well as a number of other potential

chemical and biological agents—remains to be determined. In addition to biological factors, psychosocial mediators may be implicated.

3.1.2 DIFFERENCES IN SUSCEPTIBILITY

There are serious gaps in the literature on how chemical or biological weapons affect individuals.³⁹ Nonetheless, studies have suggested that males are more susceptible to organophosphates. Males are at greater risk than females of various neurodevelopmental and neurodegenerative disorders, such as autism and the condition known as amyotrophic lateral sclerosis, a disease of the nervous system which weakens muscles and affects nerve cells in the brain and spinal cord. Several researchers have deemed understanding the immediate and long-term effects of organophosphate exposure across sexes as critical as it could advance the understanding of how this family of chemicals induces neurotoxicity and disease.⁴⁰

When it comes to biological agents, research with male and female animals has been able to uncover several factors impacting vaccine-induced immunity. Such factors include sex, genetics, environment, nutrition and microbiome. Females typically develop higher antibody responses and experience more adverse events following vaccination than males. This enhanced

36 Shakeri, S. et al. 2007. "Long-Term Effects of Exposure to Mustard Gas on Male Infertility". *Iranian Red Crescent Medical Journal* 9 (2): 59–62.

37 The mechanism whereby sulfur mustard (mustard gas) causes damage to the sperm is unclear but may involve a process known as oxidative stress. See *ibid.*

38 WHO. 2016. "Clinical Care for Survivors of Ebola Virus Disease". <https://www.who.int/csr/resources/publications/ebola/guidance-survivors/en/>. p. 17.

39 For example, none of the OPCW materials on key agents discussed above discuss sex-specific effects. See OPCW. 2018. "Choking Agents and their Countermeasures". https://www.opcw.org/sites/default/files/documents/2018/08/Choking%20Agents%20and%20their%20Countermeasures-2018_0.pdf; OPCW. 2018. "Organophosphorus (OP) Nerve Agents and Countermeasures"; OPCW. 2018. "Blister Agents and their Countermeasures". <https://www.opcw.org/sites/default/files/documents/2018/08/Blister%20Agents%20and%20their%20Countermeasures-2018.pdf>; OPCW. 2018. "Blood Agents and their Countermeasures". <https://www.opcw.org/sites/default/files/documents/2018/08/Blood%20Agents%20and%20their%20Countermeasures-2018.pdf>.

40 See, for example, Comfort, Nicole and Re, Diane B. 2017. "Sex-Specific Neurotoxic Effects of Organophosphate Pesticides Across the Life Course". *Current Environmental Health Reports* 4 (4): 392–404. <https://doi.org/10.1007/s40572-017-0171-y>; see also Hung, Dong-Zong et al. 2015. "The Long-Term Effects of Organophosphates Poisoning as a Risk Factor of CVDs: A Nationwide Population-Based Cohort Study". *PLOS ONE* 10 (9): e0137632. <https://doi.org/10.1371/journal.pone.0137632>; Torres-Rojas, Carolina and Byron C. Jones. 2018. "Sex Differences in Neurotoxicogenetics". *Frontiers in Genetics* 9 (June). <https://doi.org/10.3389/fgene.2018.00196>.



immune reactivity among females is thought to render females more resistant to multiple infectious diseases, including agents that could be used in biological warfare.⁴¹

It is also evident that males and females exhibit contrasting degrees of susceptibility to infectious and non-infectious inflammatory diseases. Research by Chamekh and colleagues demonstrated that this difference is “particularly observed in respiratory diseases where human males are more likely to be affected by infection-induced acute inflammations compared to females”.⁴²

Sex-specific differences affect the immune response and can therefore affect outcomes of vaccination. Yet few studies stratify data in terms of sex. Currently, most vaccines are developed based on a male-dominated participant pool. Yet, the same set of vaccines is administered to everyone. The effects of sex and pregnancy should be considered in all guidelines and recommendations for vaccines, including vaccination against agents used in biological warfare. This represents an opportunity for researchers and public health officials to better understand and explain individual variability in vaccine efficacy. In fact, sex-specific vaccine strategies may provide enhanced protection for females.⁴³

