

N°01 • JULY 2023

VIETNAM HEALTH AND AGING STUDY

EARLY-LIFE WAR EXPOSURE AND LATE-LIFE HEALTH



N°01 • JULY 2023

VIETNAM HEALTH AND AGING STUDY

EARLY-LIFE WAR EXPOSURE AND LATE-LIFE HEALTH

VHAS WAVE 1 REPORT, 2023

KIM KORINEK
BUSSARAWAN TEERAWICHITCHAINAN
ZACHARY ZIMMER
YVETTE YOUNG
TRẦN KHÁNH TOÀN
NGUYỄN HỮU MINH

EDITORS



Copyright © 2023 **Vietnam Health and Aging Study**. Some rights reserved.

University of Utah, Department of Sociology,
380 South 1530 East, Salt Lake City, Utah, United States of America 84112

Mount Saint Vincent University, Global Aging and Community Initiative
166 Bedford Highway, Halifax, Nova Scotia, Canada

National University of Singapore, Centre for Family and Population Research
5 Arts Link, Singapore 117570

Hanoi Medical University, Department of Family Medicine
No 1 Ton That Tung-DongDa-Hanoi, Việt Nam

Institute for Family and Gender studies
27 Tran Xuan Soan, Hai Ba Trung, Ha Noi, Việt Nam

This work is a product of the staff and affiliates of the Vietnam Health and Aging Study. The work was supported by a grant from the National Institutes of Health/National Institute on Aging (R01 AG052537). Any opinions, findings, or conclusions expressed in this paper are those of the authors and do not necessarily reflect the views of the funding agencies, VHAS, or affiliated institutions.

Nothing herein shall constitute or be considered to be a limitation upon or waiver of the privileges and immunities of Vietnam Health and Aging Study, all of which are specifically reserved.

Rights and Permissions

This work is available under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) license. <https://creativecommons.org/licenses/by-nc-sa/4.0/>. Under the license, you are free to copy, distribute, and adapt this work, for non-commercial purposes, under the following conditions:

Attribution—Please cite the report as follows: Korinek, K., Zimmer, Z., Teerawichitchainan, B., Young, Y., Tran T.K., Nguyen, M.H., et al. (2023). *Vietnam Health and Aging Study Wave 1 Report: Early-life War Exposure and Late-life Health*. Edited by K. Korinek, B. Teerawichitchainan, and Z. Zimmer. Salt Lake City: Vietnam Health and Aging Study.

Translations—If you create a translation of this work, please add the following disclaimer along with the attribution: This translation was not created by the Vietnam Health and Aging Study and should not be considered an official Vietnam Health and Aging Study translation. The Vietnam Health and Aging Study shall not be liable for any content or error in this translation.

Adaptations—If you create an adaptation of this work, please add the following disclaimer along with the attribution: This is an adaptation of an original work by the Vietnam Health and Aging Study. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by the Vietnam Health and Aging Study.

Third-party content—The Vietnam Health and Aging Study does not necessarily own each component of the content contained within the work. The Vietnam Health and Aging Study therefore does not warrant that the use of any third-party-owned individual component or part contained in the work will not infringe on the rights of those third parties. The risk of claims resulting from such infringement rests solely with you. If you wish to re-use a component of the work, it is your responsibility to determine whether permission is needed for that re-use and to obtain permission from the copyright owner. Examples of components can include, but are not limited to, tables, figures, or images.

All queries on rights and licenses should be addressed to the Vietnam Health and Aging Study, 380 S 1530 E, Salt Lake City, Utah, United States of America 84112; e-mail: info@vhas.utah.edu.

Vietnam Health and Aging Study website with additional documentation: www.vhas.utah.edu

DOI: TBD

TABLE OF CONTENTS

KEY TAKEAWAYS	ix
---------------	----

CHAPTERS

01 VHAS OVERVIEW	3
02 GENDER, MILITARY SERVICE, AND WAR EXPOSURE	11
03 BIOMARKER DATA COLLECTION AND ANALYSIS	23
04 FERTILITY AND LIVING ARRANGEMENTS	35
05 SOCIAL PARTICIPATION AND SOCIAL SUPPORT	41
06 SOCIOECONOMIC CONDITIONS	49
07 MIGRATION HISTORIES	55
08 PHYSICAL HEALTH STATUS THROUGH THE LENS OF MULTIMORBIDITY AND SELF-RATED HEALTH	63
09 COGNITIVE IMPAIRMENT	71
10 FUNCTIONAL HEALTH AND FRAILTY	79
11 POSTTRAUMATIC STRESS DISORDER AND PSYCHOLOGICAL DISTRESS	87
12 CONCLUSION—LESSONS FOR POLICYMAKERS AND PRACTITIONERS	95

CONTRIBUTING AUTHORS	103
----------------------	-----

APPENDIX

SUPPLEMENTARY MATERIAL	105
------------------------	-----



FIGURES

1.1	Conceptual model of war exposure and later life health	5
1.2	Districts sampled in the VHAS.	6
1.3	VHAS sample by gender and military service status	6
2.1	Map of bombing intensity	12
2.2	Conceptual model of war exposure	13
2.3	Bombing exposure intensity by gender and military service status	14
2.4	Loss of family members due to military service or war-related causes	15
2.5	Exposure to military and civilian casualties by gender and military service status	16
2.6	War-related violence exposures by gender and military service status	17
2.7	Percent experiencing malevolent conditions during and after the war by gender	18
2.8	Components of war exposure indices for civilians, informal military participants, and military veterans	19
4.1	Average lifetime fertility by gender and military service status	36
4.2	Age and lifetime fertility	36
4.3	War exposure and lifetime fertility	37
4.4	Living arrangements by gender	37
5.1	Formal and informal social participation by gender and military service status	42
5.2	Receipt and provision of social support by gender and military service status	42
5.3	Formal and informal social participation by age	43
5.4	Receipt and provision of social support by age	43

5.5	Social participation by level of war exposure	44
5.6	Social support by level of war exposure	44
5.7	Predicted percentile of Military Friendship Quality Index	47
6.1	Distribution of VHAS participants' main lifetime occupations	50
6.2	Socioeconomic Index values for main lifetime occupations in 16 categories	50
6.3	Main lifetime occupation by gender and military service status	51
6.4	Perceived income sufficiency by gender	51
6.5	Predicted SEI for main lifetime occupation by gender and military service status	52
7.1	Migration flows	56
7.2	Reasons for migrating during the war	56
7.3	Comparison of the geographic intensity of bombings and herbicide spray with migrations to the affected provinces	57
7.4	Wartime migration and combat experience by gender	58
7.5	Predicted wartime migrations by levels of exposure to violence and malevolent conditions	59
7.6	Predicted military deployments by levels of exposure to violence and malevolent conditions	59
8.1	Physical health status by gender	65
8.2	Physical health status by age	65
8.3	Prevalence of select chronic conditions by age	66
8.4	Percent with poor or very poor self-rated health by level of exposure to violence and malevolent conditions	66
8.5	Mean number of comorbid conditions by level of exposure to violence and malevolent conditions	67
8.6	Predicted number of respiratory conditions by military service status and intensity of war exposure	68
9.1	Cognitive health by gender	72
9.2	Cognitive health by age	73
9.3	Cognitive health by military service status	73
9.4	War exposure and cognitive health	74
9.5	Predicted memory by gender	75

9.6	MMSE memory by military service status	77
10.1	Measures of physical functioning by gender	80
10.2	Measures of physical functioning by age	80
10.3	Measures of physical functioning by gender and military service status	81
10.4	Predicted probability of having one or more functional limitations, disabilities, or being frail by gender and exposure to violence and malevolent conditions	82
10.5	Distribution of education by gender in the VHAS sample	83
10.6	Predicted probability of having one or more functional limitations, disabilities, or being frail by education level and gender	84
11.1	Posttraumatic stress by gender	88
11.2	Posttraumatic stress by exposure to wartime violence and malevolent conditions	89
11.3	Percent with a psychological distress score above eight (by gender)	89
11.5	Percent experiencing psychological distress by war exposure severity	90
11.6	Predicted psychological distress scores by malevolent conditions exposure	91
11.7	Predicted PTSD and predicted psychological distress scores	92

TABLES

1.1	Participation rates for VHAS Wave 1 data collection	7
2.1	VHAS Sample by gender and military service status	12
2.2	Dimensions of war exposure	13
3.1	Laboratory assays for blood-based biomarkers in VHAS Wave 1	27
3.2	Preliminary descriptive statistics of Wave 1 anthropometric measures	28
3.3	Preliminary descriptive statistics of Wave 1 blood pressure measures	29
3.4	Descriptive statistics for Wave 1 point-of-care measures	30
3.5	Descriptive statistics for Wave 1 assays	31
4.1	Statistical models predicting lifetime fertility	38
5.1	Models of social participation and social support	45
8.1	Regression models predicting self-rated health (SRH) and multimorbidity scores	67
9.1	Models of cognitive impairment and self-assessed memory	74
11.1	Statistical models predicting PTSD score	89

KEY TAKEAWAYS

STUDY OBJECTIVES AND FUNDING

The Vietnam Health and Aging Study (VHAS) was conceived by an international team of scientists to document the long-term social and health impacts of the American War on the Vietnamese population, to explore the social, psychological, and biological mechanisms through which exposure to war in lower- and middle-income countries influences health and aging, and to provide a data resource for scholars to investigate the global disease burden associated with armed conflict, in particular through population-level exposure to war stressors and military participation. This report aims to disseminate findings from the first phase of VHAS to a broad international audience, from scholars to policymakers and practitioners.

The VHAS is supported by the National Institute on Aging of the National Institutes of Health (R01-AG-052537) and the Canadian Institutes of Health Research. The content of this report is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the Canadian Institutes of Health Research.

DATA AND METHODS OVERVIEW

In the first wave of data collection conducted in 2018, a team of researchers collected in-person interviews and biomarker data from a sample of 2,447 men and women aged 60 and older residing in four districts of Northern and North-central Vietnam, purposively chosen to represent a spectrum of American aerial bombing intensity. Study participants living in these districts, randomly selected for participation within military service and gender subdomains, represent a range of characteristics thought to be risk factors for ill health and accelerated aging, as well as moderating and mediating factors impacting the long-term effects of wartime trauma. The second wave of data collection was conducted from May 2021–June 2022. Through its collection of in-depth in-person interview data (Chapter 1) along with biological markers obtained through anthropometric measurement and collection of blood and hair samples (Chapter 3), VHAS allows investigators to examine life course processes of health and aging with an emphasis upon multidimensional war exposures experienced by men and women across a wide range of social positions during the American War (Chapter 2).

The analyses in this report based on Wave 1 data are designed for easy interpretation by diverse audiences and to allow comparison of results across chapters. Authors collaboratively contributed chapters using agreed-upon, common analytical approaches, particularly bivariate analyses and multivariate regression techniques that include a common set of covariates such as participant age, gender, and other sociodemographic characteristics.

VHAS—OVERARCHING CONCLUSIONS

- From VHAS analyses, we learn that the ill effects of war exposure can carry on into late adulthood, with those survivors most exposed experiencing heightened risk for a range of poor health outcomes in their later years. The ill effects of war stressors span physical (e.g., multimorbidity), psychological (e.g., PTSD), and cognitive health (e.g., self-assessed memory) outcomes.
- The legacies of the American War exhibit marked gender differences that warrant attention. Not only were men and women differently exposed to the hardships and violence of war, but their mental and physical health also bears unique imprints of war.

- It is essential to consider significant events over the life course, in particular participation in large-scale military mobilization and exposures to violence and malevolent conditions in adolescence and early adulthood, as underlying recent age- and gender-specific patterns of disease, aging, and mortality in Vietnam's older adult population.

VHAS—RESULTS OF NOTE

- Vietnamese older adults surveyed in VHAS faced numerous, diverse, potentially traumatizing events as youths coming of age during wartime. These include direct exposure to combat violence, witnessing comrades' and community members' death and suffering, experiencing the war-related death of family members, and enduring malevolent conditions of war, such as food shortages, mortal fear, and living under the threat of bombing.
- Exposure to war trauma in early life hastens aging in Vietnamese older adults. This is evinced by significantly greater levels of frailty among those intensely exposed to war-related stressors (Chapter 10). For example, the probability of having moderate to severe frailty increases from 27% among men exposed to the lowest levels of war violence to 40% among the most severely exposed.
- Nearly half of VHAS older adults rate their health as poor or very poor; they have, on average, 1.7 measured chronic conditions, with hypertension and arthritis being particularly pervasive. These and several other chronic conditions rise with age and reach peak prevalence between the ages of 75 and 79, then are less prevalent in the oldest old. Both self-rated health and multimorbidity are significantly positively associated with exposure to war-related violence and malevolent conditions (Chapter 8).
- VHAS begins to shed light upon the mental health of older Vietnamese who were directly and indirectly exposed to war traumas. Those VHAS participants who endured severe exposures to violence and malevolent environments demonstrate heightened psychological distress and PTSD over 40 years post-war (Chapter 11). Prevalence rates for provisional PTSD range from 3% for those with the lowest levels of violence exposure to 14% for those with the highest levels of violence exposure.
- Those who served in the formal military have a notably higher likelihood of experiencing provisional PTSD compared to other older adults.
- The American War precipitated shifts in population migration among northern Vietnamese. Migration for work, marriage, and family support still occurred, but migration for military deployment became predominant. Organized evacuations and other responses to village bombings compelled population migrations, with repercussions for mental health.
- There are also certain social and psychological benefits associated with war exposure. Notably, service in the formal military may offer resilience or buffer against late-life health decline. For some, formal military participation is positively linked to social engagement in late adulthood (Chapter 5). Participation in the formal military also resulted in greater chances of achieving upward social mobility (Chapter 6). Wartime military service possibly enabled older Vietnamese to broaden and diversify their social networks and enhance their social participation later in life.

CONCLUSIONS AND RECOMMENDATIONS

VHAS represents an effort to learn from one of the most devastating and violent armed conflicts of the twentieth century. It provides insights for a range of practitioners and policymakers to treat and support survivors and their families, in particular, those most directly and negatively affected by the violence and upheaval of the American War. For instance, VHAS results demonstrate that women with weak social support networks are more susceptible to psychological distress and cognitive decline. Such findings, and others reported herein, should encourage us to develop tailored, evidence-based interventions for women, men, and children affected by war in Vietnam and globally. Lessons from VHAS can extend to other post-conflict survivor populations that are now aging rapidly. Attending to wartime and post-war sociocultural contexts in which men and women are embedded is critical to address war's enduring health impacts.

EARLY-LIFE EXPERIENCES
OF WAR AFFECT HEALTH
WELL INTO OLD AGE





VHAS OVERVIEW

ZACHARY ZIMMER, KIM KORINEK, TRẦN KHÁNH TOÀN ,
BUSSARAWAN TEERAWICHITCHAINAN

WHAT IS VHAS?

The **Vietnam Health and Aging Study**, or **VHAS**, encompasses a broad set of research activities structured around the overarching objective of understanding the long-term impacts of war, war trauma, and military experience in Vietnam on the health and aging of Vietnamese survivors. The current report focuses on the analysis of VHAS data collected in 2018, or what is called *Wave 1* data. This data collection effort was supported by a grant (R01 AG052537) from the National Institute on Aging (NIA), part of the National Institutes of Health (NIH) in the United States. The grant, titled: “Health and Aging Post Conflict: War’s Enduring Effects Among Survivors in Vietnam,” was awarded in 2016. The NIH-funded grant’s main aims include assembling a dataset for multidisciplinary analysis of war exposure and its long-term impacts on health and wellbeing and using this dataset to examine linkages between war exposure, mortality, and morbidity. It also aims to disseminate findings from these analyses to the stakeholder community and others that may benefit from the results. This report is part of that dissemination process.

Data were collected from a sample of 2,447 adults aged 60 and older residing in four districts in Việt Nam. These districts were purposively chosen for study because they represent a spectrum of American aerial bombing intensity. While the intensity of bombing differentiates the districts, study participants living in these districts were randomly selected (see Methods section below for more information) and represent a range of characteristics thought to be risk factors as well as moderating and mediating factors impacting the long-term effects of wartime trauma. Some of these factors include sex, formal and informal military participation, combat and non-combat activities, traumatic experiences, demographic background, socioeconomic status, social engagement and social support resources, and other life experiences. Information on these characteristics, experienced in the present and earlier





VHAS Wave 1 field researchers and principle investigator. Photo: **Trần Khánh Toàn**

stages of the life course, was gathered from each participant during in-person interviews. In addition, interviews collected extensive health information, such as details on chronic disease, physical functioning, health behaviors, cognitive status, and psychological health. Most study participants also provided an array of biomarker data, including anthropometric and functional measurements such as grip strength and blood pressure, hair samples for cortisol assays, and blood samples for assays of a host of biological indicators, such as C-reactive protein, cholesterol, HbA1c, and other markers of cardiovascular and other disease risks. The biomarker information is linked to the information provided by in-person interviews to generate an expansive database that can permit detailed studies of complex associations between war experiences and later-life health and wellbeing.

FUNDING AND RESEARCH TEAM

The writing of this report and the dissemination meeting accompanying its release are supported by the NIH grant that funded VHAS Wave 1 data collection. This award is based at the University of Utah and is led and administered by Dr. Kim Korinek. The research team that has been formed and has collaborated for over a decade toward the goals of VHAS includes Principal Investigators Dr. Kim Korinek of the University of Utah in the U.S., Dr. Zachary Zimmer of Mount Saint Vincent University in Canada, and Dr. Bussarawan Teerawichitchainan of the National University of Singapore in Singapore. The team also includes Vietnamese co-investigators Dr. Nguyễn Thị Kim Chuc and Dr. Trần Khánh Toàn of the Hanoi Medical University and Dr. Nguyễn Hữu Minh of the Institute of Family and Gender Studies and Việt Nam Academy of Social

Sciences. Over the years, several additional researchers have joined the research team, some of whom have co-authored chapters in this report. These include, among others, the following researchers who are part of the core team: Dr. Yvette Young, formerly of the University of Utah in the U.S. and now of Max Plank Institute for Demographic Research in Germany, Dr. Melanie A. Martin of the University of Washington in the U.S., and Trần Thị Cẩm Nhung of the University of Utah in the U.S. In addition, data collection was facilitated by commune-level population volunteers and a team of over 25 interviewers and health examination staff. The core research team also employs several Research Assistants who help analyze and manage data, conduct literature reviews, and undertake other tasks necessary when running a large-scale project such as this. These assistants are often university students who gain valuable hands-on research experience working on the project.

**THE POTENTIALLY LASTING
EFFECTS OF WAR HAVE BEEN
UNDER-APPRECIATED AS A
DETERMINANT OF HEALTHY AGING.**

IMPORTANCE OF THE VHAS STUDY

Studying the enduring impact of wartime trauma is, unfortunately, relevant for many populations around the world. Billions alive today have been affected by war, and the number is increasing (Spagat, 2012). Addressing the needs of those exposed to war is an enormous challenge for population health and policy (Levy & Sidel, 2008). This is especially true

of the world's older populations, given the population aging occurring around the world and the reality that more and more of those moving into old age today are from cohorts that have experienced conflict. Zimmer (2022) estimates that 85% of older persons living in Asia today experienced a *cumulatively intense* war in their country of residence at some point during their lives. Several influential journals in gerontology and gerontological researchers have postulated that war is a critical social determinant of old-age health and quality of life among veterans and those who have experienced wartime trauma (Wilmoth & London, 2016). Far too many older persons around the world are experiencing the same phenomena: they sustained the trauma of war earlier in life; they live in economically disadvantaged countries where quality health services are underdeveloped; and they are now moving into older ages when signs and symptoms of chronic disease begin to emerge. Despite this, the potentially lasting effects of war have been under-appreciated as a determinant of healthy aging. **To what extent have individuals who faced wartime trauma earlier in life recovered from these events, and to what extent do they suffer?** It is incumbent upon the global health community to move toward a better understanding of war's long-term impact on aging, the global disease burden, and demands upon public health and support systems.

