



**Identifying the Social Determinants of Health Impacting Those Living in Vietnam Affected
by Agent-Orange-Related Health Complications**
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ABSTRACT

Through a literature review, I will be covering the social determinants of health that affect people living in Vietnam who are impacted by Agent Orange exposure. Agent Orange was a chemical herbicide used in the Vietnam War which still has lasting health effects on Vietnamese citizens today. Exposure to Agent Orange causes a number of health issues, including various kinds of cancer, birth defects, and deformities. Social determinants of health are the non-medical conditions that can impact a person's health outcomes. This paper will discuss conditions such as location, gender, education, and ethnicity, all of which may impact the ability of a person with Agent-Orange-related disorders to get the healthcare they need.

BACKGROUND

History of The Vietnam War

The Vietnam War was a political conflict that lasted from 1955 to 1975, with the communist North fighting against the free South and its leading ally, the United States. For around 70 years prior to the war, Vietnam was under French rule in the larger colony French Indochina, and it was even occupied by the Japanese for a brief period of time. Maltreatment and colonial exploitation caused the movement for independence from France and Japan, led by political activist Ho Chi Minh and his organization the Viet Minh who were inspired by the communist and nationalist ideologies of China and the Soviet Union. Japan was forced to leave Vietnam in 1945 after their defeat in World War II, and France left after their defeat by the Viet Minh in the First Indochina War (Vietnam War). Due to disagreements on how to govern the newly independent country, the 1954 Geneva Accords temporarily divided Vietnam through the 17th parallel, with the North under a communist government and the South under a Western-inspired government. Growing political tensions between the North and South eventually evolved into armed fighting between the communist Viet Cong army and the southern army (Spector). Soon after, the United States sided with the free South because of Cold War conflicts with the Soviet Union and a fear of the spread of communism. Principles from the domino theory held the belief that if one of the Southeast Asian countries fell to communism, neighboring countries would follow suit (Vietnam War). Due to the Cold War policy of containment that was based in the Truman Doctrine, the US was obligated to intervene and support anti-communist movements to stop the spread of communism (Containment). The war resulted in over 3 million deaths, half of which were Vietnamese civilians (Vietnam War).

Agent Orange Usage in the War

Agent Orange was a chemical herbicide used by United States military forces during the war to kill plants on Viet Cong land, both destroying valuable crops and forest areas that the Viet Cong might use to hide in, a tactic frequently used by the Viet Cong that created numerous challenges for US troops. Agent Orange was just one of the many herbicides used for this purpose such as Agents Pink, Blue, Green, and more, but Agent Orange was the most efficient for large-scale deforestation and mass production (Spector). Although the herbicide was not overtly used with the intention of directly harming the health of civilians, this consequence was overlooked and usage continued until it was discontinued in 1970 due to further investigation

into its major health consequences (Danchi and Chen). By the end of the war, around 13 million gallons of Agent Orange had been sprayed over Vietnam, containing about 375 pounds of dioxin, a highly toxic byproduct of the manufacturing system (Spector). Some of the immediate effects of exposure to the toxin include chloracne (sudden outbreak in facial acne, blackheads, and fluid-filled cysts), muscle tremors, edema of the legs, infections, and numbness or tingling sensation (Agent; Chloracne).

Why is Agent Orange Still Relevant?