Observations related to Ebola also point to sex-specific differences in immunization and biological response to infectious disease. Although male and female

persons face similar risks, on average, of being infected by Ebola, a higher survival rate was evident among female patients.⁴⁴ Moreover, the average interval from symptom onset to hospitalization was approximately 0.5 days shorter among female patients than among male patients in all countries.⁴⁵ Male patients spent 12.5 per cent longer (approximately 12 hours) on average in the community while symptomatic. This could be particularly important if infectiousness increases after onset, making the risk of transmission in that last half-day higher than average. This suggests that, in the event of a biological attack, public health measures to reduce community-based transmission might benefit from awareness of sex-specific differences.⁴⁶

3.2 AGE-SPECIFIC EFFECTS

In addition to sex-specific effects, chemical and biological weapons could disproportionately affect children, particularly if the agents are aerosolized, that is, dispersed through the air. As children have a higher number of respirations per minute, they are at risk of being exposed to a relatively greater dosage of aerosolized chemical or biological agents.⁴⁷

In terms of biological weapons, advances in understanding of the effects of disease on pediatric populations has identified how

41 Fischinger, Stephanie et al. 2019. “Sex Differences in Vaccine-Induced Humoral Immunity”. *Seminars in Immunopathology* 41 (2): 239–49. <https://doi.org/10.1007/s00281-018-0726-5>.

42 Chamekh, Mustapha et al. 2017. “Differential Susceptibility to Infectious Respiratory Diseases between Males and Females Linked to Sex-Specific Innate Immune Inflammatory Response”. *Frontiers in Immunology* 8 (December). <https://doi.org/10.3389/fimmu.2017.01806>.

43 Fischinger, Stephanie et al. 2019. “Sex Differences in Vaccine-Induced Humoral Immunity”. *Seminars in Immunopathology* 41 (2): 239–49. <https://doi.org/10.1007/s00281-018-0726-5>; Klein, S. L. et al. 2015. “Sex-Based Differences in Immune Function and Responses to Vaccination”. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 109 (1): 9–15. <https://doi.org/10.1093/trstmh/tru167>; Oertelt-Prigione, Sabine. 2012. “The Influence of Sex and Gender on the Immune Response”. *Autoimmunity Reviews* 11 (6–7): A479–85. <https://doi.org/10.1016/j.autrev.2011.11.022>.

44 WHO Ebola Response Team. 2016. “Ebola Virus Disease among Male and Female Persons in West Africa”. *New England Journal of Medicine* 374 (1): 96–98. <https://doi.org/10.1056/NEJMc1510305>.

45 Ibid.

46 Ibid.

47 Committee on Environmental Health and Committee on Infectious Diseases. 2000. “Chemical-Biological Terrorism and Its Impact on Children: A Subject Review”. *Pediatrics* 105 (3): 662–70. <https://doi.org/10.1542/peds.105.3.662>.



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Vaccination Against Ebola.

children may be particularly susceptible to certain viruses.⁴⁸

Although limited, there is data to suggest that children are more sensitive than adults to exposure to chlorine, an agent used extensively as a chemical weapon in the First World War and, more recently, in the ongoing civil war in Syria. Infants have immature blood–brain barriers, which means there is greater penetration of chemicals from blood to brain than in adults. It is also apparent that children have a longer period over which chronic effects of exposure may become manifest.⁴⁹

Age-based differences in the effect of chemical weapons are, to some extent, illustrated in the wider literature. A study of 344 children who were less than 10 years

of age at the time of exposure to chemical weapons in Iraqi Kurdistan found that the children presented with more frequent lung and gastrointestinal symptoms when compared with adults and a matching control group of 517 children.⁵⁰

Concerning the provision of assistance, consideration needs to be given to the application of medical countermeasures following chemical and biological weapons use. For example, dosage for post-exposure treatment against chemical weapons agents may require adjustment based upon the child's weight.⁵¹ Similar adjustments may be needed to protect children against biological agents, although the efficacy of vaccines for children in this regard are understudied.⁵²

48 Murray for example, notes that "Children, in particular, are highly susceptible to the H1N1 virus". See Murray, Colonel John S. 2010. "A Collaborative Approach to Meeting the Psychosocial Needs of Children during an Influenza Pandemic". *Journal for Specialists in Pediatric Nursing* 15 (2): 135–43. <https://doi.org/10.1111/j.1744-6155.2009.00229.x>

49 US Agency for Toxic Substances and Disease Registry (ATSDR). 2010. "Toxicological Profile for Chlorine". November 2010. CAS#: 7782-50-5 <https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=1079&tid=36>.