THE VIETNAMESE CONTEXT

Việt Nam provides an ideal context within which to examine the long-term impacts of war on the health of an aging population for various reasons:

1. **Việt Nam is undergoing rapid population aging.** In Việt Nam, considerable numbers of men and women exposed to war and mobilized to support war efforts are now moving into ages where the signs and symptoms of chronic disease common in older age begin to emerge. Is the likelihood of experiencing health problems in older age linked to their war experiences? In Việt Nam, there is currently a time-sensitive but unique opportunity to answer this question and, in the process, gain insights into determinants of health in older ages.
2. A majority of the studies looking into war's impacts have concerned veterans and immigrant survivors of war. **Under-addressed is war's burden of disease where conflict ensues.** Rather than from afar, today's older Vietnamese experienced conflict in their own homes and communities and within their social infrastructure. Older Vietnamese today did not have to be directly involved in military combat to experience the harsh circumstances

that often accompany war. They may have experienced the death or injury of family members, relatives, and friends; they may have been exposed to bombings and chemical weapons that characterized the violence of the wars in Việt Nam; and they may have lived through stressful ambient conditions that accompanied the country's involvement in war generally.

3. **There is tremendous diversity in the experiences of Vietnamese survivors.** Some were directly involved in the war, and others less so. Some lived in or near communities targeted by bombing, others farther away. Some lost family members and endured injuries; others did not. This resulted in a range of exposures, from mild to extreme, and a range of participation that allows for comparison across differentially exposed groups.
4. American War-era cohorts in Việt Nam include many women who engaged in combat and dangerous paramilitary operations. Although women's military participation is increasing and changing globally, **information on the long-term physical and mental health consequences of military service among female veterans remains sparse.** Therefore, Việt Nam presents a unique opportunity to employ a gender-informed perspective on the effects of war. Women's and men's divergent support networks, coping methods, and behaviors are possible mechanisms for influencing gendered impacts of exposure upon health.

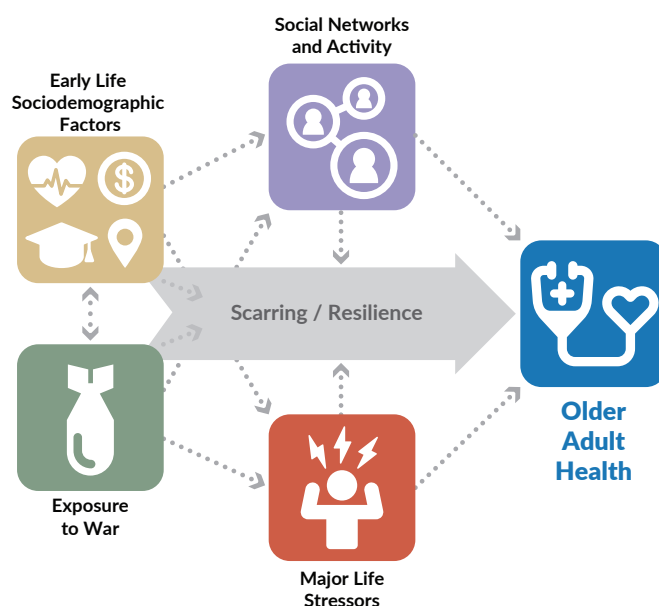


Figure 1.1 Conceptual model of war exposure and later life health

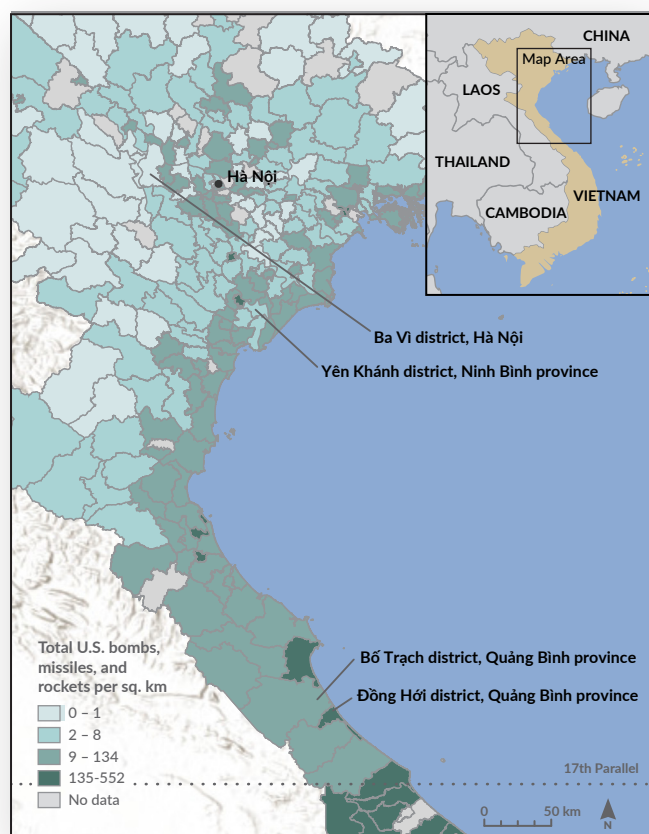


Figure 1.2 Districts sampled in the VHAS. Districts are categorized based on the amount of ordnance dropped from U.S. and allied aircraft in Vietnam between 1965 and 1975, as well as artillery fired from naval ships. Data source: Miguel & Roland, 2011.

METHODS

A comprehensive report on the methodology used in the 2018 VHAS Wave 1 data collection has been published elsewhere (Korinek et al., 2019). Reviewed here are a few key elements.

Individuals who participated in the VHAS study were selected using a multistage probability sample design. These individuals resided in one of four districts differentiated by wartime bombing (See Figure 1.2). Within these four districts, 12 communes were randomly selected for study, including four each from Ba Vì and Yên Khánh districts and two each from Bồ Trạch and Đồng Hới districts. In each randomly selected commune, investigators consulted household registration databases to generate a list of potential participants. The list included the following information about all potential participants: address, name, age, sex, and veteran status. To ensure that the sample contained a sufficiently representative number of female and male veterans, the list was

stratified by sex and veteran status (i.e., male-veteran; female-veteran; male-nonveteran; female-nonveteran). Individuals were then randomly selected from within each of the communes and strata. After eliminating those who were ineligible and those who declined to participate, the sample included 2,447 individuals. Figure 1.3 shows the distribution of the sample by gender and veteran status. Sample weights were constructed such that, when applied, the results are representative of the older adult population aged 60+ living in the twelve communes from where the sample was drawn.

Population volunteers from the area contacted the potential respondents, described the study, and invited their participation. Participants were familiarized with the study so that they were able to consider participation and provide informed consent. Ethical standards committees at Hanoi Medical University, University of Utah, Mount Saint Vincent University, Singapore Management University, and the National University of Singapore approved all procedures. Staff scheduled an appointment with each participant, and participants were visited in their homes by an interviewer who administered a questionnaire that took about two hours to complete. Responses were recorded using Computer Assisted Personal Interviewing (CAPI) via the CommCare data collection app, and thus data were directly logged and saved into a computer database. Participants were also scheduled for a health exam that included the collection of anthropometric information and hair and capillary blood samples. The biomarker collection occurred at the commune health center in the two days following the interview.

The overall response rate for VHAS Wave 1 interview data, calculated as the number of respondents divided

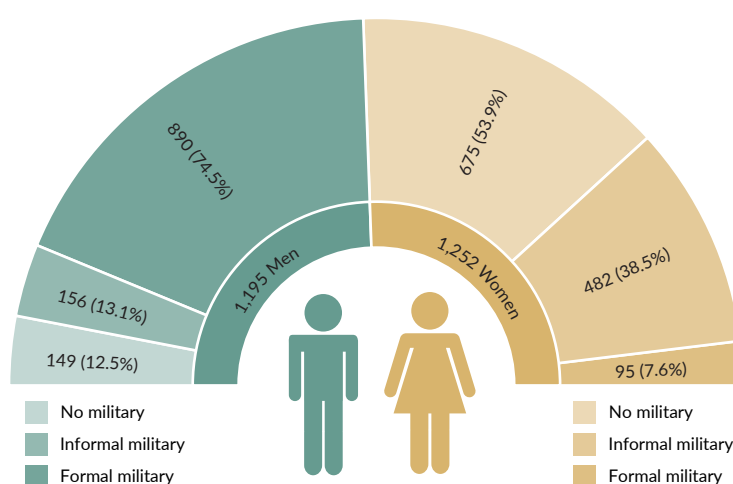


Figure 1.3 VHAS sample by gender and military service status

Table 1.1 Participation rates for VHAS Wave 1 data collection

	Percent of possible participants	Number of participants
Respondent Interview	97%	2,372
Biomarker Collection Participation	96%	2,342
Capillary Blood Sample Provided	90%	2,210
Proxy Respondent	3%	75

85%
**OVERALL
RESPONSE RATE
FOR VHAS WAVE 1**

by the number of potential respondents contacted, was approximately 85% (see Table 1.1) Those who did not participate either declined, were unavailable, or could not be located. If the sampled participant was too frail or otherwise did not have the capacity to answer questions independently, a proxy respondent, such as a spouse or adult child who could respond on their behalf, was identified. In total, 75 interviews, or about 3% of the total, were completed entirely by a proxy. Individuals could complete the interview but elect not to participate in the biomarker data collection. Even with this option, participation in biomarker collection was remarkably high. About 96% of those who completed interviews provided at least some biomarker data, and roughly 90% provided capillary blood samples.

CURRENT REPORT

Wave 1 VHAS data has been used in several research articles published in peer-reviewed journals and papers presented at scholarly conferences. A current list of scientific materials to which VHAS has contributed can be found on the study website at: www.vhas.utah.edu. Thus far, these analyses have examined the socioeconomic and demographic situation of older Vietnamese and suggested links between

wartime stressors and several physical and psychological health outcomes, including PTSD, cardiovascular conditions, respiratory function, and frailty, among others (Korinek et al., 2020; Teerawichitchainan et al., 2023; Young et al., 2022; Zimmer et al., 2021). While an enormous amount of work remains to be completed, these early analyses have exposed a great deal of complexity in associations that characterize the link between wartime events, wartime trauma, and social, economic, and health outcomes. For instance, physical and psychological reactions to wartime trauma may vary by age, type of exposure, an individual’s military experience, whether it be formal, informal, or non-military, their sex, and other socio-demographic and economic characteristics that could predispose individuals to better or worse health outcomes (Glass et al., 2023; Young et al., 2022).

This report provides an analytical overview of some of the most pertinent information available in Wave 1 of VHAS data. The chapters that follow describe how VHAS approaches the measurement of wartime exposure; review some demographic, social, and economic realities for the wartime surviving population in Việt Nam, such as migration histories and family life; and examine fundamental linkages between wartime exposure and specific health outcomes such as cognitive

ORGANIZATION OF ANALYSES

Most of the chapters follow a consistent strategy for displaying results. The chapters center around key outcomes, such as cognitive health or physical functioning. The chapters describe outcomes’ measurement and their distributions. We generally show associations between the outcomes and two key predictors, sex (male versus female) and military experience (formal military, informal military, and civilian). We then run regression models to indicate whether and how the outcomes vary by exposure to wartime stressors. The next chapter describes how exposure to wartime stressors is defined and measured in VHAS.

REGRESSION MODELS

The regression models in the report are statistical procedures that test for associations between wartime stressors and health and well-being outcomes while accounting for other factors that may also explain the associations. For instance, the effect of wartime experiences on cognitive or physical health may depend upon one's educational status, the region of the country in which one lives, or other factors. The tables and graphs shown in this report simplify the results by focusing on how the level of wartime stressors are associated with the outcomes after accounting for other factors, and so they can be interpreted as adjusted associations. Full results showing the associations of all the factors included in the regression models will be published in online Appendices at www.vhas.utah.edu.

health, chronic conditions, and functionality. The report ends with a discussion of the implications of the findings presented in this report and those published elsewhere.

THE FUTURE OF VHAS

We conclude this chapter with a few comments about the future direction of VHAS beyond the current report. The VHAS team collected Wave 2 data in 2021 and 2022. Wave 2 features a follow-up interview and biomarker collection with all Wave 1 surviving participants and includes a verbal autopsy for the approximately 200 participants who passed away since 2018. Wave 2 provides updated and additional measures of participants' health, living conditions, and social relationships. Soon we will be examining in detail how health and other

dimensions of wellbeing have changed over time and how war, wartime stressors, and trauma influences changes in health in older ages. VHAS has received additional funding from NIH to examine war-related risk factors for cognitive impairment, Alzheimer's Disease, and related dementias in a subsample of the VHAS. A grant from the Canadian Institute of Health Research (CIHR) is funding the analysis of blood for epigenetic outcomes and the analysis of hair for cortisol outputs. CIHR is also supporting additional analyses on blood biomarker attributes. In the longer term, the research team is planning further follow-up data collection with the VHAS sample and studies involving the participants' families to assess the intergenerational transmission of trauma. Geographically, the current VHAS study is limited



VHAS Wave 2 field researchers preparing to conduct household interviews in Quảng Bình. Photo: **Trần Thị Cẩm Nhung**

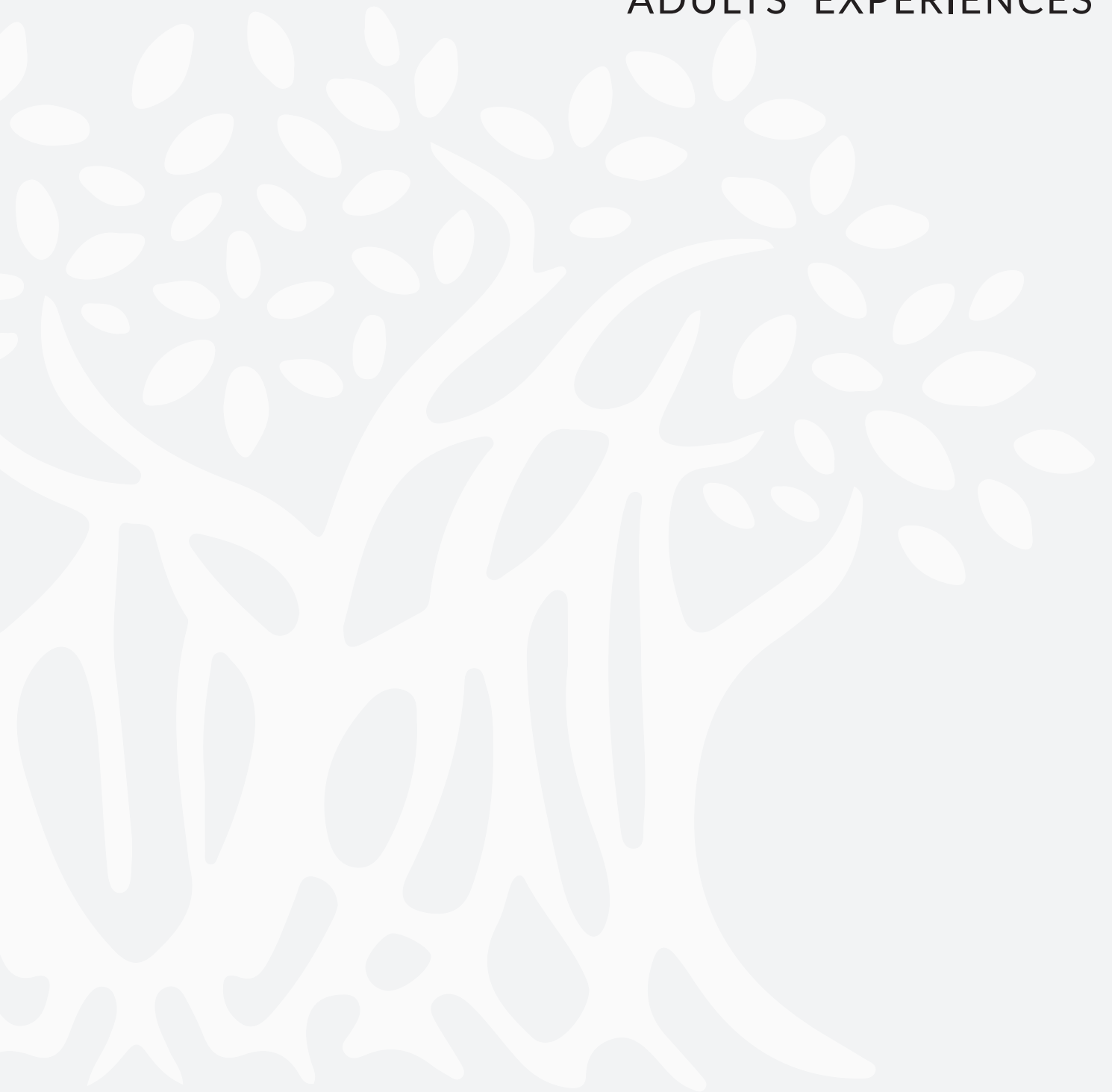
to several districts located in Northern Việt Nam. Budgetary constraints and practical matters restricted area coverage. However, future research may expand to other areas of Việt Nam and other areas in Southeast Asia also affected by these wars. In other words, the VHAS team considers the Wave 1 VHAS data collection and analyses, including the analyses presented in this report, to be the beginning of a longer-term interdisciplinary and multidimensional set of studies. While these studies are substantively aimed at understanding the enduring impacts of war and wartime trauma on health and

wellbeing, there are several additional parallel objectives and aspirations. Notably, the research team is working to train up-and-coming researchers to continue VHAS. Some of these are Vietnamese students, and therefore there is a capacity-building component to VHAS. VHAS has contributed to the creation of an international group of researchers, some of whom are graduate and newly graduated students coming from different fields, united by their concern about the long-term impacts of war on the health and aging of populations in developing countries.

REFERENCES

- Glass, D. J., Young, Y. M., Tran, T. K., Clarkin, P., & Korinek, K. (2023). Weathering within war: Somatic health complaints among Vietnamese older adults exposed to bombing and violence as adolescents in the American war. *Journal of Psychosomatic Research*, 165, Article 111080. <https://doi.org/10.1016/j.jpsychores.2022.111080>
- Korinek, K., Teerawichitchainan, B., Zimmer, Z., Brindle, E., Nguyen T. K. C., Nguyen, H. M., & Tran, K. T. (2019). Design and measurement in a study of war exposure, health, and aging: Protocol for the Vietnam health and aging study. *BMC Public Health* 19(1), Article 1351. <https://doi.org/10.1186/s12889-019-7680-6>
- Korinek, K., Young, Y., Teerawichitchainan, B., Kim Chuc, N. T., Kovnick, M., & Zimmer, Z. (2020). Is war hard on the heart? Gender, wartime stress and late life cardiovascular conditions in a population of Vietnamese older adults. *Social Science & Medicine*, 265, Article 113380. <https://doi.org/10.1016/j.socscimed.2020.113380>
- Levy, B. S., & Sidel, V. W. (2008). *War and Public Health*. New York: Oxford University Press.
- Miguel, E., & Roland, G. (2011). The long-run impact of bombing Vietnam. *Journal of Development Economics*, 96(1), 1-15. <https://doi.org/10.1016/j.jdeveco.2010.07.004>
- Spagat, M. (2012). Estimating the human costs of war: The sample survey approach. In M R. Garfinkel & S. Skaperdas (Eds.), *The Oxford Handbook of the Economics of Peace and Conflict* (pp. 318-340). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780195392777.013.0014>
- Teerawichitchainan, B., Zimmer, Z., Low, T. Q. Y., & Toan, T. K. (2023). Respiratory health among older adults in Vietnam: Does earlier-life military role and war exposure matter?. *Journal of Aging and Health*, 35(3-4), 168-181. <https://doi.org/10.1177/08982643221118445>
- Wilmoth, J. M., London, A. S. (2016). The influence of military service on aging. In L. K. George & K. F. Ferraro (Eds.), *Handbook of Aging and the Social Sciences* (8th ed., pp. 227-250). Elsevier. <https://doi.org/10.1016/B978-0-12-417235-7.00011-1>
- Young, Y., Kovnick, M. O., Korinek, K., & Nguyen, H. M. (2022). Gendered exposure, gendered response: Exposure to wartime stressors and PTSD in older Vietnamese war survivors. *Gender & Society*, 36(5), 704-734. <https://doi.org/10.1177/08912432221113744>
- Zimmer, Z., Korinek, K., Young, Y., Teerawichitchainan, B., & Tran, K. T. (2021). Early-life war exposure and later-life frailty among older adults in Vietnam: Does war hasten aging?. *The Journals of Gerontology: Series B*, 77(9), 1674-1685. <https://doi.org/10.1093/geronb/gbab190>
- Zimmer, Z. (2022). War exposure: an under-appreciated determinant of population health in Asia. *Asian Population Studies*, 18(3), 207-212. <https://doi.org/10.1080/17441730.2022.2142394>

MEASURING WAR
EXPOSURE REQUIRES
A MULTIDIMENSIONAL
APPROACH TO CAPTURE
THE DIVERSITY OF
VIETNAMESE OLDER
ADULTS' EXPERIENCES





CHAPTER 2

GENDER, MILITARY SERVICE, AND WAR EXPOSURE

KIM KORINEK, YVETTE YOUNG, ZACHARY ZIMMER, BUSSARAWAN
TEERAWICHITCHAINAN, NGUYỄN HỮU MINH

Far beyond the lives lost to combat, bombings, and other mortal violence, war exacts an immeasurable and lasting toll on human health (Murray et al., 2002). For decades, scholars have sought to estimate war's direct and indirect impacts on health, an effort that begins with quantifying and characterizing exposure to war's violence, stress, and devastation. Globally, this work has primarily concentrated on military veterans of foreign wars and has generated numerous instruments and scales for capturing veterans' warzone experiences (e.g., Keane et al., 1989; King et al., 2006). However, in the American War in Việt Nam, as in many modern wars, civilians bore a heavy burden. Growing research documents critical exposures to violence among combatants and noncombatants alike, emphasizing the associated injuries and the lasting consequences for maternal health; child health and development; psychiatric morbidities; and a range of chronic conditions (Chukwuma & Ekhatior-Mobayode, 2019; Goto et al., 2021; Wild et al., 2020).