People can be exposed to Agent Orange through three main methods: inhalation, direct dermal contact, and ingestion. The chemicals are released by low-flying aircrafts and sprayed over the land below. Inhalation, direct contact, and ingestion of the chemical through the air was far less common than through soil or water. When people were directly sprayed with Agent Orange, they were exposed to the chemical by air. Exposure through air could also occur if individuals were within a 2.5 kilometer distance from the chemical because of spray drift, the idea that the air-borne chemical could move in other directions depending on the wind or other circumstances. However, the most common method of exposure was through food, soil, and water. When land was sprayed with Agent Orange, the chemical lingered within the soil and the water. Exposure methods expanded greatly, for example, if one walked past an area with contaminated soil, they could inhale dust or soil particles that may be floating in the air. Exposure through direct contact occurred most commonly for farmers who frequently handled soil and plants that had been exposed, but it could also occur with contact of small windblown soil particles (Exposure). Ingestion was the most prominent issue, with over 90% of human exposure to Agent Orange coming from food (Dioxins). Water sources such as rivers and canals were directly sprayed by the chemical, often lingering in people's drinking water. When the soil was contaminated, it not only contaminated crops growing there at the time, but it would also lead to contaminated future crops that would grow for years and years to come. People who consume those crops face exposure through ingestion (Exposure). This is the reason that Agent Orange exposure is still ongoing today. While Agent Orange sprayed on certain areas of vegetation may have a half life, or the time it takes to decrease the concentration of the chemical by half, relatively quickly, the chemical breaks down very slowly in many areas of soil. Its half life of around 9-15 years impacts surface level soil, and subsurface level soil may remain unchanged. The chemical can also easily reenter water systems if contaminated water sediments are disturbed (Mainelli; Olson and Morton).

There were other chemical warfare agents used in the Vietnam War, including chlorobenzalmalononitrile (CS gas), adamsite (DM gas), and chloroacetophenone (CN gas), but the effects were not nearly as long lasting as those of Agent Orange. These are classified as tear gasses, chemical agents with the purpose of incapacitating large groups of people temporarily by causing irritation, brief blindness, burning sensations, or coughing. Tear gases like CS, DM, and CN gases caused temporary harm to people's health, and had an environmental persistence from hours to days, while chemical herbicides like Agent Orange had an environmental persistence of years (Honeyman et al.).

Health Consequences of Agent Orange Exposure

Agent Orange – specifically, the dioxin in the herbicide – is the cause of many ongoing health concerns, lasting not just for a single lifetime, but for generations after the war. According to researcher Anh D Ngo and their team, exposure to Agent Orange causes an increased risk of birth defects and malformations, primarily spina bifida (a condition where the spine or spinal cord does not form properly). Risk of birth defects is increased depending on the intensity and duration of parental exposure to the herbicide (Ngo). Other defects associated with dioxin exposure include cleft lip or palate, learning and behavioral disabilities, heart defects, and digestive tract defects (Mekdeci). In addition, increased risk of various cancers has also been traced back to Agent Orange exposure. In particular, there is a strong association between dioxin exposure and soft tissue sarcomas, which are tumors originating in the body's connective tissues like muscle, fat, and blood vessels; and B cell lymphomas, cancer originating in the white blood cells in the lymphatic system ("Committee").

Social Determinants of Health

As defined by the World Health Organization, social determinants of health are the circumstances that people live in that affect their health outcomes due to health inequities in the healthcare system. For example, lower income families may have limited access to education, housing, food, etc., which impacts their ability to access healthcare and puts them at higher risk for poor health than families with higher levels of income (Social). In other words, social determinants of health are the non-medical factors that have an impact on overall health. Social determinants do not act individually. In fact, different social determinants of health are often all intertwined, each indirectly affecting one another to influence health outcomes. In this paper, I will discuss the social determinants of health that impact those living in Vietnam who are affected by Agent Orange exposure related health complications, specifically, location, education, age, gender, and parental exposure.

METHODS

A systematic search of literature was conducted to identify peer-reviewed sources investigating topics related to Agent Orange and the social determinants of health that affect those living in Vietnam. From January 2026 to July 2026 I utilized databases including Google Scholar and ProQuest to identify appropriate articles for inclusion. Key words such as "social determinants", "agent orange", "Vietnam", "education", "income inequality" and "gender inequality" were utilized to identify potential articles. I worked with my research mentor, Claire Ambile from the Polygence Research Program, to confirm the reliability of sources. Articles that were not relevant to the topic, outdated, or biased were excluded. Myself and my mentor met for ten sessions to evaluate article inclusion and exclusion, and any discrepancies were discussed until a consensus was reached. A total of 31 of articles were found relevant and therefore included in the present review. Iterative thematic analysis was conducted to identify salient results. Findings were then organized into their respective determinants of health.