50 Most of the children were exposed to mustard gas but nerve agent exposure may also have occurred given the location of the victims when exposure occurred. Talabani JM, Ali AL, Kadir AM, et al. 2018. "Long-term health effects of chemical warfare agents on children following a single heavy exposure". *Human & Experimental Toxicology*, 37 (8). pp. 836-847. <https://doi.org/10.1177/0960327117734620>.

51 Mueller, Carolyn R. 2006. "The Effects of Weapons of Mass Destruction on Children". *Journal for Specialists in Pediatric Nursing* 11 (2): 114–28. <https://doi.org/10.1111/j.1744-6155.2006.00053.x>.

52 Committee on Environmental Health and Committee on Infectious Diseases. 2000. "Chemical-Biological Terrorism and Its Impact on Children: A Subject Review". *Pediatrics* 105 (3): 662–70. <https://pediatrics.aappublications.org/content/105/3/662.long>.



Additionally, there may be important logistical factors to consider in chemical or biological disaster response. For example, to minimize any further trauma and increase efficiency in decontamination and evaluation, children and parents (or accompanying adults) should remain together, whenever possible.⁵³

3.3 GENDERED EFFECTS

Health effects do not take place in a vacuum—the way they are experienced is shaped by cultural aspects, including gender. Therefore, in addition to possible sex-specific effects, it is important to consider potential gendered consequences of the use of chemical and biological weapons against civilians.

3.3.1 SOCIAL ROLES AND EXPOSURE: WOMEN AS THE PRIMARY CAREGIVERS

Understanding how gender norms structure societies can help uncover different patterns of exposure to chemical or biological agents. For example, in most societies, women typically shoulder the larger share of care work. In responding to disasters, women's roles as caregivers can expand dramatically as they assume both a frontline and long-term caregiving role.⁵⁴

In the event of a chemical or biological attack, women may face an increased burden of care within families that have chronically ill members.

Natural disease outbreaks, such as the Ebola epidemic, can help to shed light on how gender roles can lead to different patterns of exposure to infectious disease. In most societies recently affected by Ebola, women are usually responsible for the provision of care and often play an important role in burial practices, including washing the bodies of the deceased. As a result, women faced a greater risk of exposure to bodily fluids or blood of infected individuals.⁵⁵ This social configuration can, in part, explain the disproportionate number of female Ebola cases in some countries.⁵⁶ In Guinea, the WHO reports that women, who are the principal caregivers, are disproportionately affected.⁵⁷ This is reflected in statistics from other countries affected by Ebola. In the Democratic Republic of the Congo, the WHO estimated that "females accounted for 62% (280/450) of overall cases where sex was reported".⁵⁸ In Liberia, "75% of those who have been infected or killed from Ebola are women".⁵⁹

In some cases, the heightened risk of contact with infected individuals faced by women can be the result of a premeditated strategy. As one WHO report stated: "an international investigator asked a group of men how they avoided contracting EHF [Ebola haemorrhagic fever], and

53 OPCW. 2019. "Practical Guide for Medical Management of Chemical Warfare Casualties". https://www.opcw.org/sites/default/files/documents/2019/05/Full%20version%202019_Medical%20Guide_WEB.pdf.

54 Enarson, Elaine and Hearn Morrow, Betty. 1998. "Why Gender? Why Women? An Introduction to Women and Disaster", in Enarson, Elaine and Hearn Morrow, Betty (eds). *The Gendered Terrain of Disaster: Through Women's Eyes*.

55 Fawole, Olufunmilayo et al. 2016. "Gender Dimensions to the Ebola Outbreak in Nigeria". *Annals of African Medicine* 15 (1): 7. <https://doi.org/10.4103/1596-3519.172554>; Hewlett, Barry S. and Amola, Richard P. 2003. "Cultural Contexts of Ebola in Northern Uganda". *Emerging Infectious Diseases* 9 (10): 1242–48. <https://doi.org/10.3201/eid0910.020493>.

56 It should be noted that, in Sierra Leone, statistical data showed cases were closer to parity between men and women: "In February 2015, out of a total of 11,132 confirmed and probable Ebola Virus Disease cases, 5,396 (48.4 per cent) were male, while 5,736 (51.6 per cent) were female". Carter, Simone E. et al. 2017. "Mainstreaming Gender in WASH: Lessons Learned from Oxfam's Experience of Ebola". *Gender & Development* 25 (2): 205–20. <https://doi.org/10.1080/13552074.2017.1339473>. p. 212.