One of the most pressing challenges in the field of armed conflict and health is the measurement of war exposure in conflict-affected populations. Despite recent innovations, the collection of data on exposure to war violence and human

**IN THE AMERICAN WAR IN
VIỆT NAM, CIVILIANS WERE
HEAVILY EXPOSED TO MORTAL
VIOLENCE AND DESTRUCTION;
THE IMPLICATIONS FOR LATE-LIFE
HEALTH ARE NOT YET KNOWN.**

vital events, health outcomes, and wellbeing in the wake of war is quite limited for the major inter- and intrastate conflicts of the 20th and early 21st centuries (Checchi et al., 2017). The

VHAS represents the first effort to systematically measure individual-level exposures to the violence and stressors of the American War among the Vietnamese populace. It is also the first to estimate the long-term effects of these war exposures on late-life health and aging in Việt Nam.

Prior armed conflict exposure studies have overwhelmingly relied on aggregating global armed conflict events datasets, which scholars linked with georeferenced health and vital events data to estimate armed conflict's influence upon mortality and morbidity (e.g., Sapir et al., 2022; Kotsadam & Ostby, 2019;). The challenge in using conflict event data comes in defining the “conflict zone” around an event to estimate the population potentially “exposed” to that conflict event (Raleigh & Urdal, 2007). Alternate approaches have involved conducting household or individual surveys in conflict or immediate post-conflict environments (Humphreys & Weinstein, 2008). Yet another body of research relies upon checklists or inventories of exposure. These are typically administered to populations within a set geographic range of the fighting during or after periods of conflict violence. Well-designed and effectively administered checklists can allow analysts to precisely quantify and categorize war exposures in ways that align with theoretical frameworks and psychosocial constructs.

The VHAS takes a unique, **multifaceted approach to estimating war exposure** within a sample that reflects the socioeconomic and demographic diversity of American War survivors in Việt Nam. First, the study was designed to incorporate regional variation in the levels and types of war violence by selecting participants from geographic locations that experienced different degrees of conflict. Second, drawing from established checklists, the VHAS survey asked about individual experiences of many types of war activities (e.g., military service) and events. This hybrid approach, described in greater detail below, provides for diverse possible experiences and guarantees that the sample represents the range of exposures typical among those that lived in Northern Việt Nam during the war.

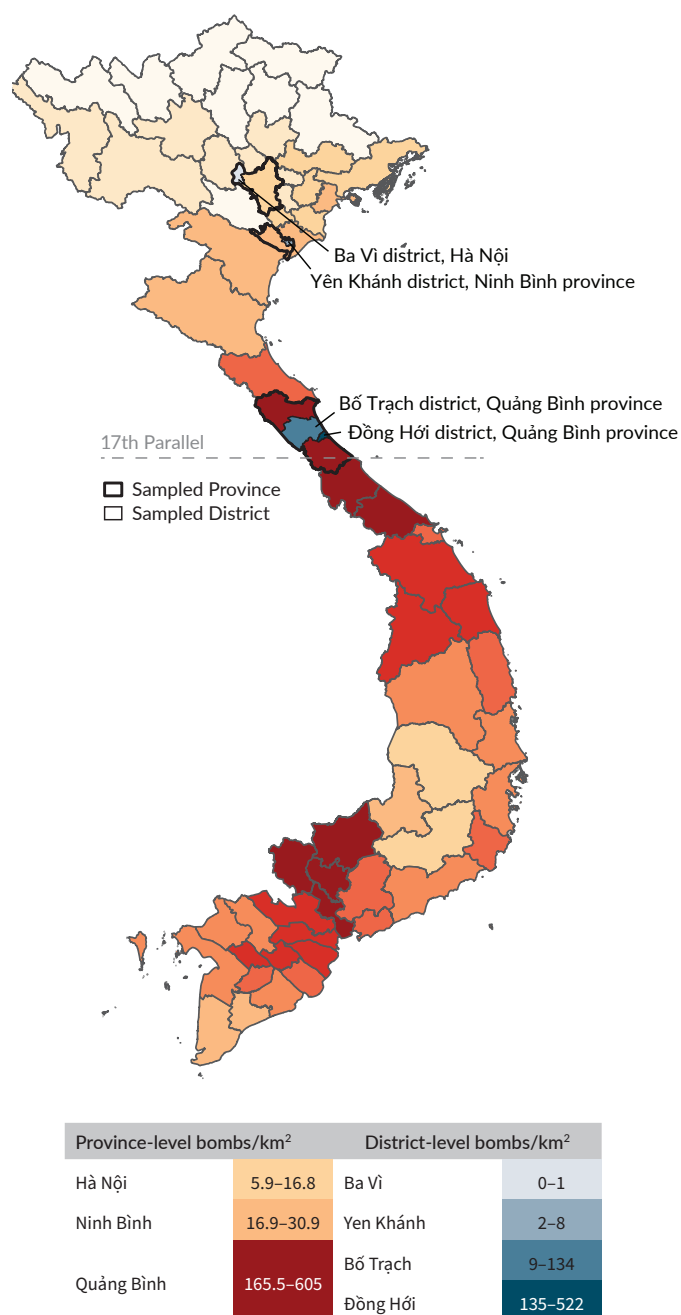


Figure 2.1 Map of bombing intensity

Table 2.1 VHAS Sample by gender and military service status

	No military service		Informal military service		Formal military service		Total	
	%	n	%	n	%	n	%	n
Men	12.5	149	13.1	156	74.5	890	48.8	1,195
Women	53.9	675	38.5	482	7.6	95	51.2	1,252
Total	33.6	824	26.1	638	40.3	985	100.0	2,447

APPROACHES TO MEASURING WAR EXPOSURE IN VHAS

The VHAS is the first comprehensive population-based survey in Việt Nam to examine health outcomes as they vary across forms and levels of war exposure. As elaborated in Chapter 1, the VHAS purposively selected four districts in northern and central Việt Nam to represent an array of bombing intensity during the 1960s and 1970s (see Figure 2.1). Within these districts, stratified random sampling was used. Twelve communes were randomly selected within the districts. Participants were then randomly selected within the communes, with oversampling to ensure adequate analytical samples in four sampling domains: male military, female military, male nonmilitary, and female nonmilitary. The military subdomain incorporates formal military participants, especially veterans of the People's Army of Việt Nam (PAVN), as well as those who volunteered in local militias and the Thanh Niên Xung Phong (TNXP).

Table 2.1 presents the VHAS sample by gender and lifetime military service status. While certain VHAS participants (N=28) served in both the TNXP and the PAVN, we classify those who performed both forms of service according to their formal military service.

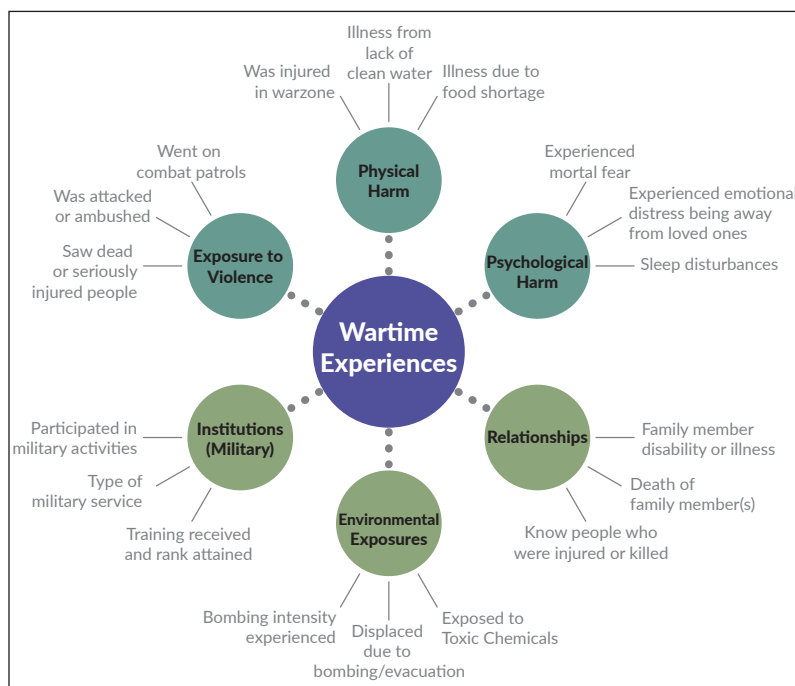


Figure 2.2 Conceptual model of war exposure

Military membership and gender were influential social statuses during the war, but they do not adequately capture survivors' extensive and diverse wartime experiences. As conceptualized in the VHAS, wartime experiences span multiple domains and can result in varied forms of harm (see Figure 2.2). For instance, each veteran of the formal military occupied a specific position in a military institution, experienced a

Table 2.2 Dimensions of war exposure

Dimension	Measure or survey question
Exposure to aerial bombing	<ul style="list-style-type: none"> Total number of bombs per km² to which the participant was exposed (based on participants' location(s) during the war).
Familial loss and disability due to war	<ul style="list-style-type: none"> Did the participant's Father, mother, sister, brother, spouse, or child die or become disabled from military service or war-related cause?
Military Service and Military Service Characteristics	<ul style="list-style-type: none"> Did the participant serve in the military, or in a militia or the Thanh Nien Xung Phong (TNXP)? If yes, what year did they enlist? What was the highest rank achieved? What were the participant's main duties in the military? Did the participant experience injury/ hospitalization due to military service?
Exposure to War-related Violence	<ul style="list-style-type: none"> How often did the participant go on combat patrols? How often was the participant ambushed or fired upon? How often did the participant have a friend shot nearby in battle? How often did the participant see dead or injured civilians or soldiers?
Exposure to War-related "Malevolent" Conditions	<ul style="list-style-type: none"> How often did the participant experience illness or weakness due to a shortage of food or clean water? How often did the participant have to move due to bombings or village evacuation? How often did the participant experience fear of death or severe injury due to war?

unique set of exposures to violence and inhospitable environments, amassed physical and psychological harms, and likely endured personal losses. While civilians may have been spared the violence of armed combat that many military members encountered, they were not immune to the physical and psychological impairments stemming from violence, loss, and hardship in a country at war.

Given the diversity of war experiences encountered during the American War, the study was designed to assess war exposure across multiple dimensions. The main dimensions of war exposure chronicled in VHAS are summarized in Table 2.2. The full battery of war exposure questions answered by VHAS participants can be found on the VHAS website: www.vhas.utah.edu. As this chapter will show, VHAS participants vary significantly across these dimensions of exposure, depending upon their gender, social class, region of residence, and military service characteristics.

Many of the measures address exposures that all members of the population might have experienced, with exposure risk varying according to age, location, social class, and other structural characteristics. For example, civilians and military members may have experienced bombing during the war, with the intensity of their exposure depending upon their residential location and wartime mobility. Death or disablement of a family member is a stressor of war that many experienced, irrespective of military service status. It was influenced by the participants' and their family members' region of residence, year of birth, number of siblings, and other factors.

Several of the war-related violence exposure measures were unlikely to be experienced by civilians. For example, VHAS inquired how often participants experienced being ambushed, faced artillery fire, went on combat patrols, had a friend shot near them in battle, and other experiences that demonstrate proximity to lethal violence. These experiences were asked about only among those who participated in the military or in volunteer military support and militia organizations (e.g., the TNXP).

PATTERNS OF WAR EXPOSURE IN THE VHAS STUDY SAMPLE

While it is beyond the scope of this report to provide a comprehensive description of war exposures experienced by VHAS participants, we present several examples to illustrate the diverse war exposures assessed in VHAS that this cohort of older adults faced in their youth.

EXPOSURE TO BOMBING

The Indochina War, centered in Việt Nam, stands out as the most intense episode of aerial bombing in human history (Clodfelter, 1995). The tonnage of ordnance dropped over Việt Nam was more than three times the tonnage dropped in both the European and Pacific theaters during World War II and around fifteen times that of the Korean War (Miguel & Roland, 2011). VHAS attempted to measure individuals' exposure to the intense but widely variable American bombing by sampling from four districts of the former DRV that experienced great diversity in their district-level aerial bombing intensity (Korinek et al., 2019). The VHAS interview also collected migration histories during the 1965–1975 war decade. Individual exposure to U.S. and allied bombing can be estimated by joining official U.S. military records of bombing missions—which document the precise timing and geographic location of all sorties—with VHAS participants' self-reported migration histories (including military deployments and other migrations) during the 1965–1975 decade. While quantifying this exposure is challenged by our relatively crude indicator of residential locations (assessed at the provincial level), nonetheless, we see, as summarized in Figure 2.3, that total exposure to bombings (number of bombs per km²) is high for this cohort of older adults and varies by participant's gender and especially their history of military service. Because they were deployed across wide-ranging areas of the conflict, men and women in the VHAS who served in the formal military exhibit the highest total bombing exposures.

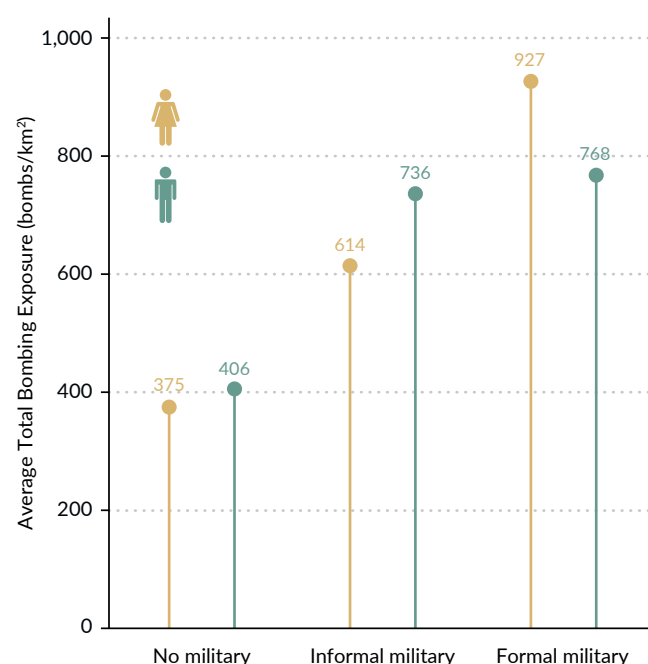
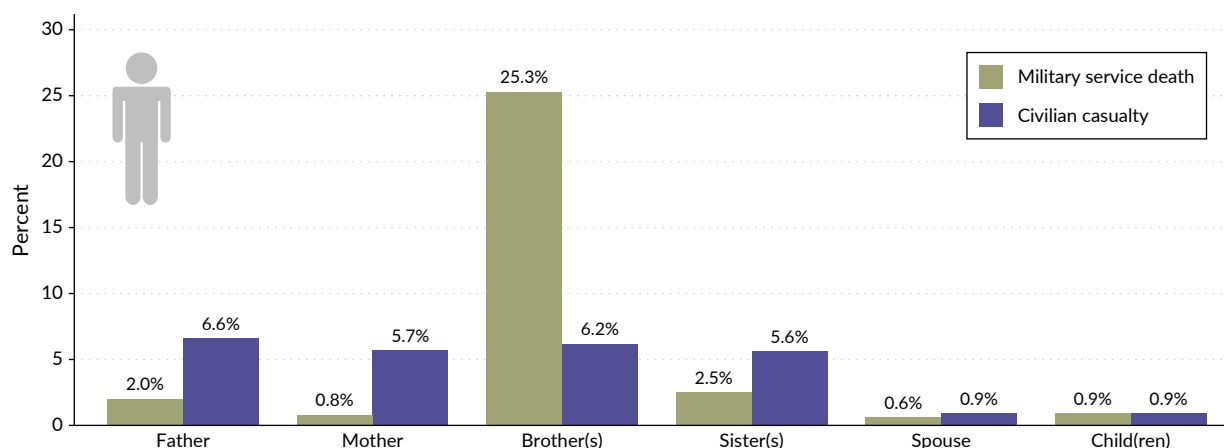


Figure 2.3 Bombing exposure intensity by gender and military service status

A War-related Death of Family Members among VHAS Men



B War-related Death of Family Members among VHAS Women

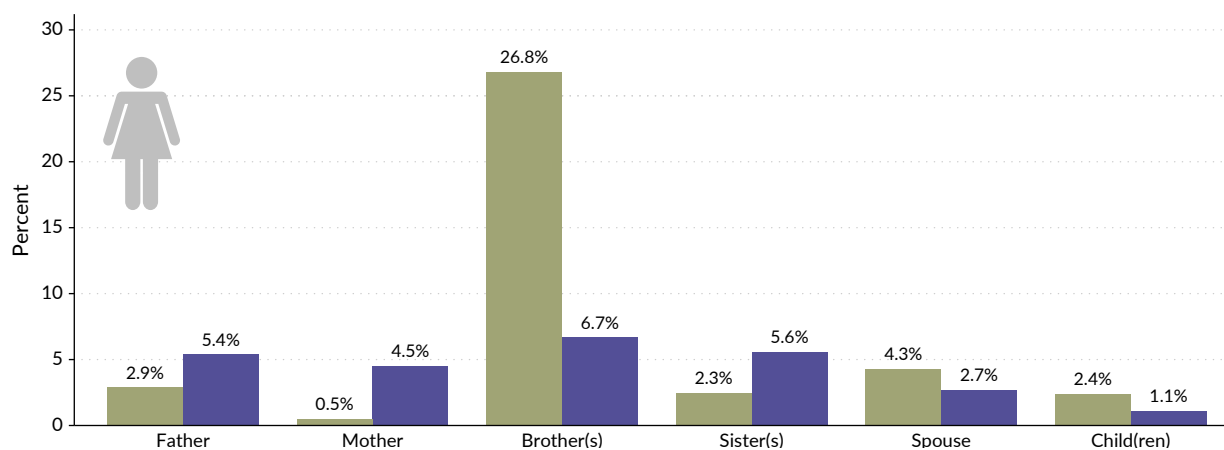


Figure 2.4 Loss of family members due to military service or war-related causes

FAMILIAL LOSS DUE TO WAR

One of several individual-level measures of war exposure in the VHAS, constructed based on participants' answers to a series of questions about the impacts of war among their immediate family members, is the personal loss of a family member due to "military service or war-related causes." The death of a family member, especially an untimely death, can place a range of social, economic, and psychological strains on young adults (Umberson et al., 2020). The strains and enduring pains of war-related deaths have been particularly exacerbated among survivors whose family members' remains were never recovered from the battlefield (Kwon, 2023). In the VHAS sample, many experienced the death of a family member due to war. Figure 2.4 indicates the share of male and female VHAS participants who experienced the death of a parent, sibling, spouse, or child as a result of wartime military service or as a civilian war casualty. Reflecting the war's mortal violence, men's greater proximity to violence through their military roles, and participants' relatively numerous siblings,

over one-quarter of VHAS participants had a brother die due to war. Most lost brothers due to their military service roles, but some described brothers who died as civilian casualties. Yet women were not spared war's violence, and as a result, approximately 8% of VHAS participants lost a sister due to war-related military service or as a civilian casualty. Due to the gender imbalance in war-related deaths, women are far more likely to have lost a spouse in the war. In particular, 7% of women surveyed in the VHAS lost a spouse as a military or civilian casualty in war.