RESULTS

Location

One of the major factors that influences health outcomes for people living with Agent Orange exposure related conditions is their location, specifically, proximity to contaminated areas and urban versus rural residency. According to a 2022 study by researchers Nobuaki Yamashita and Trong-Anh Trinh, where they surveyed residents of 262 districts in South Vietnam, post-war health disparities are more common for residents living in areas that were heavily contaminated by the herbicide (Yamashita and Trinh). The two primary hot-spots for Agent Orange today are located near former airbases Da Nang Airbase and Bien Hoa Airbase, both of which are located relatively near Ho Chi Minh City, Vietnam's capital (Maps).

Yamashita and Trinh's study also noted differences in health outcomes between those born or living in urban areas and rural areas, stating that urban residents tend to be less impacted by long term health effects of war because of more convenient access to healthcare (Yamashita and Trinh). Another survey by Hoang Van Minh and their team found a significant difference between urban and rural access to resources, specifically, maternal education, and basic amenities and infrastructure. About 7% of urban women between ages 15-49 had low access to maternal education, while around 15% of those in rural areas had low access to maternal education. Additionally, 22.6% of urban women between ages 15-49 had low access to basic amenities and infrastructure (defined as safe energy, safe water, sanitation, and safe energy for cooking), while a shocking 64.7% of rural women had low access to basic amenities and infrastructure (Minh).

Gender

Women are impacted significantly by Agent Orange related health consequences because of both biological risks and social responsibilities that affect health outcomes and quality of life. Although men typically have a greater mortality rate during the war because of direct involvement in fighting, more women and children are affected by post-war, indirect consequences (Yamashita). This explains why women are at greater risk for lasting Agent Orange related health consequences.

Biologically, women are uniquely impacted by exposure to Agent Orange because of its effects on pregnancy and reproductive health. Even in small amounts, exposure can lead to an increased risk of miscarriages, endometriosis, congenital birth defects, and lowering fertility (Nham Tuyet and Johansson). These outcomes are mostly due to the fact that dioxins negatively affect the function of ovaries, a pivotal organ in the female reproductive system. Issues with the ovaries lead to disruption of hormones from the endocrine system. A study by Nour Aldeli and their team looked at the effects on dioxin exposure to the reproductive health of female animals such as rats, mice, and zebrafish. Some health outcomes included decreased ovarian size, preterm births, decreased offspring weights, and inhibited follicular development. They found that dioxins act as a ligand, binding with and activating the AHR (Aryl Hydrocarbon Receptor), which alters gene expression and disrupts normal biological processes such as the production of the progesterone hormone (Nour Aldeli et al.). Although this study was done on animals, results may be applicable to effects on humans because of many similarities between reproductive systems. Another biological impact of Agent Orange exposure that is unique to women is through breastmilk. When mothers are exposed to Agent Orange in any way, whether through direct exposure or from past generations, the toxins make their way into their tissues and breastmilk, allowing toxins to be passed down to their children (Nham Tuyet and Johansson).

With an estimated 3 million people living in Vietnam being impacted by the initial spraying of Agent Orange (Agent), there's room to believe that the rationale for utilizing such harmful chemicals spreads further than just environmental damage. Corcoran-Nantes argues that the use of Agent Orange was operationalized as a means to control reproductive rights of the women throughout Vietnam, as well as diminish the Viet Cong's physical ability to fight the war, due to the health consequences Agent Orange causes (Corcoran-Nantes). Beyond the said purpose of eliminating foliage, harming the health of not only living Viet Cong soldiers and civilians, but also Vietnam's future generation of soldiers and civilians could have been an underlying strategy utilized by the US to weaken the Viet Cong's ability to defend itself by diminishing their workforce and military force