57 WHO. 2014. "Barriers to Rapid Containment of the Ebola Outbreak". <https://www.who.int/csr/disease/ebola/overview-august-2014/en/>.

58 WHO. 2018. "Ebola virus disease – Democratic Republic of the Congo." 6 December 2018.

59 Akanni, Tooni. 2014. "Confronting Ebola in Liberia: The Gendered Realities". Open Democracy. <https://www.opendemocracy.net/en/5050/confronting-ebola-in-liberia-gendered-realities-0/>.



An Ebola survivor and now child care provider at the Child Care Centre washes a child whose mother is being treated at an Ebola Treatment Unit in Guinea.



they responded that they made sure that women cared for the sick—thus protecting males from infection”.⁶⁰ Understanding these differences in patterns of exposure to biological agents that result from gendered roles can help inform targeted response strategies design to minimize the spread of infection.

The difficulties in fulfilling social roles after infectious or toxic events can pose additional challenges to women. The 1984 Bhopal tragedy offers examples of long-term gendered harm. Beyond the deaths and injuries, the exposure to toxic chemicals may have rendered women more vulnerable to abuse, as they became less able to fulfil the domestic activities.⁶¹ In situations where male chemical-warfare victims are revered for the sacrifices they made in protecting the country this can place increased pressure on female spouses when society expects them to continue to provide support for their partners.

In these situations, women may feel compelled to stay in a marriage long after it might have ended under normal circumstances. For example, the divorce rate in couples in Iran where the male partner was exposed to chemical weapons is 1.5 per cent against a national average of 14 per cent. Other evidence suggests that the quality of life for caregivers of chemical weapons victims is much affected by their spouse’s injury. Moreover, although support is available in many instances for male victims of chemical weapons, much

less is available for their caregivers.⁶² This remains a poorly researched issue.

3.3.2 DISPLACEMENT

The accidental or deliberate release of toxic chemicals will likely result in the evacuation or displacement of large sections of the effected population.⁶³ Displacement tends to amplify vulnerabilities and exacerbates pre-existing inequalities. This can create an additional burden on women as it can force them to assume additional workloads and limit their access to food, shelter and medical supplies. In conflict situations, displacement also leaves women and girls increasingly vulnerable to sexual violence and abuse.⁶⁴

3.3.3 WOMEN AND POISON: THE GENDERED STEREOTYPE OF THE WITCH

There is a long literary and mythological history of association between women and poison.⁶⁵ In some cultures this continues to manifest through the witchcraft belief system, in which ‘witchcraft’ accounts for unnatural deaths.⁶⁶ This can have very real implications concerning the apportioning of blame for deaths caused by biological and chemical weapons. For example, in his account of the use of chemical and biological weapons in the Rhodesian Bush

60 WHO. 2007. *Addressing Sex and Gender in Epidemic-Prone Infectious Diseases*. <https://www.who.int/csr/resources/publications/SexGenderInfectDis.pdf>.

61 Amnesty International. 2004. “Clouds of Injustice: Bhopal Disaster 20 Years On”.

62 Mousavi, B. “Impact of Chemical Weapons on Psycho-Social Health and Well Being”. Presented at OPCW. 2018. “International Symposium on Medical Treatment of Chemical Warfare Victims: Challenges and Hopes”.

63 In some cases, States may have deliberately employed chemical weapons, in part, to displace or uproot populations. Hardi speaks of Iraqi chemical attacks as being designed in part to terrify and uproot civilians. Hardi, Choman. 2011. *Gendered Experiences of Genocide: Anfal Survivors in Kurdistan-Iraq*. <https://www.routledge.com/Gendered-Experiences-of-Genocide-Anfal-Survivors-in-Kurdistan-Iraq-1st/Hardi/p/book/9780754677154>; See also Abdulkarim Ekzayez. 2018. “Attacks on Healthcare in Syria Look Like a Bloody Strategy of Forced Displacement”. 2018. <https://www.chathamhouse.org/expert/comment/attacks-healthcare-syria-look-bloody-strategy-forced-displacement>.

64 Gururaja, Srilakshmi. 2000. “Gender Dimensions of Displacement”. *Forced Migration Review* 9 (December). <https://www.fmreview.org/sites/fmr/files/FMRdownloads/en/gender-and-displacement/gururaja.pdf>.