It warrants mentioning that, in addition to direct military and civilian casualties, many other VHAS respondents attribute family members' deaths to other war-related causes. Though these deaths due to "other war-related causes" were not clearly delineated in the data collection, they likely include diseases linked to war-related stressors, toxin exposures, and complications from injuries, as well as shortages in healthcare and food supply exacerbated by war. This broader

set of war-related deaths confirms Levy and Sidel's (2008) observations on war's direct and indirect morbidity and mortality and calls for more detailed accounting to accurately estimate the excess mortality attributable to war in post-conflict societies.

EXPOSURE TO WAR-RELATED VIOLENCE

Exposure to violence in war is known to exact an enduring impact on survivors' health. The enduring impact of this violence may stem from direct personal physical injury, moral injury resulting from perpetrating or witnessing violence, or the psychological imprint left when one experiences acute or chronic stress related to mortal danger. Even though the districts included in the VHAS were not sites of guerrilla warfare and associated violence, nor the war's most intense aerial bombing, many of the participants in the VHAS experienced a significant degree and wide range of violence exposure in

wartime. Violence was experienced by those who were military combatants, militia and TNXP volunteers, and noncombatants who experienced brushes with violence vis-à-vis their family members or their proximity to bombing and other violent acts. To derive its measures of war violence exposure, VHAS drew upon and adapted several existing instruments originating from work with veteran populations in the United States. Specifically, investigators selected items from the **U.S. National Vietnam Veterans Readjustment Study** (Kulka et al., 1988), the **Deployment Risk and Resilience Inventory** (King et al., 2006), and the **Combat Exposure Scale** (Keane et al., 1989). The VHAS investigators selected items that were deemed pertinent to the Việt Nam context, captured a range of violence exposures, and were relevant to Vietnamese people across diverse military and nonmilitary statuses.

One example of impactful violence exposure, experienced regardless of gender and military service status categories in the American-Việt Nam War, is having directly witnessed war casualties, including Vietnamese soldiers, American soldiers, or civilians who had been killed or severely injured. VHAS asked participants how often they were exposed to each of these types of war casualties. Figure 2.5 delineates the frequency of having witnessed dead or severely injured Vietnamese soldiers among VHAS participants and demonstrates that while the majority of women and nonmilitary members were spared this form of exposure to violence, minorities of them did endure this experience on multiple occasions. The VHAS data also reveal that most men who served in formal or informal military roles saw the dead or severely injured bodies of their comrades. For approximately half of them, this form of violence exposure occurred more than ten times. Figure 2.5 repeats this analysis for witnessing civilian casualties in war. We see again how commonplace this exposure has been among VHAS participants. With respect to witnessing civilian casualties, men and women who did not serve in the military more closely resemble their military counterparts on this indicator of violence exposure. Notably, men and women who served in informal military organizations (e.g., TNXP, militias) report having experienced more frequent exposure to civilian casualties than their formal military counterparts.

VHAS also obtained information from those who engaged in military service, either in formal military units or as volunteers in militias or TNXP, regarding their direct experience of mortal danger due to their proximity to bombings, participation in battle, or other violent encounters. Figure 2.6 indicates the percentage of men and women, across formal and informal military service roles, who experienced specific war-related

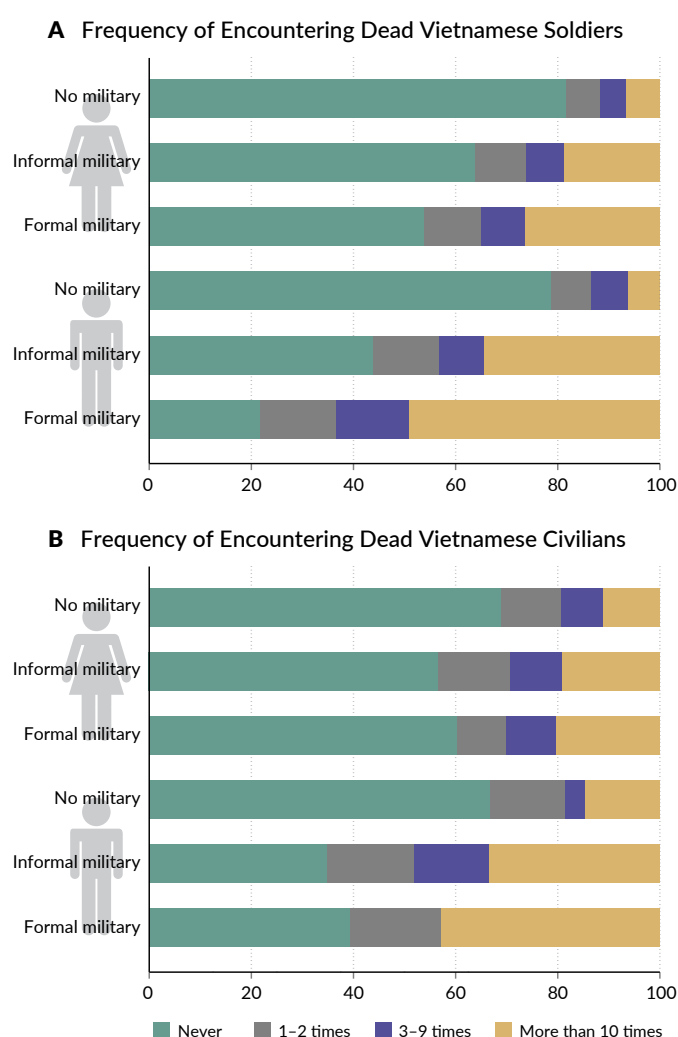


Figure 2.5 Exposure to military and civilian casualties by gender and military service status

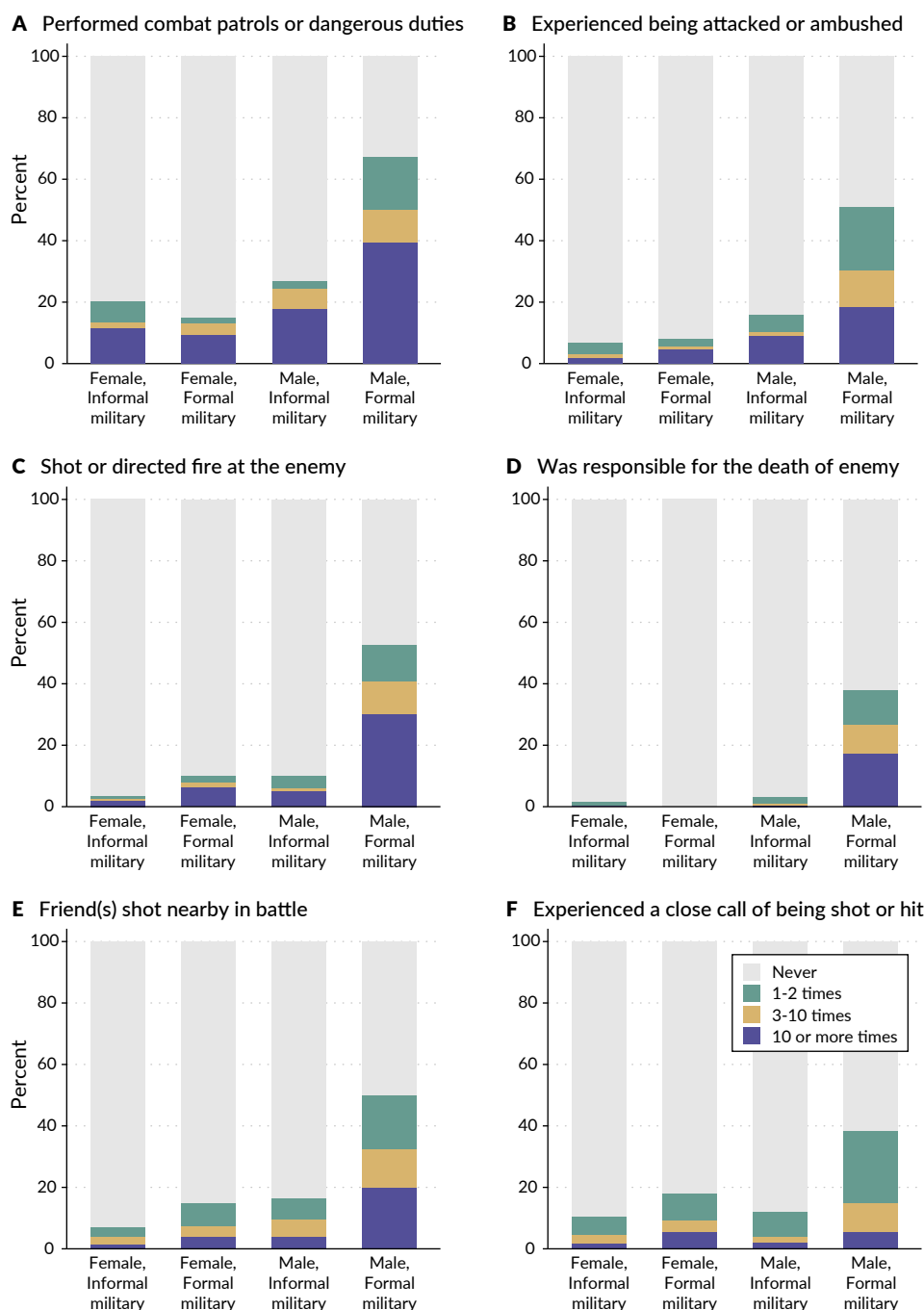


Figure 2.6 War-related violence exposures by gender and military service status

violence exposures. The overarching message is that many members of this cohort experienced significant, potentially traumatizing events, often repeatedly, over the course of the war. Men who served in the formal military were especially likely to have experienced this proximity to mortal violence, but women and those in the informal military were not spared.

EXPOSURE TO THE MALEVOLENT CONDITIONS OF WAR

Recognizing that the stressors of war extend beyond experiencing and witnessing violence, VHAS adopted a

strategy of measuring participants' experience of "malevolent environments." Malevolent environment encompasses difficult conditions and vulnerabilities that stem from war, such as insufficiencies and perceived threats, but do not equate with direct experience of war violence (Fontana & Rosenheck, 1999). Prior investigations among U.S. veterans demonstrate malevolent environmental conditions comprise a critical dimension of warzone stress that is highly relevant to post-war PTSD and other forms of suffering (Ibid., King et al., 1995), in part because such environments can create greater susceptibility to stress reactions (King et al., 1998). VHAS

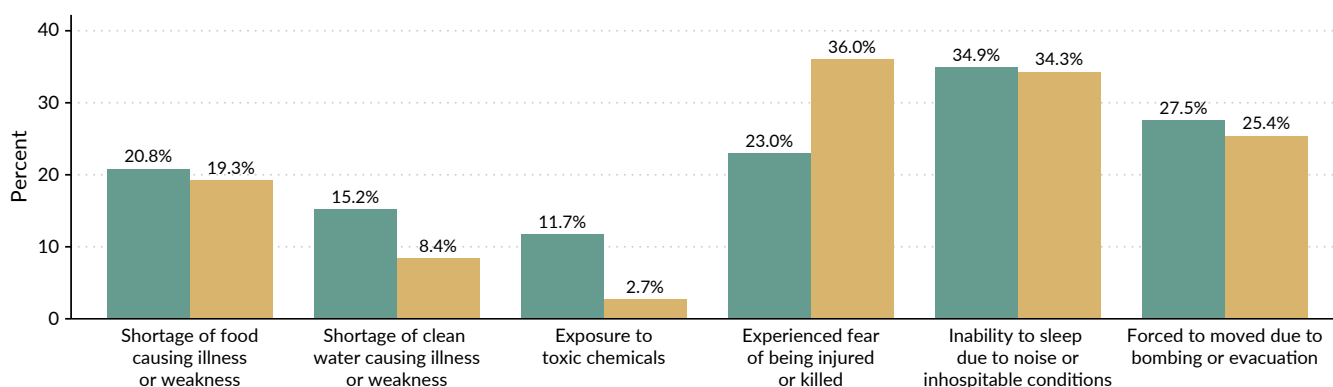
adapts these concepts, considering the threats, vulnerability, and insufficiencies that characterize all members of the society who were exposed to war, whether as soldiers, militia members, or civilians.

As a means of assessing malevolent conditions of war, VHAS participants were presented with the following prompt: “Often during wartime and in the years following, soldiers as well as civilians experience harsh living environments. How often did you encounter the following conditions during the following time periods?” Participants were then asked about a series of harsh living conditions (e.g., inability to sleep due to noise or inhospitable conditions; illness, weakness, or discomfort due to shortage of clean water), whether they experienced them, and if so, how frequently they experienced them from 1965–1975 and in the subsequent ten years (1976–1985).

In Figure 2.7, we summarize the distribution of malevolent condition exposures during and after the war, respectively, by participant sex. Across men and women, we see certain malevolent conditions, such as fear of death or mortal injury, forced migration related to bombing or evacuation, and inability to sleep as a result of noise and inhospitable conditions, were

quite common in these older adults’ wartime youth. While both genders experienced these exposures, men and women diverged in the malevolent conditions to which they were most vulnerable. Women were more prone to forced migration, experiencing fear of death, and being unable to sleep. Men, on the other hand, reflecting their greater representation in the military and deployment to dangerous locations, report more clean water insufficiency and greater exposure to toxic chemicals. Comparing parts A and B of Figure 2.7, we see a pronounced decline in most malevolent conditions after the war’s conclusion. However, certain malevolent conditions, such as severe food shortage, fear of death and mortal injury, and inability to sleep due to environmental conditions, persisted beyond the American War period. These chronic environmental stressors likely reflect the economic difficulties that plagued some communities and families under collectivized agriculture in the post-war period (Raymond et al., 2000). In addition, the Cambodian-Vietnamese War (Chiến dịch Phản công Biên giới Tây-Nam) spanning from 1978–1989 and the border war with China in 1979 (Chiến tranh chống bành trướng Trung Hoa) likely brought some VHAS participants into contact with war’s environmental stressors once again.

A Experienced condition during the American War



B Experienced condition after the American War

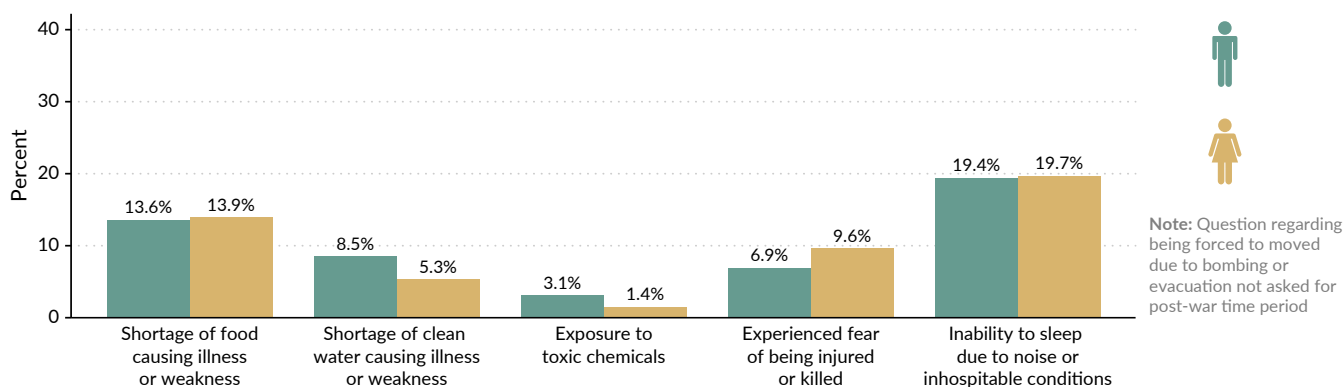


Figure 2.7 Percent experiencing malevolent conditions during and after the war by gender

CONSTRUCTING INDICES TO SUMMARIZE EXPOSURE

To assess the total toll of these varied wartime experiences, we created two indices combining exposures to war violence in one index and exposures to malevolent conditions of war in the other. The experiences of war differed substantially by gender and military activity. While many events were experienced by civilians and soldiers alike, others were exclusive to members of the military. Thus, we conducted statistical analyses to determine which events most frequently occurred together as war exposure experiences. The groups of experiences differed for people with different military service statuses. As a result, we used different sets of experiences to capture war exposure for those with no military service, informal military service, and formal military service. The events summarizing war exposure for these three groups are shown in Figure 2.8. Since the number of events in the index differs for each group, we standardized the indices such that the scores indicate how far¹ the participants' score is from their group's average score.

LIMITATIONS AND FUTURE DIRECTIONS TO ADVANCE THE FIELD OF ARMED CONFLICT, AGING, AND HEALTH

The VHAS offers a uniquely detailed accounting of war exposure among Vietnamese war survivors and, indeed, one of the most thorough accountings of war exposure across conflict-affected populations globally. It is valuable for capturing exposures faced by military members and those who did not serve in the armed forces but nonetheless experienced war violence directly or indirectly. Despite this encompassing and detailed set of war exposure measures, there are limitations that must be considered and from which we can learn for future studies. First, measurement is based on individuals' recollections of experiences that occurred over 40 years ago. Despite the intensity of memories from young adulthood and from emotionally intense episodes in the life course, memory can be clouded, and recollections of the past are imperfect. We recognize that our assessments of specific war exposures and their frequency may be affected by some degree of recall error. Second, we drew from extant research instruments, previously applied in Western settings, to assess war exposures and are certain to have missed particular exposures, salient in the Việt Nam context, that are pertinent to health and aging. Third, reliance upon a quantitative approach and questionnaires with fixed response categories means that VHAS was unable to

¹ Distance is measured in standard deviations.

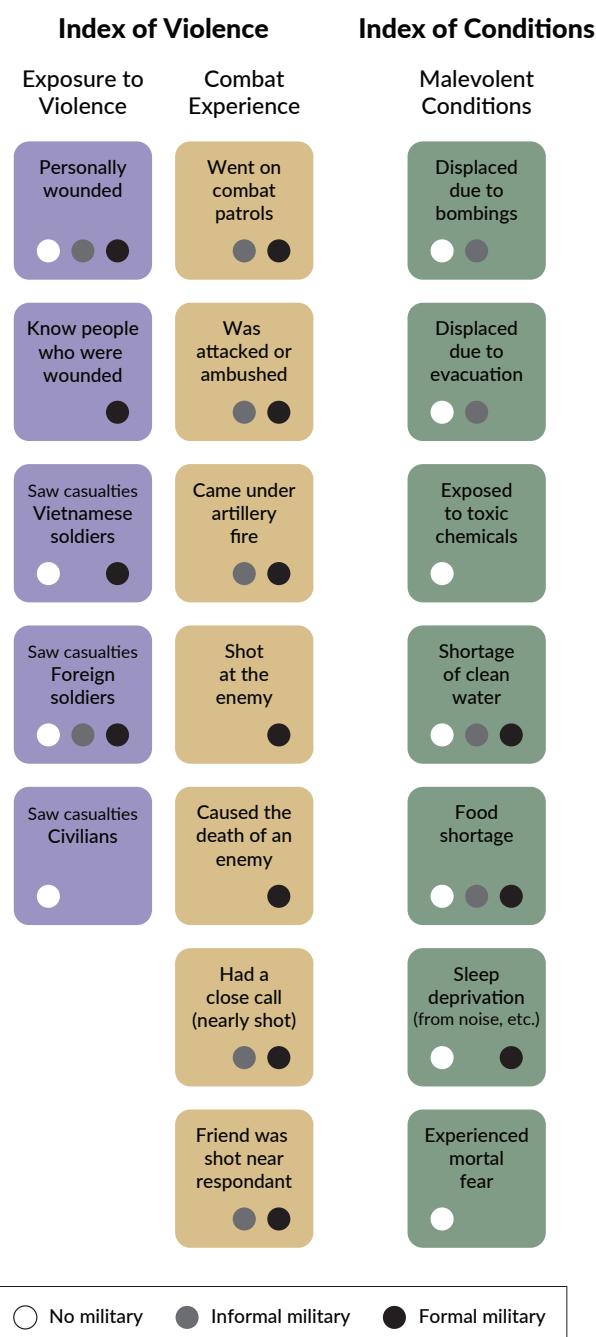


Figure 2.8 Components of war exposure indices for civilians, informal military participants, and military veterans

delve into the unique experiences of war survivors to ascertain their perspectives on war exposures that were particularly impactful or traumatizing.