In addition to the biological effects on women's lives, social expectations and traditional gender roles make women more susceptible to worse health outcomes because they are more likely to work in agriculture, and their greater involvement in childcare. According to a survey by the Vietnam Household Living Standards, 63% of rural women work in agriculture, compared to 58% of men ("Building"). Generally, Southeast Asian countries have a higher proportion of women in agriculture than in other countries. These jobs make women more vulnerable to exposure through direct contact with contaminated soil. Specifically, for rice farming, one of the primary crops grown in Vietnam, rice is grown in wet rice paddies, meaning they are flooded with water. Because dioxins are hydrophobic, they float on the surface of the water, making it easier to come into contact with them if working in wet rice paddies (McHugh). Thus, Vietnamese women working in agriculture are at an increased risk of further exposure to Agent Orange.

Gender roles also impact women's health outcomes because of their greater participation in childcare. With women typically being assigned more domestic roles, they are often more involved in the care of their children than men in the household (McHugh). According to an interview of thirty women living in contaminated areas, there was a disproportionately greater number of children living with disabilities. Of the 108 children born alive from all thirty of these women, fourteen had died before the age of five, four more died at later ages, and sixty were described to have some sort of disability (Nham Tuyet and Johansson). Parents of disabled children are also more likely to experience physical issues like insomnia, musculoskeletal pain, or chronic fatigue, and mental health issues like depression and anxiety (Shahali).

Education and Ethnicity

Another major factor that affects health outcomes for people living with Agent Orange exposure related conditions is their level of education, which is often directed by their ethnicity because of systemic inequities in the education system in Vietnam. Education impacts health outcomes because it influences future employment opportunities, and therefore, income and financial mobility ("Education"). Typically, higher education (i.e., a college degree) is required for higher paying jobs, meaning that those with less access to education have limited opportunities to earn a living. In turn, income influences a person's ability to afford life-saving procedures, medications, health insurance, and other health-related services, all of which contribute to health disparities. This becomes a detrimental cycle because those with lower income tend to live in underfunded areas with underfunded schools, therefore getting a lower quality education. Children enrolled in underfunded schools that have limited health education and health resources are more likely to experience poor physical and mental well-being. For example,

adults who had participated in early childhood education programs were less likely to engage in high-risk behaviors like smoking and binge-drinking by age 21, and had lower risk for high cholesterol, high blood pressure, obesity, and high blood sugar (Social Determinant of Health: Education Is Crucial).

Education level is heavily influenced by ethnicity in Vietnam. For context, Vietnam has 54 recognized ethnic groups. The ethnic majority is the Kinh, comprising about 87% of Vietnam's entire population and living mainly along rivers, coasts, and in major cities. The other 53 ethnic groups, about 8 million people, typically inhabit rural mountainous regions all around the country ("Ethnic Groups"). Although educational institutions do not deliberately exclude ethnic minorities, they still have less access to education because of various systematic circumstances. Geographically, rural and mountainous regions tend to have less schools and are further spread apart than those concentrated in major cities. A lack of transportation also makes it difficult for kids in rural areas to travel the far distance to their nearest school. In addition, most schools and textbooks are based in the Vietnamese language, which poses a language barrier to those who do not speak the language or have limited knowledge of it (Chalupnik). These barriers in access to education directly influence risk of experiencing Agent Orange related symptoms, and may impact help-seeking behaviors.

These barriers cause many children belonging to ethnic minority groups to drop out of school before completing secondary education, or grades six through nine. Primary schooling is required for all children by the law, with 98% completing it. Secondary education is not mandatory, so that percentage drops to 87%, but for ethnic minorities, only 55-60% complete secondary education. Because of this, in 2023, about 3 million children in ethnic minorities were not able to read or write (Chalupnik). Literacy skills like reading and writing are vital to understanding written health information such as instructions for medication dosage or any advice from medical providers. Those with a limited access to education are therefore more vulnerable to not understanding the importance of seeking treatment for their exposure to Agent Orange, possibly leading to their health condition worsening more than it would if they had sought out preventative care. Additionally, lacking literacy skills could result in potential mothers not understanding the risks of pregnancies and childbirth that are tied to Agent Orange exposure. Thus, they may not be able to make an informed decision regarding whether or not they feel able and comfortable with the potential health difficulties their children could face.