65 Hallissy, Margaret. 1987. *Venomous Woman: Fear of the Female in Literature*.

66 Quarmyne, Maakor. 2011. “Witchcraft: A Human Rights Conflict Between Customary/Traditional Laws and the Legal Protection of Women in Contemporary Sub-Saharan Africa”. *William Mary Journal of Women and the Law* 17 (2): 475-508.



war, Cross points out that “mysterious deaths are seen as poisonings and [incorrectly] attributed to the work of witches”. Further adding “Guerrilla-orchestrated witch hunts targeted adult females in the village and subjected the suspects to interrogation, torture and eventual execution”.⁶⁷ This highlights the importance of clear public health messaging around the nature of the cause of harm in the prevention of misattribution.

3.3.4 PSYCHOLOGICAL IMPACTS

The psychological and social effects of exposure to chemical and biological weapons is not well researched and far more rigorous investigation is required. Nonetheless, it is reasonable to assume that a chemical or a biological attack will cause fear and confusion among populations and may lead to large-scale panic.⁶⁸ Exposure to chemical or biological weapons can also result in significant individual psychological impacts, including prolonged post-traumatic stress disorder in both women and men.⁶⁹

Studies of the long-term effects of the Bhopal chemical accident suggest the event continued to have a psychological impact three decades later, including

through anxiety, depression, post-traumatic stress disorder, and adjustment disorders.⁷⁰ Survivors of Ebola have faced a “traumatic illness both in terms of symptom severity and mortality rates”.⁷¹ Moreover, in many cases survivors will have further witnessed the death of loved ones, a factor that can add to the psychological trauma.⁷² A survey in Sierra Leone undertaken a year after the Ebola outbreak concluded that three quarters of the participants expressed symptoms of post-traumatic stress disorder.⁷³ Another study found that an “Ebola outbreak has profound psychosocial implications at individual, community and international levels”.⁷⁴

While post-traumatic stress disorder (PTSD) affects women and men, boys and girls, it does not necessarily affect them equally. Research suggests that women are more likely to develop PTSD under certain circumstances. One study found that women are approximately twice as likely as men to develop PTSD following exposure to a traumatic event.⁷⁵ Another study on PTSD following terror attacks concluded that the “odds of [women] developing posttraumatic stress symptoms are six times higher than those of men”.⁷⁶ The causes of these results are unclear and scholars have speculated this may be a result of “differences in appraisal of

67 Cross, Glenn. 2017. *Dirty War: Rhodesia and Chemical Biological Warfare 1975-1980*. p. 83.

68 Wessely, S. et al. 2001. “Psychological Implications of Chemical and Biological Weapons”. *BMJ* 323 (7318): 878–879. <https://doi.org/10.1136/bmj.323.7318.878>.

69 Moradi, Faraidoun et al. 2019. “Health Perspectives among Halabja’s Civilian Survivors of Sulfur Mustard Exposure with Respiratory Symptoms—A Qualitative Study”. *PLOS ONE* 14 (6). <https://doi.org/10.1371/journal.pone.0218648>; Lacy, Timothy J. and Benedek, David M. 2003. “Terrorism and Weapons of Mass Destruction: Managing the Behavioral Reaction in Primary Care”. *Southern Medical Journal* 96 (4): 394–399. <https://doi.org/10.1097/01.SMJ.0000054783.69453.79>.

70 Murthy, R. Srinivasa. 2014. “Mental Health of Survivors of 1984 Bhopal Disaster: A Continuing Challenge”. *Industrial Psychiatry Journal* 23 (2): 86–93. <https://doi.org/10.4103/0972-6748.151668>.

71 Van Bortel, Tine et al. 2016. “Psychosocial Effects of an Ebola Outbreak at Individual, Community and International Levels”. *Bulletin of the World Health Organization* 94 (3): 210–214. <https://doi.org/10.2471/BLT.15.158543>.

72 Ibid.

73 Jalloh, Mohamed et al. 2018. “Impact of Ebola Experiences and Risk Perceptions on Mental Health in Sierra Leone, July 2015.”. *BMJ Global Health* 3 (2): e000471.