These limitations aside, VHAS yields a valuable accounting of war exposures in this important cohort of older adults, permitting many approaches to measurement and thus allowing extensive analyses of war exposure as a determinant

of late-life health and wellbeing. In addition to the individual events and exposures that one can query in the data, and the indices which capture degrees of exposure to wartime violence and malevolent conditions, numerous other permutations of war exposure can be estimated using the VHAS data. For instance, latent class analysis techniques, which cluster participants based on their characteristics and experiences, inform the creation of classes of wartime experience based upon “emergent patterns of experience” among VHAS participants (Zimmer et al., 2022).

Looking toward the future, it will be crucial to expand the research in several directions in order to best understand war exposure and its lingering effects on health and aging

processes in Vietnamese older adults. First, expansion of the VHAS methodology to provinces south of the 17th parallel would allow for a more representative sampling of the myriad war stress exposures during the American war, many of which were of much greater intensity in particular provinces of southern Việt Nam. Second, while comprehensive, the VHAS methodology would benefit from including additional exposures faced by noncombatants during and after the war, such as missing-in-action family members, witnessing atrocities, and destruction of property. Lastly, capturing the voices of war survivors in qualitative accounts of their war exposures can provide more nuanced insights into the sources of post-war scarring and resilience.

REFERENCES

- Chukwuma, A., & Ekhatior-Mobayode, U. E. (2019). Armed conflict and maternal health care utilization: evidence from the Boko Haram Insurgency in Nigeria. *Social Science & Medicine*, 226, 104-112. <https://doi.org/10.1016/j.socscimed.2019.02.055>
- Fontana, A., & Rosenheck, R. (1999). A model of war zone stressors and posttraumatic stress disorder. *Journal of Traumatic Stress*, 12(1), 111-126. <https://doi.org/10.1023/A:1024750417154>
- Goto, R., Frodl, T., & Skokauskas, N. (2021). Armed conflict and early childhood development in 12 low-and middle-income countries. *Pediatrics*, 148(3). <https://doi.org/10.1542/peds.2021-050332>
- Humphreys, M., & Weinstein, J. M. (2008). Who fights? The determinants of participation in civil war. *American Journal of Political Science*, 52(2), 436-455. <https://doi.org/10.1111/j.1540-5907.2008.00322.x>
- King, D. W., King, L. A., Gudanowski, D. M., & Vreven, D. L. (1995). Alternative representations of war zone stressors: relationships to posttraumatic stress disorder in male and female Vietnam veterans. *Journal of Abnormal Psychology*, 104(1), 184. <https://doi.org/10.1037/0021-843X.104.1.184>
- King, L. A., King, D. W., Fairbank, J. A., Keane, T. M., & Adams, G. A. (1998). Resilience–recovery factors in post-traumatic stress disorder among female and male Vietnam veterans: Hardiness, postwar social support, and additional stressful life events. *Journal of Personality and Social Psychology*, 74(2), 420. <https://doi.org/10.1037/0022-3514.74.2.420>
- King, L. A., King, D. W., Vogt, D. S., Knight, J., & Samper, R. E. (2006). Deployment Risk and Resilience Inventory: A collection of measures for studying deployment-related experiences of military personnel and veterans. *Military Psychology*, 18(2), 89-120. https://doi.org/10.1207/s15327876mp1802_1
- Kotsadam, A., & Østby, G. (2019). Armed conflict and maternal mortality: a micro-level analysis of sub-Saharan Africa, 1989–2013. *Social Science & Medicine*, 239, 112526. <https://doi.org/10.1016/j.socscimed.2019.112526>
- Kulka, R. A., Schlenger, W. E., Fairbank, J. A., Hough, R. L., Jordan, B. K., Marmar, C. R., & Weiss, D. S. (1988). Contractual report of findings from the National Vietnam veterans readjustment study. Research Triangle Park, NC: Research Triangle Institute, 1-682.
- Kwon, H. (2023). Wounds to the soul: A view from Vietnam. *Routledge Handbook of Trauma in East Asia*. (T. Burrett, & J. Kingston, Eds.). Routledge. <https://doi.org/10.4324/9781003292661>
- Levy, B. S., & Sidel, V. W. (Eds.). (2008). War and public health. Oxford University Press.
- Miguel, E., & Roland, G. (2011). The long-run impact of bombing Vietnam. *Journal of Development Economics*, 96(1), 1–15. <https://doi.org/10.1016/j.jdeveco.2010.07.004>
- Murray, C. J., King, G., Lopez, A. D., Tomijima, N., & Krug, E. G. (2002). Armed conflict as a public health problem. *BMJ*, 324(7333), 346-349. <https://doi.org/10.1136%2Fbmj.324.7333.346>
- Raymond, C., Selden, M., & Zhou, K. (2000). The Power of the Strong? Rural Resistance and Reform in China and Vietnam. *China Information*, 14(2), 1-30. <https://doi.org/10.1177/0920203X0001400201>
- Sapir, D., Ogbu, J. T., Scales, S. E., de Almeida, M. M., Donneau, A. F., Diep, A., ... & Burnham, G. (2022). Civil war and death in Yemen: Analysis of SMART survey and ACLED data, 2012–2019. *PLOS Global Public Health*, 2(8), e0000581. <https://doi.org/10.1371/journal.pgph.0000581>
- Wild, H., Stewart, B. T., LeBoa, C., Stave, C. D., & Wren, S. M. (2020). Epidemiology of injuries sustained by civilians and local combatants in contemporary armed conflict: an appeal for a shared trauma registry among humanitarian actors. *World Journal of Surgery*, 44, 1863-1873. <https://doi.org/10.1007/s00268-020-05428-y>
- Zimmer, Z., Korinek, K., Young, Y., Teerawichitchainan, B., & Toan, T. K. (2022). Early-Life War Exposure and Later-Life Frailty Among Older Adults in Vietnam: Does War Hasten Aging? *The Journals of Gerontology: Series B*, 77(9), 1674-1685. <https://doi.org/10.1093/geronb/gbab190>

INVESTIGATING
BIOLOGICAL INDICATORS
OF THE RELATIONSHIP
BETWEEN WARTIME
TRAUMA, HEALTH,
AND AGING





BIOMARKER DATA COLLECTION AND ANALYSIS

MELANIE A. MARTIN, PHƯƠNG ANH TUYẾT, TRẦN KHÁNH TOÀN,
TIFFANY PAN, ROBERT L. TENNYSON

Biomarkers, also known as biological markers, are measurable indicators used for monitoring various physiological and pathological processes taking place within the human body (Green & Hillersdal, 2021). They serve as valuable measures for assessing and tracking an individual's health conditions, as well as prognostic tools for health screening and diagnostic tools for age-related diseases (Hartmann et al., 2021). **Biomarkers of aging illuminate true “biological age,” which can better predict future health and survival than does chronological age** (Fuellen et al., 2019; Hartmann et al., 2021). Biomarker research is advancing through technologies that enable more precise quantitative measurements of bodily signals (Green & Hillersdal, 2021). Consequently, biomarkers have been increasingly applied to human population health studies and are a cornerstone of evidence demonstrating links between social environment and health (Crimmins, 2015; Snodgrass, 2022).

In Việt Nam, there is currently a paucity of research on biomarkers associated with the health of older adults.

To have a comprehensive assessment of health status and aging processes in the elderly population and to further examine how war exposure and life experiences impact risk and resilience in older age in Việt Nam, the VHAS is collecting biological measures (biomarkers) of participants' cardiometabolic health, immune function, inflammation, and senescence. VHAS is unique in that it will assay a wide variety of biomarkers—collected from blood, hair, and anthropometric measures at two different time points—to examine both acute and chronic health and disease states in conjunction with participants' survey and demographic data. The VHAS team chose biomarkers based on the up-to-date research on which biomarkers are most efficacious for understanding biological aging. For example, we selected DNA methylation, standard profiles used to construct multivariate indices of health and aging (e.g., total lipid profiles and complete blood counts), and



Wave 1 medical examination staff processing samples. Photo: **Bussarawan Teerawichitchainan**

those that are currently thought to be related to the damaging impacts of stress and trauma such, as cortisol and C-reactive protein (CRP). Based on these data, VHAS aims to develop an index that allows for evaluating the level of biological aging in the elderly population of Việt Nam. Furthermore, these data will provide a unique opportunity to robustly gauge relationships between wartime trauma and later life health and the pace of aging.

BIOMARKER COLLECTION AND MEASUREMENT

OVERALL BIOMARKER COLLECTION PROCEDURE

Biomarkers from VHAS participants were collected during two waves of data collection: Wave 1 from May to August 2018 and Wave 2 from May 2021 to June 2022 (interrupted due to the Covid-19 pandemic). In each wave, participants were scheduled to visit the commune health centers (CHCs) for a health exam, one to two days before or after the interview, at the participants' convenience. For those too unhealthy to travel to the facility, VHAS staff provided accessibility assistance by home-visit examination. After obtaining informed consent from the participants, biomarkers were measured by four trained technicians, under the advisement of Eleanor Brindle and Co-PIs at the University of Washington's Center for Studies in Demography and Ecology Biodemography Core,

and with direct supervision from a Hanoi Medical University (HMU) biomarker field supervisor. Biomarker collection took approximately 30–40 minutes, including the following steps: 1) check-in and instruction, 2) measurement of anthropometrics, 3) taking functional measurements and blood pressure, and 4) blood and hair sample collection. Finally, the participants also received a complimentary abdominal ultrasound scan performed by physicians from the District Health Center as a gesture of appreciation for consenting to provide biomarkers.

ANTHROPOMETRIC AND FUNCTIONAL BIOMARKER MEASUREMENTS

The Seca 213 portable stadiometer was used for height measurement, while Seca 201 anthropometric measuring tapes were used to measure the circumferences of the left upper arm, waist, hip, and left calf. Weight and body fat percentage were assessed using the OMRON HBF-514 Full Body Sensor Body Composition Monitor and Scale. Grip strength was measured twice for each hand using the Charder MG 4800 Digital Handgrip Dynamometer. Peak expiratory flow was measured three times at 30-second intervals using a Clement Clarke Airzone 3130045 peak flow meter with disposable mouthpieces. Blood pressure and pulse were measured twice at a 45-second interval using the Omron BP785 Upper Arm Cuff Digital Monitor. Vision testing was performed using the Landolt C chart, and gait speed was measured twice over a 4-meter distance at a normal walking speed.

Peak expiratory flow was not measured in Wave 2 due to the perceived risks of Covid-19 transmission associated with conducting the test. Otherwise, all anthropometric and functional measures assessed in Wave 1 were also assessed in Wave 2 using the same procedures and equipment. The vision assessment and timed walk measures were added in Wave 2 to enhance the study's functional health measurements.

BLOOD SAMPLE COLLECTION AND PROCESSING

In both waves, a small portion of the collected whole blood was utilized for complete blood count (CBC) testing and HbA1c assay. The remaining larger portion was processed and separated into plasma and buffy coat components to be transported to HMU to store for later assays. Blood collection was changed from capillary to venous blood between Wave 1 and Wave 2 to lessen participant discomfort and hasten the pace of collection. This also allowed for the collection of larger sample volumes per participant to be stored at HMU for future research. Additionally, CBC and HbA1c were measured using point-of-care (POC) testing in Wave 1 and through routine laboratory-based testing at the laboratory of the district health centers/hospitals in Wave 2.

In Wave 1, a trained phlebotomist performed a finger puncture with a sterile safety lancet to collect capillary blood. Each consenting participant provided a minimum of 0.4 mL

and up to 0.6 mL of whole blood, which was collected in BD Microtainer tubes containing K2-EDTA anticoagulant. Approximately 65–75 μ L of whole blood containing reagents were extracted for CBC testing using the QBC STAR Centrifugal Hematology System. Another tube with 20 μ L of whole blood was extracted for HbA1c testing using the Diazyme SMART Analyzer. Within 15 minutes of collection, the remaining blood sample was centrifuged, and the plasma fraction (\approx 0.15–0.2 mL) and buffy coat layer (\approx 0.1–0.15 mL) were separated and each retained in cryovials. All samples were frozen within one hour of collection, and most were frozen within 15 minutes of collection. Samples were stored in a -20 °C freezer at the CHC for up to 1 week. At the end of data collection in each CHC, specimens were transported on ice to HMU for long-term storage at -80 °C.

In Wave 2, approximately 10 mL of venous blood was collected from each participant into three tubes: a 2 mL tube containing K2EDTA was sent to the laboratory of the district hospital or health center for CBC testing (using a laser-based cell counter) and HbA1c testing (using high-pressure liquid chromatography); a 4 mL tube containing K2EDTA was used for processing and separating into plasma and buffy coat; and a 4 mL clot activator tube was used for serum separation.

Blood transport and storage procedures were otherwise the same for Wave 1 and Wave 2. For both waves, the buffy coat fraction containing peripheral blood mononuclear cells



Wave 1 medical examination staff collecting blood and other biomarker samples from a VHAS participant.
Photo: **Bussarawan Teerawichitchainan**



Medical staff taking a participant's weight and bioimpedence measurements. Photo: **Yvette Young**



Wave 2 Medical staff conducting an vision examination. Photo: **Yvette Young**

was retained for genetic analyses. The plasma fraction was stored for later laboratory analyses of multiple biomarkers of inflammation, immune function, cardiometabolic health, metabolic regulation, and cognitive functioning that collectively contribute to biological senescence. Specific plasma analytes were analyzed via manufactured kits and reagents using hematology auto-analyzers, enzyme immunoassay, and multiplex chemiluminescence methods (Table 3.1).

POINT-OF-CARE TESTING FOR HBA1C AND CBC

In Wave 1, point-of-care (POC) devices were used to measure capillary blood HbA1c and Complete Blood Count (CBC). In Wave 2, HbA1c and CBC were measured from aliquots of venous EDTA whole blood using clinical lab analyzers at district clinical labs. CBC is a standard blood test given during routine healthcare visits to assess overall health and to diagnose blood diseases, infections, and immune system disorders. CBC analysis of capillary blood samples in Wave

1 was conducted with the QBC STAR Hematology Analyzer, validated for capillary and venous blood. The QBC STAR™ system has on-board automatic quality control procedures that were performed each day at the start of testing. This instrument differentially stains white blood cells, separates blood by cell type by centrifugation then uses optical scanning to quantify the cell fractions. We describe the CBC results using the following parameters: hematocrit (%), hemoglobin (g/dL), mean corpuscular hemoglobin concentration (g/dL), white blood cells ($10^9/L$), granulocytes ($10^9/L$ and %), lymphocytes/monocytes ($10^9/L$ and %), and platelets ($10^9/L$).

HbA1c or glycated hemoglobin is an index of mean glycemia and a measure of risk for diabetes complications. It is considered a good indicator of glycemic control in the preceding two to three months. Capillary blood samples in Wave 1 were analyzed for HbA1c using the SMART Analyzer (DZ168B-POC, Diazyme Laboratories; Poway, California, USA), which is validated for both capillary and venous whole blood samples. Results are given in percent HbA1c and are aligned with Diabetes Control and Clinical Trials (DCCT) system and

Table 3.1 Laboratory assays for blood-based biomarkers in VHAS Wave 1

Priority	Analyte	Assay method	Required plasma volume (μL)	Dilution	Sample size
1	Quansys 14-plex: IL-1β, IL-6, IL-10, Ghrelin, IL-18, Ferritin, hTNF-α, IFN-γ, Leptin, TNF-R1, Adiponectin, BDNF, CRP, Resistin (biomarkers of immunological and metabolic-mediated inflammation)	Quansys custom 14-plex	60	2; 50μL/well	2,100
2	Fibrinogen (blood clotting protein; increases with age)	Abnova KA0475	2	500; 25μL/well	1,981
3	DHEA-S (steroid hormone involved in pituitary and adrenal function; decreases with age)	DRG International EIA1562	50	undiluted	1,906
4	Apolipoprotein B (protein involved in lipid metabolism; high concentrations increase cardiovascular disease risk)	R&D Systems DAPB00	50	1000; 50μL per well	544
5	Total, HDL, LDL cholesterol (higher total cholesterol and high LDL/low HDL increase cardiovascular disease risk)	Ben Pharma	32	5	1,487

reported in NGSP standardized formats (NGSP, 2010). The manufacturer protocol cites the HbA1c range of 4-6% as the range for non-diabetic individuals as measured by DCCT-based assays. The United States Federal Drug Administration (FDA) compared venous and capillary samples for the SMART HbA1c Analyzer and determined that for 97% (124 out of 128) of samples tested, capillary fingerstick results were within $\pm 0.75\%$ HbA1c of the results obtained from the venous samples (correlation coefficient = 0.93). For this procedure, used in the VHAS Wave 1 biomarker collection, finger-prick capillary blood was collected into a capillary tube and added to a lysis buffer. The assay reagent and blood lysate were then transferred into a DRS Cuvette that was read by the SMART Analyzer.

LABORATORY ASSAYS OF OTHER BLOOD BIOMARKERS

Total cholesterol, high-density lipoprotein (HDL) cholesterol, and low-density lipoprotein (LDL) cholesterol were analyzed via clinical analyzers at HMU using Ben Pharma kits and reagents in Wave 1 and Cobas in Wave 2. Additional blood-based biomarkers were measured at HMU using commercially purchased conventional singleplex ELISA and Quansys multiplex assays. Due to the limited volumes of capillary specimens obtained in Wave 1, some plasma tubes did not contain sufficient volume to complete all planned tests. Therefore, the testing sequence at the HMU lab was conducted as follows: 1) Quansys 14-plex assay (for all samples); 2) Fibrinogen assay (as many samples as possible), 3) DHEA-S assay (as many samples as possible); 4) ApoB assay (on a subset of plasma specimens selected to represent all

communes); and 5) Lipid panel assay (as many samples as possible, taking into account the remaining plasma volume).

Details of the testing of blood-based biomarkers from Wave 1 samples are reported in Table 3.1 above. Wave 2 assays, scheduled for July to August 2023, will follow the same procedures as in Wave 1, except for the use of different Lipid kits and reagents. Additionally, a Quansys Custom 10-plex, including NG-2, CEA, Eotaxin-3, Fas Ligand, IL-5, IL-7, MCP-1, MIF, MIP-1α, and TIMP-1, will also be performed on a subset of 400 samples from Wave 2 to assess the risk of Alzheimer's Disease and Related Dementias.

HAIR SAMPLE COLLECTION AND TESTING

A section of hair was collected for cortisol analysis as described by Meyer and colleagues (Meyer et al., 2014). A hair sample approximately the diameter of a pencil was tied with string and cut as close as possible to the scalp from the posterior vertex of the occipital lobe. Samples and corresponding identifiers were wrapped in foil and stored, noting the scalp end of the sample, and then shipped to the Biodemography Lab at the University of Washington's Center for Studies in Demography and Ecology for cortisol assay.