DISCUSSION

Location affects health outcomes for those living with Agent Orange related disorders through proximity to contaminated areas and differences in urban and rural access to resources. Living near areas that are highly contaminated with Agent Orange, with major targets being airbases and large cities, increases the chances and severity of exposure. In addition, living in urban areas provides greater access to health and educational resources necessary to get proper care for exposure and understand the importance of getting that care. The fact that people living in urban areas are less impacted by Agent Orange than people living in rural areas, regardless of proximity to highly contaminated areas, points to the need for an expansion of health and educational resources for people in rural areas, rather than those resources being concentrated in urban areas. This ties to education as a social determinant of health, as people with higher education status tend to have higher rates of health literacy, meaning that increased education access among rural populations could also help mitigate the long term impacts of

Agent Orange. This calls for additional resources being flooded to the educational sectors of rural Vietnam, where Agent Orange is having the largest impact.

To address the disparity in access to healthcare resources between rural and urban communities, there should be more funding allocated to create more clinics and hospitals in rural areas. This would not only make healthcare more accessible, but would open up many more job opportunities for people to serve as healthcare professionals, potentially increasing income levels in rural areas. Increasing educational attainment opportunities would be paramount as well, to ensure that community members would be able to secure employment opportunities in these health care spaces. Additionally, building more accessible and safe public transportation methods, such as buses or trains, in rural areas would also be beneficial so that even people who live far from the nearest healthcare clinic can still have a way to reach those resources if they do not have access to a personal vehicle.

Women are disproportionately affected through biological outcomes and social expectations. The dioxins in Agent Orange disrupt the ovaries, impacting both a woman's fertility and hormones. Dioxins can also infiltrate a woman's breastmilk, allowing for the generational cycle of Agent Orange exposure to persist even decades after it had been discontinued (Nham Tuyet and Johansson). Women also tend to adhere to the societal role of childcare, therefore, they are caring for the disproportionate amount of children with disabilities that result from the dioxin exposure. It is possible that women with one or more disabled children may neglect their own health to focus on their child's healthcare. There is a possibility that the effects of exposure on women are often overlooked because most discussions surrounding Agent Orange exposure typically focus on soldiers and veterans, particularly those who are still living, rather than the broader long-term impact. This may be rooted in systemic sexism and misogyny seen throughout history, as women are less likely to be taken seriously by the healthcare system. Their pain is often disregarded by medical providers, leading to delayed diagnoses and often, prolonged and severe harm to their organs. They have also been excluded from many safety and medical trials, meaning most of healthcare is tailored to the average male, not taking female anatomy into account (Harrilal-Maharaj). This calls for a shift in culture that places value on women, as their health is more negatively impacted than their male peers.

Additionally, in thinking about how reproductive health is impacted by Agent Orange, the propensity for birth defects would give the US the advantage throughout the Vietnam War and beyond, because in addition to the soldiers who fought in the war becoming physically weaker, any future children who may become soldiers may face physical disadvantages due to serious birth defects. Agent Orange not only affected soldiers, but also the entire population, and future population, of Vietnam, weakening the country as a whole by diminishing its workforce. If this was the true motivation of the operation, this is an example of an indirect effort to take control over women's reproductive rights, as it interferes with Vietnamese women's ability to safely reproduce. Overall, the impact that Agent Orange has had on those able to reproduce calls for the need for women to receive education surrounding the potential impacts of Agent Orange on pregnancy, as well as support with raising children who may be living with the negative health outcomes as a result of Agent Orange.