74 Van Bortel, Tine et al. 2016. “Psychosocial Effects of an Ebola Outbreak at Individual, Community and International Levels”. *Bulletin of the World Health Organization* 94 (3): 210–214. <https://doi.org/10.2471/BLT.15.158543>.

75 Irish, Leah A. et al. 2011. “Gender Differences in PTSD Symptoms: An Exploration of Peritraumatic Mechanisms”. *Journal of Anxiety Disorders* 25 (2): 209–216. <https://doi.org/10.1016/j.janxdis.2010.09.004>.

76 Solomon, Zahava et al. 2005. “Is Terror Gender-Blind? Gender Differences in Reaction to Terror Events”. *Social Psychiatry and Psychiatric Epidemiology* 40 (12): 947–954. <https://doi.org/10.1007/s00127-005-0973-3>.



threat, dissociation, coping style and social support".⁷⁷

3.3.5 SOCIAL STIGMA AND DISCRIMINATION

A chemical or biological attack could further lead to social stigmatization and discrimination towards the victims, which may affect men and women differently. Infectious disease is certainly associated with stigma and discrimination.⁷⁸ For example, many of those infected with Ebola have experienced "intense stigmatization", fueled by fear over infection, gaps in information and cultural perceptions of Ebola as a "bewitched disease with those affected at fault or deserving their illness".⁷⁹

Chemical weapons victims are also vulnerable to social stigmatization and, in some cases, social ostracization. For example, exposure to blister agents can result in visible disfigurements caused by chemical burns. In some cultures, this can create difficulties for social reintegration.⁸⁰ The literature on the social consequences of acid violence documents the social isolation and rejection of acid burns survivors by society. Research conducted with survivors of acid violence in Bangladesh shows that "burn survivors have very little chance of finding work and of getting married if single at time of

attack in a culture that places a premium on unblemished facial features".⁸¹

Yet acts of discrimination are not always based on outwardly visible scars. In some cases, the knowledge of someone as being 'gas affected' can result in discrimination. For example, research into the Halabja chemical attack suggest that many victims "described disgust and discrimination from others, both at work and in public".⁸²

The experience of stigma is often particularly acute for children, who can face isolation along with "emotional scars [that] can take years to heal".⁸³ It can also be experienced differently by women. A study of the consequences of the Bhopal accident suggested that "being gas-affected carries with it social stigma, and activists working with survivors' organizations say that young women who are known to be gas exposed often face difficulties in getting married".⁸⁴ Likewise, for women exposed to infectious disease, stigma "may limit their marital prospects; constrain their participation in community, household and family roles; and diminish their quality of life".⁸⁵

3.3.6 HEALTH-SEEKING BEHAVIOURS

Stigmatization can also have more direct effects on the provision of assistance.

77 O'Leary, Ann et al. 2018. "Fear and Culture: Contextualising Mental Health Impact of the 2014–2016 Ebola Epidemic in West Africa". *BMJ Global Health* 3 (3): e000924. <https://doi.org/10.1136/bmjgh-2018-000924>.

78 Williams, Joan et al. 2011. "Infectious Diseases and Social Stigma." *Applied Technologies & Innovations* 4 (1): 58–70. <https://doi.org/10.15208/mhsj.2011.127>; O'Leary, Ann et al. 2018. "Fear and Culture: Contextualising Mental Health Impact of the 2014–2016 Ebola Epidemic in West Africa". *BMJ Global Health* 3 (3): e000924. <https://doi.org/10.1136/bmjgh-2018-000924>.

79 See Hewlett, Barry S. and Amola, Richard P. 2003. "Cultural Contexts of Ebola in Northern Uganda". *Emerging Infectious Diseases* 9 (10): 1242–1248. <https://doi.org/10.3201/eid0910.020493>; Van Bortel, Tine et al. 2016. "Psychosocial Effects of an Ebola Outbreak at Individual, Community and International Levels". *Bulletin of the World Health Organization* 94 (3): 210–214. <https://doi.org/10.2471/BLT.15.158543>.

80 Pallua, N. et al. 2003. "Psychosocial Adjustments 5 Years after Burn Injury". *Burns* 29 (2): 143–152. [https://doi.org/10.1016/S0305-4179\(02\)00238-3](https://doi.org/10.1016/S0305-4179(02)00238-3).

81 Mannan, A. et al. 2006. "Psychosocial Outcomes Derived from an Acid Burned Population in Bangladesh, and Comparison with Western Norms". *Burns* 32 (2): 235–241. <https://doi.org/10.1016/j.burns.2005.08.027>.