Cortisol reflects hypothalamic-pituitary-adrenal axis activity, with acute increases in and higher baseline measures of cortisol used as an index of acute and chronic stress. Since cortisol is slowly incorporated into growing hair shafts, hair cortisol provides a measure of integrated HPA activity over periods of weeks to months (Meyer et al., 2014). Hair cortisol, therefore, provides a more appropriate proxy measure of

chronic stress and hypercortisolism than cortisol measured in other biological tissues (e.g., blood, urine), which vary diurnally and in response to acute stressors. Hair cortisol analysis will be conducted at the Biodemography Lab at the University of Washington's Center for Studies in Demography and Ecology in Seattle, WA, United States. Cortisol will be extracted from 1–3 cm cut hair samples using previously described methods (Meyer et al., 2014) and analyzed using a well-validated in-house cortisol enzyme immunoassay protocol (Munro & Stabenfeldt, 1985)

LESSONS LEARNED FROM THE FIELD

Although less invasive, capillary blood collection in Wave 1 proved to be more time-consuming and challenging in older adults. This was particularly the case with the frailest participants, as it was often difficult to obtain capillary blood samples, or only a small amount of blood could be collected that was insufficient for testing purposes. They also frequently complained about the pain and discomfort associated with the efforts to obtain capillary blood samples. Although the

amount of capillary blood collected was sufficient for essential tests such as POC tests, Quansys, and DNA methylation, it was not enough to cover the entire planned test panel, nor was it adequate for repeat Quansys testing and reserving samples for future supplementary tests. Extended POC processing times, high temperatures, and humidity posed challenges for both biomarker technicians and participants and may have adverse influences on the operational capability and accuracy of POC devices. A portable dehumidifier and a portable air conditioner were positioned near the testing instruments, and temperature and humidity were tracked throughout the day. At least once, the VHAS leadership reorganized and supplemented staffing in the field to allow for timeline biomarker data collection. The shortage of local facilities and importation logistics required extensive labor by VHAS staff to equip data collection and outfit HMU laboratories for VHAS assays. On a positive note, participants were surprisingly at ease with hair collection implementation.

During Wave 2 venous blood collection, VHAS staff took additional time to explain the required blood volume and the

Table 3.2 Preliminary descriptive statistics of Wave 1 anthropometric measures

Anthropometrics	Total Mean or % (SD)	Men Mean or % (SD)	Women Mean or % (SD)
Height (cm) (n = 2267)	153.3 (8.4)	159.1 (5.8)	147.8 (6.5)
Weight (kg) (n=2270)	51.2 (9.4)	54.9 (8.8)	47.6 (8.5)
Body Fat (n = 2018)	22.8 (9.4)	16.2 (6.3)	28.4 (7.9)
BMI [†]	21.7 (3.1)	21.6 (3.0)	21.7 (3.2)
BMI < 18.5 (underweight)	15%	15%	16%
BMI 18.5 – 24.9 (normal)	71%	72%	70%
BMI 25 – 29.9 (overweight)	14%	13%	14%
BMI > 30 (obese)	0%	0%	0%
Waist Circumference (cm)	78.1 (9.2)	78.6 (8.8)	77.5 (9.6)
Waist-to-height (WHR) ratio	0.51 (0.06)	0.49 (0.05)	0.52 (0.06)
WHR abdominal adiposity	41%	33%	49%
Hip Circumference (cm)	87.8 (6.3)	88.6 (5.8)	87.1 (6.7)
Arm Circumference (cm)	25.9 (3.1)	26.1 (3)	25.8 (3.3)
Calf Circumference (cm)	30.0 (3.3)	30.9 (3.6)	29.2 (2.8)
Grip Strength (kg)	20.5 (8.2)	25.2 (8.2)	16.1 (5.1)
Peak Expiratory Flow (L/min)	288.3 (99)	335.6 (103.6)	242.5 (68)
< 10 th percentile	12%	11%	12%
> 10 th percentile	11%	11%	11%

†Note: Reference ranges from the global classification system, as recommended for use with Asian populations by the World Health Organization Expert Consultation.

Table 3.3 Preliminary descriptive statistics of Wave 1 blood pressure measures

Blood Pressure	Total (n=2,325)	Men (n=1,141)	Women (n=1,184)	Clinical Reference Ranges [†]		
	Mean or % (SD)	Mean or % (SD)	Mean or % (SD)	Healthy	Pre-hypertension	Hypertension
Systolic Blood Pressure (mmHg)	139.5 (22.1)	141.5 (21.8)	137.6 (22.3)	< 120	120–139	> 140
Diastolic Blood Pressure (mmHg)	82.9 (11.6)	84.9 (11.7)	81 (11.2)	< 80	80–89	> 90
Average Pulse (beats/minute)	83.8 (13.4)	83.1 (14.1)	84.4 (12.5)	—	—	—
Prehypertensive	34%	34%	53%	—	—	—
Hypertensive	49%	35%	45%	—	—	—

[†] Clinical reference ranges: Healthy, pre-hypertension, and hypertension (Chobanian et al., 2003).

safety of blood draw procedures. Many participants expressed concerns about the volume of blood requested, and some of them agreed to provide only one tube of blood (approximately 4 ml). For older and more frail individuals, venous blood collection was still challenging, but overall, it was more convenient compared to capillary blood collection in Wave 1. Local challenges in equipment setup for data collection also occurred. Setting up the examination on the second floor of the CHC made it harder for frail participants to access. Because stair climbing could influence certain results, participants were provided resting time before starting the examination process. The vision and timed walking tests had standard requirements in distance and space that were difficult to arrange in some

facilities. Furthermore, the staff faced several difficulties in providing instructions for the vision test, especially in Quảng Bình province, due to the hearing impairment of participants as well as different dialects.

Biomarker collection in Wave 2, in the context of the Covid-19 pandemic, presented unique experiences and challenges. Although the incidence of disease in the study areas was not high, the fieldwork was repeatedly delayed due to social distancing policies. For example, there were instances during the fieldwork when the entire research team had to abruptly leave the study site at midnight to comply with the rapid implementation of social distancing measures, which became effective at 6 a.m. the following day. During the permitted fieldwork periods, a meticulous schedule for biomarker collection was crucial to ensure proper planning and avoid overcrowding at CHCs at certain times. On the one hand, local collaborators actively engaged and invited participants to CHCs for examination. On the other hand, all measures to prevent the transmission of SARS-CoV-2 were strictly observed by the research team, participants, and their families. Fortunately, despite some individuals having been exposed, no one was infected with Covid-19 during the fieldwork. In the context of Covid-19, the fact that more than 90% of participants provided at least one biomarker in Wave 2 is a notable achievement. Areas with more active local collaborators showed higher participation rates.

PRELIMINARY RESULTS FROM WAVE 1

ANTHROPOMETRICS AND FUNCTIONAL BIOMARKERS

Preliminary descriptive results of direct anthropometric measures and functional biomarkers from Wave 1 participants are given in Tables 3.2 and 3.3. The mean BMI for the total



Medical staff taking a participant's blood pressure.
Photo: **Bussarawan Teerawichitchainan**

Table 3.4 Descriptive statistics for Wave 1 point-of-care measures

Point-of-Care Tests	Total	Men	Women	Clinical reference ranges [†]
	Mean (SD) or %	Mean (SD) or %	Mean (SD) or %	
Hemoglobin (g/dL)	9.4 (2.0)	9.8 (2.1)	9.0 (1.8)	14.0–18.0 (men) ; 12.0–16.0 (women)
None to mild anemia	33%	67%	1%	
Moderate anemia	55%	26%	80%	
Severe anemia	10%	1%	19%	
WBC (x 10 ⁹ /L)	6.9 (2.4)	7.1 (2.0)	6.7 (2.8)	4.3–10
Low (< 4.3)	4.3%	3%	6%	
High (> 10.0)	4.8%	6%	3%	
HbA1c (%)	6.2 (1.0)	6.1 (1.0)	6.3 (1.0)	< 6.5
Pre-diabetic	7%	5%	7%	5.7–6.4
Diabetic	7%	9%	7%	≥ 6.5

[†] Clinical reference ranges: Hemoglobin; WBC; HbA1c (American Diabetes Association, 1995-2023).

sample was 21.7 ± 3.1 . No VHAS participants are classified as obese according to the global classification system (WHO Expert Consultation, 2004). The total percentage of people overweight (14%) is much lower than in high-income countries like the U.S. (31%) (Fryar et al., 2021) and consistent with proportions previously reported for middle-aged Vietnamese populations (Ngwuyen & Trevisan, 2020). There were no marked gender differences in mean BMI or percentage of overweight and obesity, though the prevalence of abdominal adiposity was slightly higher for women (Table 3.2). Mean grip strength and peak expiratory flow rate were higher for men, as expected. Levels of prehypertension (Stage 1) and hypertension (Stage 2 and hypertensive crisis) are concerningly high in this sample (Table 3.3), even as compared to the high prevalence nationally (42% prehypertension and 21% hypertension) (Nguyen & Trevisan, 2020). The higher rate of hypertension in men is consistent with national trends.

Preliminary descriptive results of lipid, protein, and steroid biomarkers also demonstrate patterned differences in VHAS participants relative to sample population reference ranges given by respective assay kit protocols (Table 3.5). These could indicate aging or a high prevalence of chronic diseases. Apolipoprotein B (ApoB) and fibrinogen have been shown to increase with age and in association with cardiovascular disease risk; both mean ApoB and fibrinogen levels were higher for VHAS participants compared to samples of healthy adults referenced in kit protocols. Conversely, DHEA-S levels are known to decrease with age, and mean levels were lower for VHAS participants compared to sample ranges referenced in kit protocols. Mean total cholesterol is high,

but within the normal range for senior adults, while mean LDL and HDL cholesterol levels fall within medium ranges indicative of borderline high risk. Continuing analysis is needed to contextualize these high levels against comparable measures for elderly and East Asian populations published elsewhere. We will also evaluate other individual cases of



Laboratory equipment at Hà Nội Medical University.
Photo: **Bussarawan Teerawichitchainan**

Table 3.5 Descriptive statistics for Wave 1 assays

Assay	Min	Max	Mean (SD)	Reference ranges cited in assay protocols	Assay kit limits of detection
ApoB (µg/ml)	154.75	2326.54	1062.34 (446.08)	Mean 568 µg/ml (range 189–985 µg/ml) from EDTA plasma, healthy volunteers	39.1–2500 ng/ml
DHEA-S (µg/ml)	0.03	2.9	0.61 (0.41)	Mean 1.01 µg/ml (men >50); 0.63 µg/ml (women >50)	0–10 µg/ml
Fibrinogen (mg/ml)	1.12	14.06	4.52 (1.64)	Mean 2.9 mg/ml (plasma) from 30 healthy adults	0–40 µg/ml
Cholesterol (mg/dl)	113.23	567.06	253.54 (58.10)	Up to 200 mg/dl adults; 180–330 mg/dl senior adults	0.3 mg/dl minimum sensitivity; linear results up to 700 mg/dl
HDL (mg/dl)	1.173	148.4	56.34 (21.93)	Men: negative > 55 mg/dl, medium 35–55, elevated < 35 mg/dl; women negative >65, medium 45–65, < 45	1.3 mg/dl minimum sensitivity; linear results up to 150 mg/dl
LDL (mg/dl)	14.4	349.37	143.04 (56.72)	Normal range 57–224 mg/dl; negative < 130, medium 130–159, elevated > 160	5.1 mg/dl minimum sensitivity; linear results up to 400 mg/dl

very high levels against other biomarkers and health histories for evidence of measurement error due to medication use or chronic conditions. Approximately one-quarter to one-third of samples run on the Quansys multiplex in Wave 1 were out of the range of detection for several key analytes (e.g., CRP, resistin) and will be rerun, sample volume permitting, prior to beginning Wave 2 sample assays. Descriptive statistics of the multiplex analytes are not reported here as they do not yet accurately represent the full range of variation in Wave 1 samples.

ADDITIONAL BIOMARKERS OF AGING AND STRESS

To examine additional complexity in health, stress, and aging, a subset of blood and hair samples were sent to North American labs for analysis of hair cortisol and epigenetic testing. Samples were selected from approximately 400 participants who provided biomarker samples in Wave 1 and Wave 2. The sample was designed to ensure sufficient representation across three levels of wartime exposure (low-level or least exposed, medium-level, and high-level or most



Temperature-controlled storage at Hà Nội Medical University. Photo: **Bussarawan Teerawichitchainan**

400
SAMPLES

**WILL UNDERGO
EPIGENETIC TESTING
AT THE KOBOR LAB**

exposed) and stratified across men and women and two types of wartime involvement: civilians and military (including formal and informal service).

Tests of epigenetic aging will be conducted at the Kobor Lab at the University of British Columbia, Canada, utilizing the most accessible and reliable epigenetic marker available, DNA methylation (“DNAm,” CpG dinucleotides). The complete analysis will allow for quantitative measurements based on epigenetic clocks to determine and compare the extent of epigenetic age acceleration of individuals overall and in relation to fluctuations in specific immune cell types

(CD8T, CD4T, B cells, monocytes, natural killer cells, and granulocytes). The Kobor lab will also conduct reliability testing between matched capillary and venous samples collected from 22 individuals during Wave 2 data collection.

Despite the various obstacles, many participants were happy to be invited to join the study and appreciated the care that they received during the project. Some prioritized participation over their personal matters and also helped to encourage others’ participation. Altogether, VHAS provided valuable insights for including biomarker measurement in future community-based studies of older adults in Việt Nam.

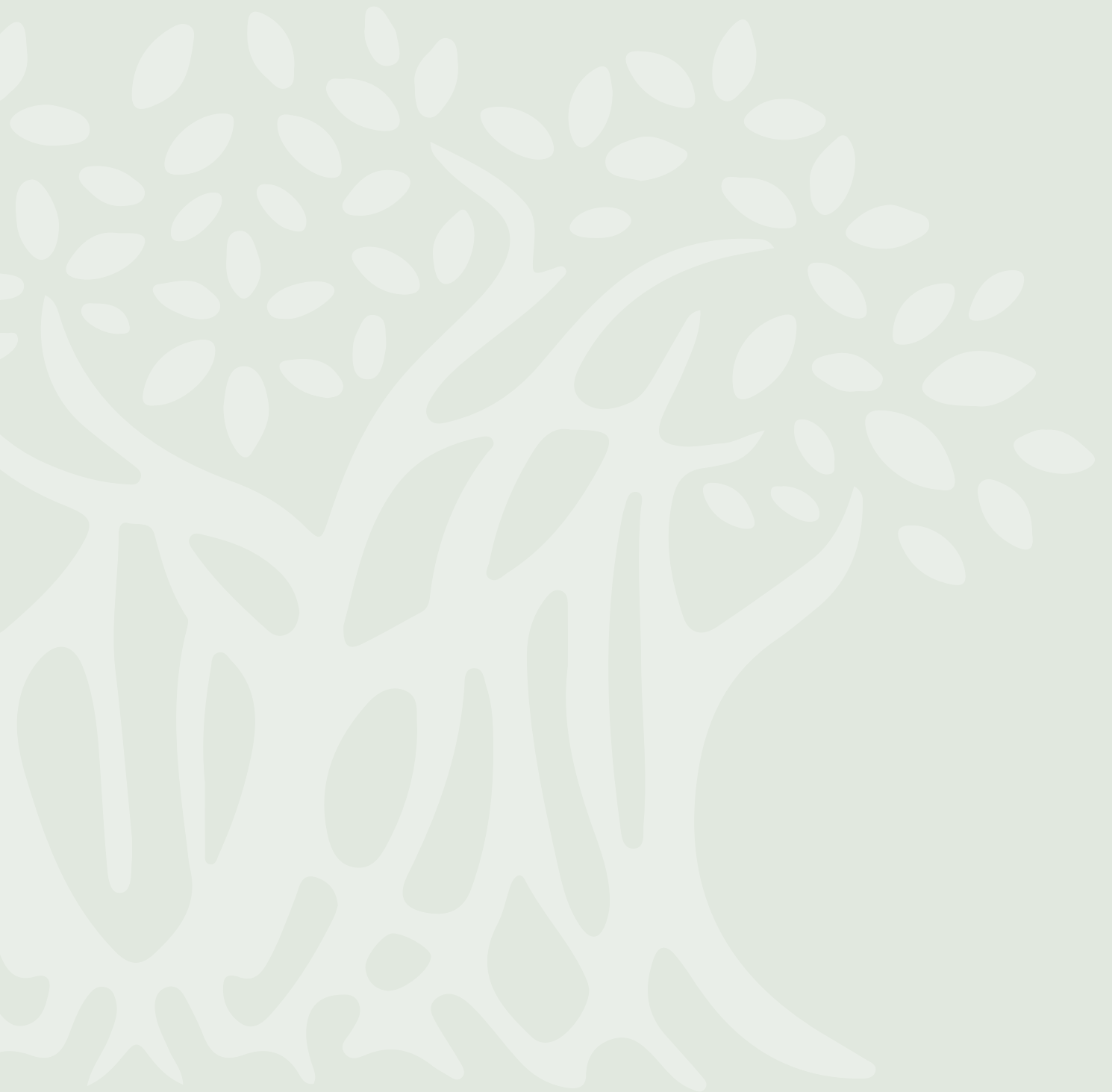


Commune health center in the Đồng Hới district of Quảng Bình province. Photo: **Yvette Young**

REFERENCES

- American Diabetes Association (1995-2023). *Diabetes Overview. Understanding A1C*.
- Bektas, A., Schurman, S. H., Sen, R., & Ferrucci, L. (2018). Aging, inflammation and the environment. *Experimental Gerontology*, 105, 10-18. <https://doi.org/10.1016/j.exger.2017.12.015>
- Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., ... Roccella, E.J., & National High Blood Pressure Education Program Coordinating Committee. (2003). Seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. *Hypertension*, 42(6), 1206-1252. <https://doi.org/10.1161/01.HYP.0000107251.49515.c2>
- Crimmins, E. M. (2015). Physiological differences across populations reflecting early life and later life nutritional status and later life risk for chronic disease. *Journal of Population Ageing*, 8(1-2), 51-69. <https://doi.org/10.1007/s12062-014-9109-4>
- Fuellen, G., Jansen, L., Cohen, A. A., Luyten, W., Gogol, M., ... Moller, S. (2019). Health and aging: Unifying concepts, scores, biomarkers and pathways. *Aging and Disease*, 10(4), 883-900. <https://doi.org/10.14336/AD.2018.1030>
- Fulop, T., Larbi, A., Dupuis, G., Le Page, A., Frost, E. H., ... Franceschi, C. (2018). Immunosenescence and inflamm-aging as two sides of the same coin: Friends or foes? *Frontiers in Immunology*, 8, 1960. <https://doi.org/10.3389/fimmu.2017.01960>
- Green, S., & Hillersdal, L. (2021). Aging biomarkers and the measurement of health and risk. *History and Philosophy of the Life Sciences*, 43(1), 28. <https://doi.org/10.1007/s40656-021-00367-w>
- Hartmann, A., Hartmann, C., Secci, R., Hermann, A., Fuellen, G., & Walter, M. (2021). Ranking biomarkers of aging by citation profiling and effort scoring. *Frontiers in Genetics*, 12, Article 686320. <https://doi.org/10.3389/fgene.2021.686320>
- Meyer, J., Novak, M., Hamel, A., & Rosenberg, K. (2014). Extraction and analysis of cortisol from human and monkey hair. *Journal of Visualized Experiments*, 83, Article e50882. <https://doi.org/10.3791/50882>
- Munro, C., & Stabenfeldt, G. (1985). Development of a cortisol enzyme-immunoassay in plasma. *Clinical Chemistry*, 31(6), 956-956.
- NGSP (2010). *Harmonizing hemoglobin A1C testing*. (<https://ngsp.org/indexation>).
- Nguyen, T. T., & Trevisan, M. (2020). Vietnam a country in transition: health challenges. *BMJ Nutrition, Prevention & Health*, 3(1), 60-66. <https://doi.org/10.1136/bmjnp-2020-000069>
- Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., ... Williams, R. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Research and Clinical Practice*, 157, Article 107843. <https://doi.org/10.1016/j.diabres.2019.107843>
- Snodgrass, J. J. (2022). Minimally invasive biomarkers in human population biology research, part 2: An introduction to the special issue. *American Journal of Human Biology*, 34(11), Article e23822. <https://doi.org/10.1002/ajhb.23822>
- WHO Expert Consultation. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet*, 363(9403), 157-163. [https://doi.org/10.1016/S0140-6736\(03\)15268-3](https://doi.org/10.1016/S0140-6736(03)15268-3)

MANY VIETNAMESE OLDER
ADULTS ENTERED THEIR
CHILDBEARING YEARS
DURING THE PEAK DECADE
OF THE AMERICAN WAR





CHAPTER 4

FERTILITY AND LIVING ARRANGEMENTS

TRẦN THỊ CẨM NHUNG, NGUYỄN HÀ ĐÔNG , JARED M. POFF,
BÙI THỊ HƯƠNG TRẦM

Over the past century, fertility rates worldwide have declined, particularly in more developed regions (Wang et al., 2020). Most countries in the global north report birth rates below replacement level (Coleman & Rowthorn, 2011). The shift to low fertility is often associated with the Second Demographic Transition, a theory maintaining that fertility falls with post-materialist societal and cultural changes such as non-marital childbearing, cohabitation, and a cultural emphasis on autonomy and self-actualization (Lesthaeghe, 2010; Zaidi & Morgan, 2017). Fertility and family life outcomes also vary greatly depending on where individuals live, their social positions, and significant historical events (Zaidi & Morgan, 2017). In the context of Việt Nam, many older adults' fertility decisions unfolded amid the American war and thus reflected the demands and opportunities of military mobilization, war-related material hardships, and a multitude of other stressors.