Education level is another major factor that impacts health outcomes for those living with Agent Orange related disorders. Level of education influences a person's ability to access employment, therefore, affecting income. Those with lower access to education and have lower income tend to live in more rural and underfunded areas where they have less access to schools, hospitals, and other resources. As discussed previously, education also impacts a

person's health literacy and their ability to understand the importance of receiving proper care for their exposure-related disorders, as well as other conditions. Education level is highly intertwined with ethnicity because those of ethnic minorities tend to live in rural areas with less access to schools, and also tend to stay in school for a shorter period of time (Chalupnik). To address the disparity between rural and urban education, there should be more funding towards initiatives to build more schools in rural areas. Because finding teachers to work at so many more schools may be difficult, another solution could be to create more roads for school buses and bike paths so students have more options for transportation to school. This inherently ties to the need for increased access to public transportation. In all schools, there should be a brief program that teaches students about the importance of preventative care and staying wary of the potential health complications of Agent Orange that they may face. Door-to-door health literacy initiatives may also be beneficial to spread this information to those who are not in school. There is also a need for more research to assess the direct correlation between education and Agent Orange related complications because current research is mainly based on education's effects on general health complications.

Overall, these social determinants of health reveal that the effects of Agent Orange on health are significantly worsened by deeply rooted systemic inequities that work against marginalized populations, leaving them without the resources to improve their health outcomes. The first step in closing these inequities is further research, specifically more focused on Agent Orange's impact on Vietnamese communities rather than US Veterans alone. While conducting my research, I found that most of the research done has been very western-centered, focusing on Agent Orange's effects on the US. While this is important research, it is crucial to study those living on the land that is still contaminated, because effects are worsened and prolonged, impacting not only Veterans but Vietnam's entire population. Additionally, the fact that Agent Orange's impact spreads primarily through soil implies that people living in Vietnam will continually be impacted by this poison for decades to come. This highlights the need for immediate research to inform future policies and advocacy efforts, with the hope of mitigating some risk through education, financial mobility, and access to healthcare. All research conducted should be community-based participatory projects (CBPR), meaning that the people most impacted by Agent Orange's outcomes are informing the findings. This approach may be especially beneficial for communities in Vietnam because unlike traditional research methods, CPBR takes into account the intersectionality of many factors that affect community health (race, ethnicity, age, gender, class, etc.), all of which shape diverse community identities (Collins et al.). This will hopefully ensure that the solutions generated from the research are sustainable, effective, and culturally informed, to best meet the community's needs.

It is also reasonable to suggest that because the US imposed this harm on Vietnamese citizens, the US should fund efforts to fix it. In early 2025, the Trump administration temporarily cut funding to the project of Agent Orange decontamination at the Bien Hoa Airbase, the airbase with the highest level of Agent Orange contamination, because they saw much of foreign aid as a waste of US money. The abrupt halt in the project posed a significant risk to the health of the 8,600 people living in the province of the former airbase because it left contaminated soil out in the open air (Rising and Ghosal). While funding was returned shortly after it was cut for reasons not publicly known according to current literature, concerns were raised about the reliability of US funding, putting the diplomatic trust between the US and Vietnam in jeopardy, as well as putting the health of millions of citizens of Vietnam at risk. This calls for funding from the US to remain as constant as possible in order to keep trust with Vietnam and show remorse for the



amount of turmoil caused by the operation. Funding from the US should not only go to this decontamination project, but could also go to the social welfare programs discussed before (building transportation, clinics, schools, and health literacy initiatives) to support those living with the effects of Agent Orange.

LIMITATIONS

As with any research project, the present review does not come without limitations. As discussed above, there is a dearth of literature surrounding perspectives from people living in Vietnam who have been impacted by Agent Orange, as many studies have exclusively looked at US veterans. Given the constraints of systemic literature reviews, this study may also be susceptible to bias from both the author and the mentor. Many of the studies utilized self-reported methods, making results susceptible to response bias or inconsistencies across responses. Several studies also included relatively small sample sizes, limiting the generalizability of their results.

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