82 Moradi, Faraidoun et al. 2019. "Health Perspectives among Halabja's Civilian Survivors of Sulfur Mustard Exposure with Respiratory Symptoms—A Qualitative Study". *PLOS ONE* 14 (6). <https://doi.org/10.1371/journal.pone.0218648>.

83 UNICEF. "Ebola". <https://www.unicef.org/emergencies/ebola>.

84 Amnesty International. 2004. "Clouds of Injustice: Bhopal Disaster 20 Years On".

85 Jones, Wanda K. et al. 2004. "Stigma: Lessons from Women". *Emerging Infectious Diseases* 10 (11). <https://doi.org/10.3201/eid1011.040624.07>.



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The Ebola task force of the United Nations Organization Stabilization Mission in the Democratic Republic of the Congo (MONUSCO) informs local population about how they may protect themselves against the Ebola Virus.

Certainly, “evidence from South Asia, Africa, and Vietnam suggests that the potential for stigmatization affects women’s help-seeking more than men”.⁸⁶ In turn, this can weaken the accuracy of case reporting as well as the effectiveness of community efforts to offer healthcare services to treat and prevent the spread of communicable disease.⁸⁷

Various studies have highlighted gendered patterns of engagement with health care. Individuals may take different approaches to seeking medical assistance depending on their gender and prevailing cultural norms. In some places, women may have little control over their own health care. For example, they may have to request permission from a male relative, elders, or the wider community to seek healthcare.⁸⁸ This can delay their seeking healthcare. In other places, women appear to seek

primary care more often than men.⁸⁹

When developing effective response strategies, it is also important to consider how populations and different demographics within a population engage with health systems. For example, if women are reluctant to receive medical treatment from male doctors, as was the case with many young Rohingya women in a recent WHO initiative, contingency measures need to be put in place.⁹⁰ In the provision of assistance this points to the importance of taking into consideration local cultural insights and customs and planning accordingly.

86 Ibid.

87 Williams, Joan et al. 2011. “Infectious Diseases and Social Stigma”. *Applied Technologies & Innovations* 4 (1): 58–70. <https://doi.org/10.15208/mhsj.2011.127>.

88 Peters, Melissa Minor. 2014. “Community Perceptions of Ebola Response Efforts in Liberia: Montserrado and Nimba Counties”. http://www.ebola-anthropology.net/wp-content/uploads/2015/02/Oxfam-MMinorPeters-Liberia-Anthro-report_Dec2014.pdf

89 For example, in Canada, women appear to seek primary care more often than men. In Pakistan, women delay seeking healthcare and will seek out low-quality care compared with males. See Thompson, Ashley E. et al. 2016. “The Influence of Gender and Other Patient Characteristics on Health Care-Seeking Behaviour: A QUALICOPC Study”. *BMC Family Practice* 17 (1): 38. <https://doi.org/10.1186/s12875-016-0440-0>; Codlin, A. J. 2011. “Gender Differences in Tuberculosis Notification in Pakistan”. *The American Journal of Tropical Medicine and Hygiene* 85 (3): 514–517. See also WHO. 2007. “Addressing Sex and Gender in Epidemic-prone Infectious Diseases”. <https://www.who.int/csr/resources/publications/SexGenderInfectDis.pdf>.

90 WHO. 2018. “WHO’s Work in Emergencies: Prepare, Prevent, Detect and Respond”. Health Emergencies Programme Annual Report 2018. <https://www.who.int/emergencies/who-work-in-emergencies/en/>.



3.3.7 ACCESS TO INFORMATION

In the event of a public health crisis caused by chemical or biological weapons, access to accurate and timely information and instruction will be crucial in order to minimize panic and mitigate the damage.⁹¹ Yet populations rarely have equitable access to information. For example, in the case of the Ebola outbreak, studies have “revealed significant disparities in men’s and women’s access to Ebola prevention and treatment information in rural areas”.⁹² While there may be several reasons for inequity of access to information, gender disparities in the provision of language education required to access information certainly played a role in some cases.⁹³

Another common problem refers to the exclusion of women in meetings where information is circulated.⁹⁴ This can create a damaging situation where primary caregivers are poorly informed of the risks and the means whereby risks can be mitigated. In providing assistance, an important consideration is therefore how potentially gendered communication barriers can be broken down and key actors, such as primary caregivers, can be engaged.