The VHAS data provide an exceptional opportunity for investigating Vietnamese family dynamics and their aftermath long after the war. Few studies have examined the family

life of Vietnamese men and women who experienced peak childbearing and adulthood transitions during the American War. Additionally, little attention has been directed to the living arrangements of older adults differentially affected by the American War during their youth. VHAS provides critical insights into these aspects of Vietnamese life and illuminates how war can impact familial trajectories on a broader scale. In addition, VHAS data allow us to examine these dynamics in the context of social and cultural transformation, postwar economic stagnation, various population control policies, and rapid economic reforms that have significantly influenced several aspects of family life in Việt Nam.

**PEOPLE WHO SERVED IN THE
FORMAL MILITARY HAD
FEWER CHILDREN THAN
CIVILIANS AND THOSE WHO
SERVED IN INFORMAL
MILITARY ORGANIZATIONS.**

MEASUREMENT

The VHAS interview collected information about family members of the primary participant. The data include information about each participant's marital history, a roster of their children, and details about who currently lives in their household. In this chapter, we summarize information about their lifetime fertility, or in other words, the total number of children they had. We also summarize their present living arrangements. The total number of children accounts for all biological sons and daughters, living and deceased. Because the participants were aged 59 and older at the time of the interview, the total number of children is considered their complete lifetime fertility.

We used information about participants' current household structure and organization to measure living arrangements. Based on who lives in the household, we classified participants as living alone, living with their spouse only, living with a child (or a child and their spouse), other two-generation households (e.g., living with a parent), and households with three or more generations.

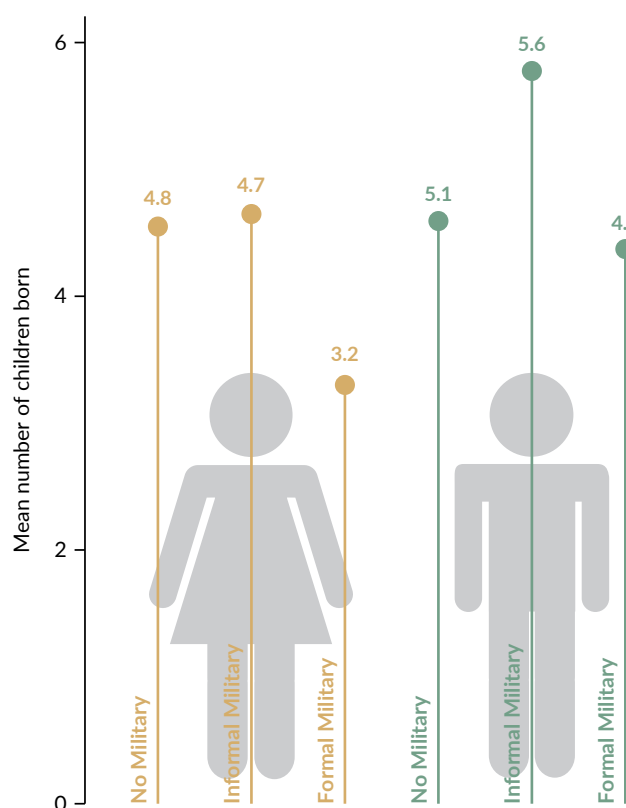


Figure 4.1 Average lifetime fertility by gender and military service status

KEY FINDINGS

LIFETIME FERTILITY

Bivariate results. On average, VHAS participants report having four to five children in their lifetime. Our data show that men's and women's lifetime fertility rates were nearly identical. However, childbearing differs depending on the participants' military service status during the war. Figure 4.1 shows that those who served in the formal military had fewer children than civilians and people who served in informal military organizations. This was true for both men and women.

Comparisons across age groups show that older participants had more children over their lifetime (Figure 4.2). Participants in their 60s have had approximately half as many children in their lifetime (3.7) compared to those aged 85 and older (6.9).

We also considered whether exposure to war violence and experiences of inhospitable living conditions affected lifetime fertility. Figure 4.3 shows that participants who reported experiencing the most intense exposure to wartime violence (above the 95th percentile for this sample) had more children

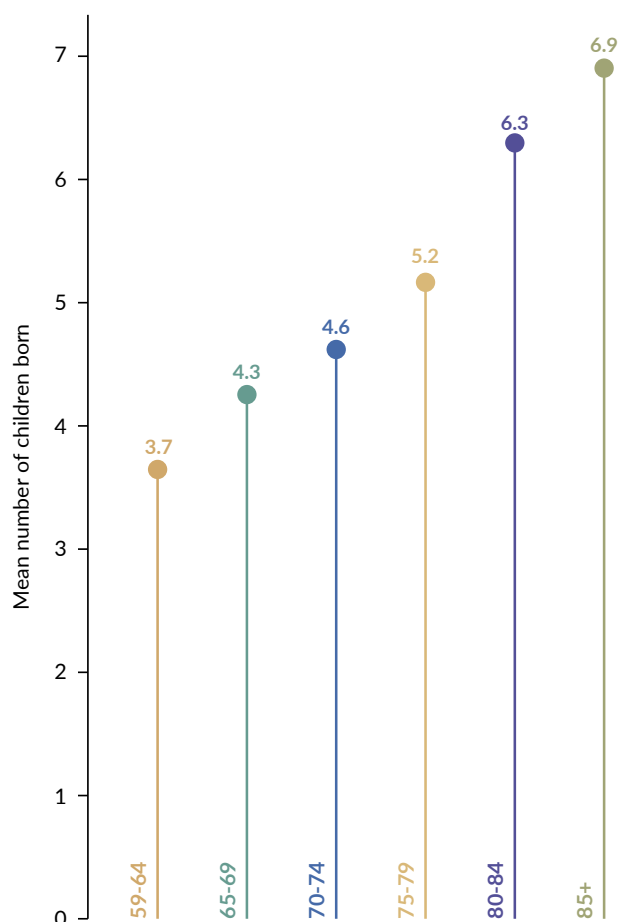


Figure 4.2 Age and lifetime fertility

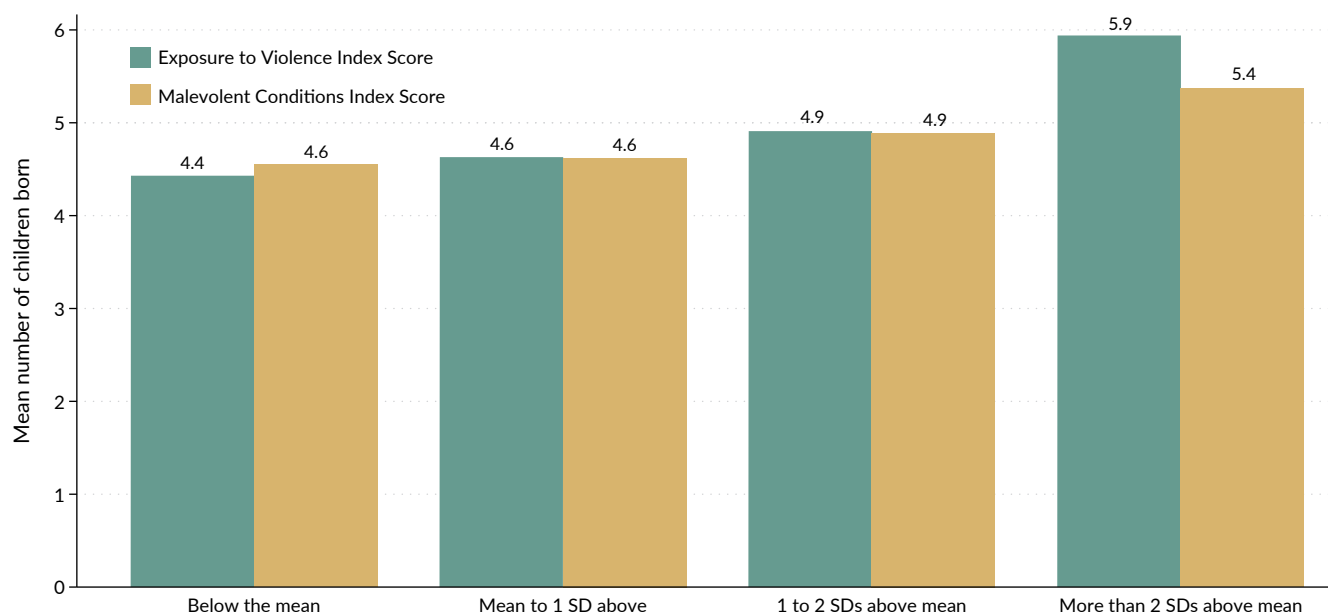


Figure 4.3 War exposure and lifetime fertility

than those who reported lower levels of wartime stress exposure. In contrast, exposure to higher levels of malevolent wartime conditions was not associated with higher lifetime fertility. Differences across exposure levels were minimal and not statistically significant.

LIVING ARRANGEMENTS

In the VHAS sample, few participants—less than 10%—reported living alone. Residing with a spouse, children, or other family members is more common. Sixty-three percent of participants reported living with extended family. This

observation is consistent with the cultural context of Việt Nam, wherein older parents live with their children to exchange financial, instrumental, and emotional support across generations (Teerawichitchainan et al., 2019). However, patterns of living arrangements vary by gender (Figure 4.4), with more women living alone than men and more men than women living with a spouse. However, when it comes to living with other family members, there are no statistically significant differences between men and women (as shown by the overlapping margins of error in Figure 4.4).

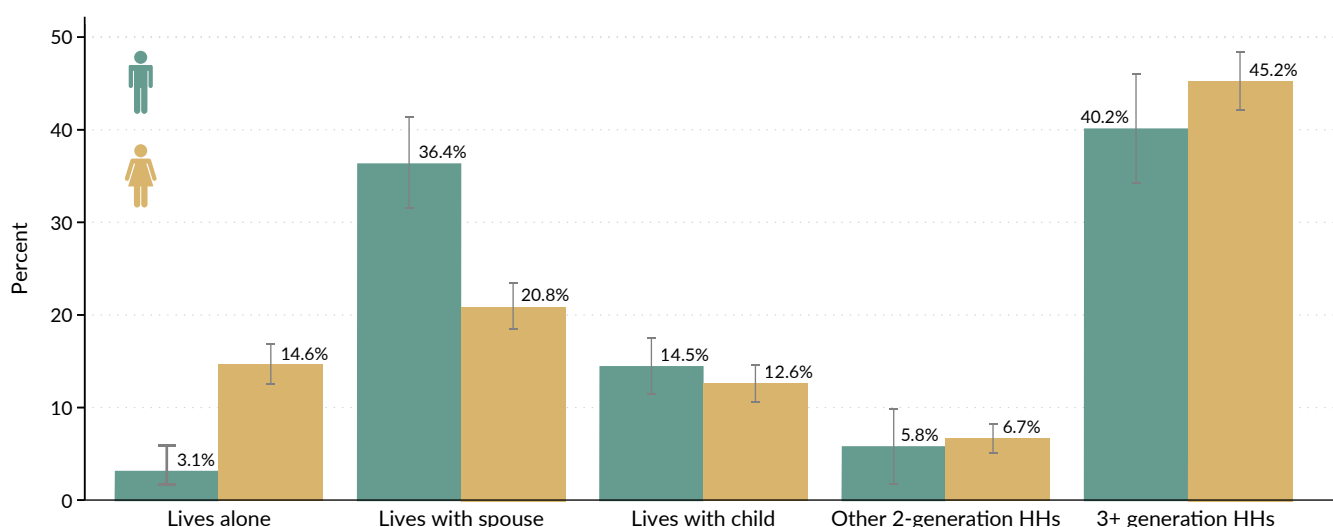


Figure 4.4 Living arrangements by gender

Note: Gray lines show the margin of error for group percentages. Statistically significant differences between groups are present when the values spanned by the gray bars for each group do not overlap.

Table 4.1 Statistical models predicting lifetime fertility

	Number of children	
	Model 1	Model 2
Gender and Military Service (ref: Female, civilian)		
Female, informal military	0.98	0.99
Female, formal military	0.79*	0.80*
Male, civilian	1.06	1.05
Male, informal military	1.04	1.05
Male, formal military	0.96*	0.95*
Exposure to War Violence Index		1.01
Exposure to Malevolent Conditions Index		1.01

Note: Coefficients represent the multiplicative odds. Values below 1 represent negative associations while values above 1 are positive. Stars indicate statistical significance. * $p < 0.05$

MULTIVARIATE RESULTS

To further explore these patterns, we use statistical models that examine the impacts of gender, military service, exposure to war violence, and inhospitable living conditions on lifetime fertility and living arrangements. We also accounted for the effects of marital status, childhood health, education, province of residence, and household assets. When accounting for the sociodemographic factors that are more closely tied to family formation and late-life living arrangements, we found that the effect of gender and military service on lifetime childbearing persists, but these factors exerted no influence on late-life living arrangements. Specifically, formal military service is associated with lower fertility for both men and women (see Table 4.1). However, war exposure was not associated with lifetime fertility or living arrangements.

CONCLUSION

Our analyses provide evidence that military service engagement, especially formal military service, is associated with smaller family sizes (i.e., fewer children born). This likely occurs because those who served in the military during wartime may have had to postpone marriage until their service was completed. Previous research documents



Woman with three children riding a motorbike.

delays in marriage and childbearing during the American War stemming from war-related male mortality and the absence of male partners for marriages (Belanger & Khuat, 1996; Goodkind, 1997; Hirschman & Minh, 2002; Minh, 1997; Teerawichitchainan & Korinek, 2012; Tetreault, 1996). One scholar describes how many couples separated immediately after their wedding to participate in the war during wartime. “After thirty years of war, many could not marry. In many cases, couples just married and went to the war. Afterward, they are too old to have children.” (Tetreault, 1996, p.47). As a result, some couples had no children or few children either due to long separations or because the women were late into their reproductive ages when the war ended.

Though our analysis found no effect of military service or other war experiences on late-life living arrangements, in all likelihood, war-related experiences in their early life stages indirectly influenced participants’ living arrangements through mediators such as marriage and childbearing timing. In addition, other social and economic transformations in Việt Nam related to the war might provide additional insights into a comprehensive understanding of family and fertility changes in Việt Nam. Our analyses invite further research on these associations.

REFERENCES

- Belanger, D., & Khuat, T. H. (1996). Marriage and the family in urban North Vietnam, 1965-1993. *Journal of Population*, 2(1), 83-112.
- Coleman, D., & Rowthorn, R. (2011). Who's afraid of population decline? A critical examination of its consequences. *Population and Development Review*, 37(Suppl 1), 217-248. <https://doi.org/10.1111/j.1728-4457.2011.00385.x>
- Goodkind, D. (1997). The Vietnamese double marriage squeeze. *The International Migration Review*, 31(1), 108-127. <https://doi.org/10.2307/2547260>
- Hirschman, C., & Minh, N. H. (2002). Tradition and change in Vietnamese family structure in the Red River Delta. *Journal of Marriage and Family*, 64(4), 1063-1079. <https://doi.org/10.1111/j.1741-3737.2002.01063.x>
- Lesthaeghe, R. (2010). The unfolding story of the second demographic transition. *Population and Development Review*, 36(2), 211-251. <https://doi.org/10.1111/j.1728-4457.2010.00328.x>
- Nguyen, M. H. (1997). Age at first marriage in Viet Nam: Patterns and determinants. *Asia-Pacific Population Journal*, 12(2), 49-74.
- Teerawichitchainan, B., & Korinek, K. (2012). The long-term impact of war on health and wellbeing in Northern Vietnam: Some glimpses from a recent survey. *Social Science & Medicine*, 74(12), 1995-2004. <https://doi.org/10.1016/j.socscimed.2012.01.040>
- Teerawichitchainan, B., Prachuabmoh, V., & Knodel, J. (2019). Productive aging in developing Southeast Asia: Comparative analyses between Myanmar, Vietnam and Thailand. *Contextualizing Productive Aging in Asia*, 229, 161-171. <https://doi.org/10.1016/j.socscimed.2018.09.053>
- Tetreault, A. M. (1996). Women and revolution in Vietnam. *Vietnam's Women in Transition*. (K. Barry, Ed.; pp. 38-60). MacMillan Press Ltd.
- Wang, H., Abbas, K. M., Abbasifard, M., Abbasi-Kangevari, M., Abbastabar, H., ... Murray, C. J. L. (2020). Global age-sex-specific fertility, mortality, healthy life expectancy (HALE), and population estimates in 204 countries and territories, 1950-2019: A comprehensive demographic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1160-1203. [https://doi.org/10.1016/S0140-6736\(20\)30977-6](https://doi.org/10.1016/S0140-6736(20)30977-6)



Mother and daughter enjoying a cup of tea on the patio.

MILITARY SERVICE IS
ASSOCIATED WITH
MORE ACTIVE SOCIAL
PARTICIPATION
LATER IN LIFE





SOCIAL PARTICIPATION AND SOCIAL SUPPORT

TIMOTHY QING YING LOW, BUSSARAWAN TEERAWICHITCHAINAN,
TRUC NGOC HOANG DANG

Social participation (e.g., volunteering, participating in community activities) and social support are considered significant aspects of older persons' lives that may influence their physical and mental health (Berkman et al., 2000; Wanchai & Phrompayak, 2019). **Higher levels of social participation and social support are consistently associated with fewer depressive symptoms and reduced mortality risks among older persons** (Tengku Mohd et al., 2019; Thomas, 2012). This chapter examines patterns of social participation and social support among VHAS participants. We focus on how military experience and war trauma exposure in young adulthood are linked to later-life social participation and social support.

Little is known about the American War's long-term impacts on social relationships, despite the fact that many of Việt Nam's older persons today were exposed to war traumas earlier in their lives (Teerawichitchainan, 2009). On the one hand, war exposure may have lasting detrimental effects,

causing former members of formal and informal militaries to be more socially disengaged later in life (Hatch et al., 2013). Evidence from the US suggests that military veterans, particularly combatants, tend to experience social isolation and lack of support due to strained post-war relationships with family members and friends who are unable to understand the traumatic events they experienced during deployment (Hinojosa & Hinojosa, 2011; MacLean & Elder, 2007). On the other hand, war exposure might have no significant impact on late-life social relationships since the war affected nearly

IN OTHER CONTEXTS, MILITARY VETERANS, ESPECIALLY THOSE WHO SAW COMBAT, EXPERIENCE SOCIAL ISOLATION AND A LACK OF SUPPORT AFTER A WAR ENDS.

all members of Vietnamese society, regardless of military or civilian status. Alternatively, war exposure may enhance one's social participation and social support through various mechanisms, such as social capital gained during military service or improved social status associated with military experience (Wilson & Ruger, 2021).