91 The WHO, for example, identifies risk communication as one of the major response activities; WHO. 2004. *Public Health Response to Biological and Chemical Weapons: WHO Guidance*. <https://www.who.int/csr/delibepidemics/biochemguide/en/>.

92 Peters, Melissa Minor. 2014. “Community Perceptions of Ebola Response Efforts in Liberia: Montserrado and Nimba Counties”. http://www.ebola-anthropology.net/wp-content/uploads/2015/02/Oxfam-MMinorPeters-Liberia-Anthro-report_Dec2014.pdf

93 Ibid.

94 Ibid.



4. MAKING THE LINK: MOVING FORWARD

Although gender may be a novel topic for the biological and chemical weapons regimes, States Parties have already started to address this issue, albeit indirectly. During the 2018 BWC Meeting of Experts, the Russian Federation and the United Kingdom submitted a joint working paper highlighting the importance of clear awareness of local cultural aspects, including funerary practices, and the need to consider this in the response to a biological weapons attack.⁹⁵ As this paper demonstrates, understanding gender dynamics is a fundamental part of gaining awareness of local cultural aspects, including funerary practices.

In the chemical weapons regime, it is possible to find similar discussions around this topic. During an Organisation for the Prohibition of Chemical Weapons (OPCW) Symposium, *Medical Treatment of Victims of Chemical Weapons: Challenges and Hopes*, possible differences between men, women and children were considered in relation to the development of diagnostic and treatment protocols for emergency services, including measures to address the psychological effects of exposure to chemical weapons.⁹⁶ As this paper shows, sex-specific differences and gender roles can influence the effects of chemical weapons on individuals, including psychological trauma.

While many States Parties to those conventions have recognized there is “no one size fits all” approach to the provision of assistance, there is less evidence of efforts to systematically map out the factors involved in developing response

strategies. This paper has sought to provide some food for thought, identifying evidence in the existing literature that is relevant to understanding the linkages between gender and chemical and biological weapons.

Further research could address gaps in the literature, including by means of:

- the development of epidemiological studies of long-term health disorders among chemical weapons victims;⁹⁷
- building an understanding of sex-based differences in immune response to potential biological agents;
- long-term research into the psychological effects of disease outbreaks and chemical events; and
- bringing together a network of researchers and different specialized agencies to develop a generic framework for the provision of assistance that includes gender-related considerations.

In order to move forward with this research agenda, States could mainstream gender in public health systems, ensuring the collection of sex- and gender-disaggregated data. At the organizational level, data from OPCW fact-finding missions and other investigative processes might have sex- or age-disaggregated data that could be used to build a better understanding of the differentiated impacts of chemical agents among women, men, boys and girls.

States Parties to the BWC and the CWC could adopt agenda items that further

⁹⁵ United Kingdom and Russian Federation. 2017. “Core Elements for an Effective Article VII Response.” BWC/MSP/2018/WP.6. <https://undocs.org/BWC/MSP/2018/WP.6>.

⁹⁶ OPCW. 2018. “International Symposium on Medical Treatment of Chemical Warfare Victims: Challenges and Hopes”. pp. 28–29.

⁹⁷ Ibid. p. 4.



discuss gender perspectives, assessing, for example, how gender roles may result in different levels of exposure, uneven access to information and distinct experiences of social stigma. These discussions could improve preparedness in the event of a chemical or biological weapons attack and enhance the effectiveness of assistance under CWC article X and BWC article VII.

Furthering scientific research and enacting gender-responsive measures within multilateral regimes will, ultimately, help States and their populations to become more resilient and recover more rapidly from chemical or biological incidents. In this sense, a gender-responsive approach to assistance can help States to ensure the security and well-being of all their citizens.



Ebola survivors.



MISSING LINKS

Missing Links offers an overview of existing literature relevant to understanding the linkages between gender and biological and chemical weapons; focusing on analyzing possible sex- and gender-specific effects of these weapons.

It argues that sex- and gender-disaggregated data, as well as knowledge of gender perspectives, can contribute to States' preparedness and enhance the effectiveness of assistance under the Biological and Chemical Weapons Conventions.

It proposes a gender-responsive approach to assistance, which can help States and their populations to become more resilient to and recover more rapidly from chemical or biological incidents.

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