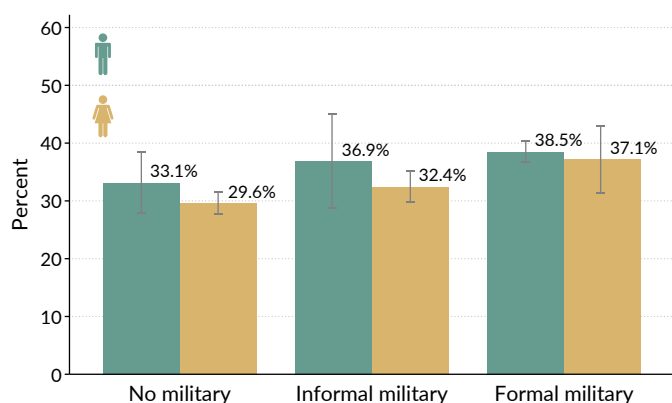
MEASUREMENT

We create two continuous measures to separately assess formal and informal social participation levels. Formal social participation is constructed from questions asking about how frequently the respondent participated in voluntary or charity activities, community meetings, or other organized activities during the past year. Possible responses range from 0 (Never) to 4 (Daily or almost daily). For informal social participation, we combine questions on how frequently the participant socialized with friends and neighbors, did physical exercise

(e.g., vigorous walking, playing sports), and played games (e.g., chess, cards) during the past year. Possible responses range from 0 (Never) to 4 (Daily or almost daily).

We also examine two dimensions of social support: social support received by the participant and social support that the participant provides. Both measures focus on family-based support. We measure receipt of social support as a count of three social activities. It indicates whether, in the past year, the participants: a) had a non-coresident child who visited them at least once a week; b) received financial support from at least one child; and c) received assistance from children, family, or non-relatives (e.g., help with chores, help with participants' activities of daily living (ADL)). For provision of social support, we create a count measure capturing whether, during the past year, the participant: a) visited a non-coresident family member; b) provided financial support to children; or c) provided assistance to family members (e.g., help a spouse

A Formal Social Participation (percentile)



B Informal Social Participation (percentile)

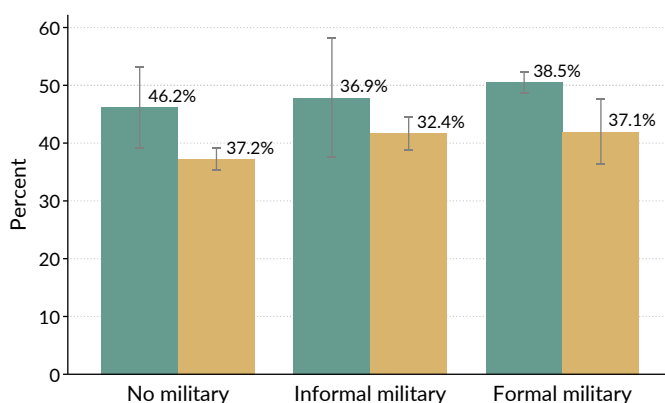
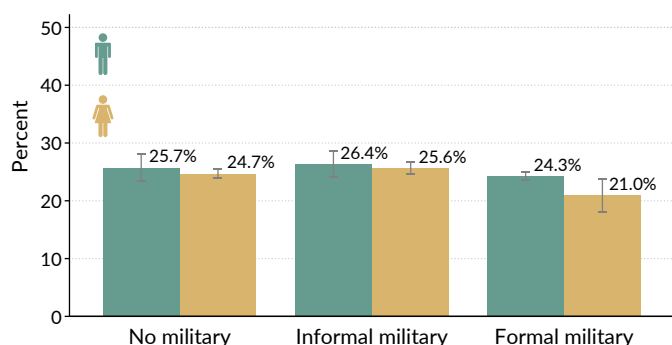


Figure 5.1 Formal and informal social participation by gender and military service status

Note: Gray lines show the margin of error for group percentages. Statistically significant differences between groups are present when the values spanned by the gray bars for each group do not overlap.

A Received Social Support (percentile)



B Provided Social Support (percentile)

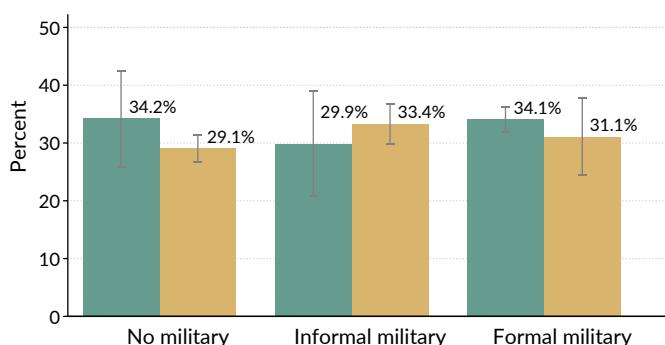


Figure 5.2 Receipt and provision of social support by gender and military service status

Note: Gray lines show the margin of error for group percentages. Statistically significant differences between groups are present when the values spanned by the gray bars for each group do not overlap.

with ADL, help children with chores, care for grandchildren).

Given that the aggregated scores for social participation and social support have different ranges, we convert these scores into percentiles for consistency and ease of comparison. Higher percentiles indicate greater degrees of social participation or social support relative to other participants in the VHAS sample.

RESULTS

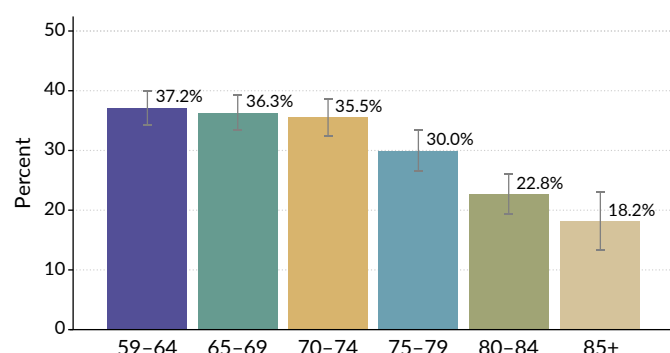
DESCRIPTIVE FINDINGS

Figures 5.1 to 5.6 present the mean percentile scores for social participation and social support among VHAS participants. The figures summarize social engagement and support by gender, military experience, age, war violence and malevolent condition exposure. Social participation and social support vary significantly by gender and military roles. In both cases,

civilian women differ significantly from men with formal military experience; however, other group differences are not statistically significant, as demonstrated by the overlapping margins of error shown in Figures 5.1 and 5.2. Furthermore, results suggest social participation, either formal or informal, and support provision consistently decline with age (see Figures 5.3 and 5.4). Conversely, the receipt of social support increases with age. These changes are potentially due to changing social roles and an increase in functional limitations associated with aging.

Bivariate results further indicate that early-life war violence exposure is related to later-life social participation. Social participation sharply declines for those experiencing the highest levels of war exposure (see Figure 5.5). Individuals who experienced the highest levels of war violence provide and receive the lowest levels of social support. Participants with less severe exposure to malevolent conditions more

A Formal Social Participation (percentile)



B Informal Social Participation (percentile)

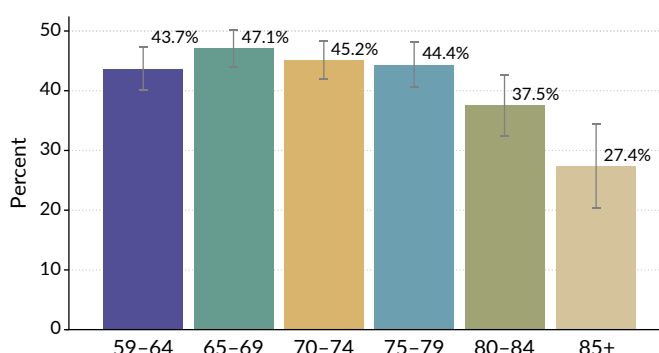
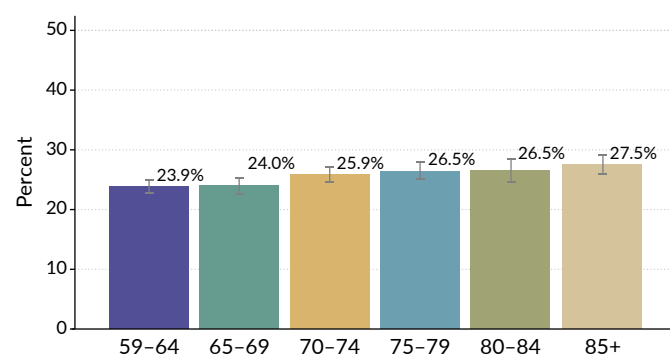


Figure 5.3 Formal and informal social participation by age

Note: Gray lines show the margin of error for group percentages. Statistically significant differences between groups are present when the values spanned by the gray bars for each group do not overlap.

A Received Social Support (percentile)



B Provided Social Support (percentile)

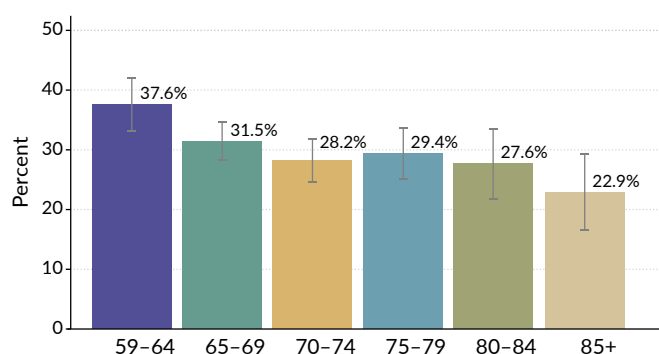


Figure 5.4 Receipt and provision of social support by age

Note: Gray lines show the margin of error for group percentages. Statistically significant differences between groups are present when the values spanned by the gray bars for each group do not overlap.

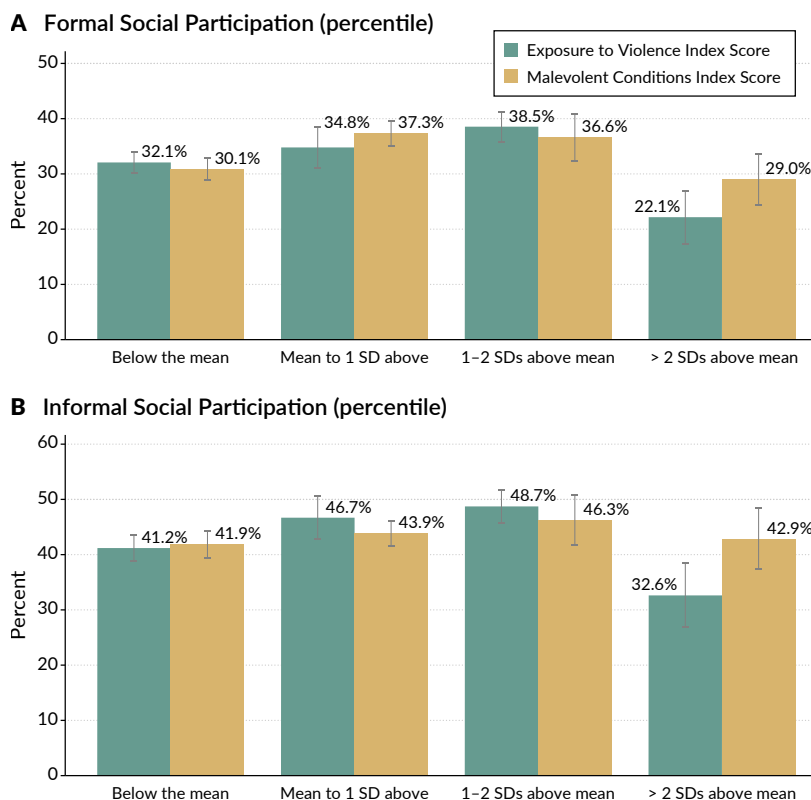


Figure 5.5 Social participation by level of war exposure

Note: Gray lines show the margin of error for group percentages. Statistically significant differences between groups are present when the values spanned by the gray bars for each group do not overlap.

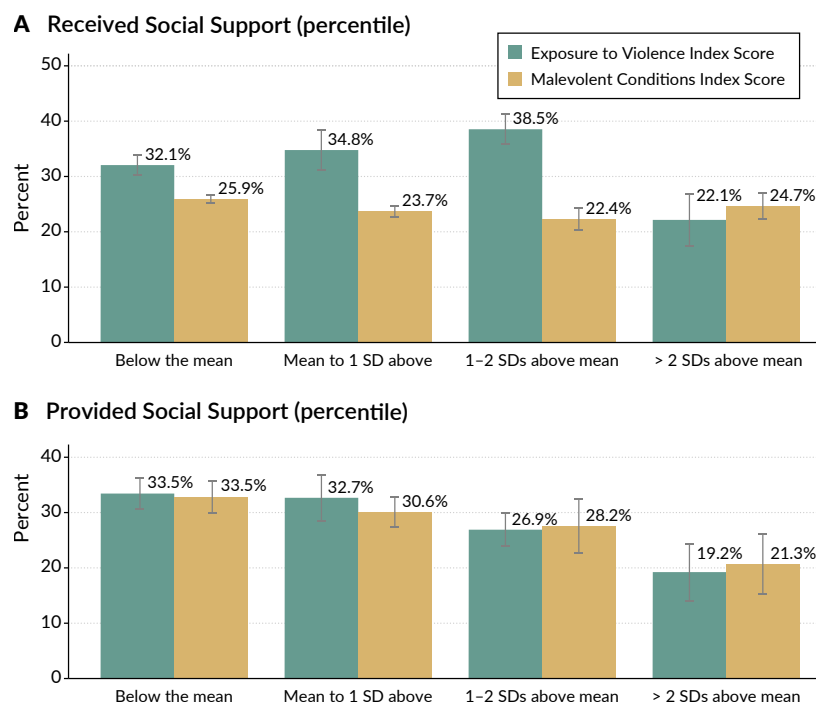


Figure 5.6 Social support by level of war exposure

Note: Gray lines show the margin of error for group percentages. Statistically significant differences between groups are present when the values spanned by the gray bars for each group do not overlap.

frequently reported providing and receiving social support than those who were more severely exposed (see Figure 5.6).

THE ROLES OF GENDER AND MILITARY EXPERIENCE

We subsequently conducted regressions to examine how military roles and gender, war violence exposure, and wartime malevolent conditions are associated with social participation and social support when we account for sociodemographic characteristics, including participant's age, location of residence, educational attainment, marital status, household assets, early childhood health conditions, and difficulty with activities of daily living. Results of our regression analyses are presented in Table 5.1

Men generally appear to have higher levels of social participation than women. This is especially the case for informal social participation. Although there appear to be differences in formal and informal social participation among male participants with different military roles, further analysis indicates that these differences are not statistically significant. Similarly, differences in women's levels of social participation across types of military service are not statistically significant.

With regard to social support, there is no statistically significant gender difference in the provision of social support. Furthermore, the provision of social support does not vary by veteran status role amongst male participants. One noteworthy finding is that women who once served in the informal military report providing more social support to their family members than men and women with other military service experiences. The regression models also test for association

Table 5.1 Models of social participation and social support

	Social Participation		Social Support	
	Formal	Informal	Received	Provided
Gender and Military Service (ref: Female, civilian)				
Female, informal military	0.910	3.678	0.802	7.551**
Female, formal military	1.417	2.198	-2.582	5.178
Male, civilian	-0.115	3.961	0.984	4.188
Male, informal military	7.969	10.456**	0.744	6.233
Male, formal military	4.268**	7.844***	-0.492	3.606
Exposure to War Violence Index	1.558	2.434*	-0.112	1.033
Exposure to Malevolent Conditions Index	0.876	0.093	-0.773	2.062

Note: Stars indicate statistical significance. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

between social participation, social support, and exposure to wartime violence. These results indicate that informal social participation is positively associated with exposure to war violence. However, exposure to war-related violence is not significantly associated with formal social participation, receipt of social support, or provision of social support.

DISCUSSION AND CONCLUSION

Our findings indicate that older Vietnamese men generally have greater formal and informal social participation than women. The strong Confucian and patriarchal tradition within Việt Nam, where men traditionally represent the family in public life while women are responsible for domestic work (Nguyen, 2022), may explain a greater tendency for men to be more socially engaged than women. Conversely, there is no clear gender difference in the receipt or provision of social support. While older women in other countries tend to receive more support from adult children as children reciprocate care received during early life (Silverstein et al., 2002), the privileged position of older men in Vietnamese households may account for the lack of a gender difference in social support among older Vietnamese adults. Further, as transfers from older adults to children are often contingent on the needs of the younger generation, social support provided by older adults may be less influenced by cultural norms in Việt Nam, thus showing little gender variation.

Past military experiences appear to increase social participation for older Vietnamese men relative to those without military experience, particularly for informal social participation. Participation in the military provides military personnel with the opportunity to form relationships with a broader group of individuals across social class and

geographical origins during military service (Settersten, 2006), and the military service promotes nationalistic sentiment and increases civic engagement of veterans (Wilson & Ruger, 2021). This allows military personnel to foster a wider set of social relationships compared to civilians. Conversely, we find that the receipt of social support does not differ by military role. This might be attributable to how older Vietnamese, particularly those in military roles, learned attitudes of self-reliance and self-sacrifice during the war (Pike, 1986) and may thus avoid seeking support despite their greater frailty during older age (Zimmer et al., 2021).

PAST MILITARY SERVICE APPEARS TO INCREASE OLDER VIETNAMESE MEN'S PARTICIPATION IN INFORMAL SOCIAL ACTIVITIES.

Finally, our results indicate that war violence exposure is positively associated with informal social participation but not formal social participation. It is possible that these older Vietnamese saw social interaction, particularly informal engagement such as socializing with friends, as an opportunity to relate their war experiences to peers and help them better cope with traumatic memories. Such frequent social interactions may have continued into older age, thereby accounting for higher informal social participation.

That our regression analyses fail to demonstrate a statistically significant relationship between war violence exposure and formal social participation may be attributed to measurement limitations. Firstly, our measurement is made up of some

components, such as engaging in physical exercise, that may at times be performed alone and hence may not accurately assess respondents' social participation. Furthermore, our measurement also emphasizes activities such as volunteering and community activities. This measurement may not be ideally suited to Vietnamese due to low rates of voluntarism stemming from limited programs and acceptance of formal voluntary work (Pham et al., 2020). Only 0.5% of VHAS

respondents participate in voluntary activities at least once a week. Since older Vietnamese have higher a participation rate in political activities than in voluntary work (Pham et al., 2020), future research may consider engagement in political activities as an indicator of social participation. In sum, our findings suggest that the historical and social context of war may shape the relationship between past war experiences and social participation and social support in later life.

REFERENCES

- Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine*, 51(6), 843–857. [https://doi.org/10.1016/S0277-9536\(00\)00065-4](https://doi.org/10.1016/S0277-9536(00)00065-4)
- Hatch, S. L., Harvey, S. B., Dandeker, C., Burdett, H., Greenberg, N., Fear, N. T., & Wessely, S. (2013). Life in and after the Armed Forces: Social networks and mental health in the UK military. *Sociology of Health & Illness*, 35(7), 1045–1064. <https://doi.org/10.1111/1467-9566.12022>
- Hinojosa, R., & Hinojosa, M. S. (2011). Using military friendships to optimize postdeployment reintegration for male Operation Iraqi Freedom/Operation Enduring Freedom veterans. *Journal of Rehabilitation Research & Development*, 48(10), 1145–1158. <https://doi.org/10.1682/jrrd.2010.08.0151>
- MacLean, A., & Elder, G. H. (2007). Military service in the life course. *Annual Review of Sociology*, 33(1), 175–196. <https://doi.org/10.1146/annurev.soc.33.040406.131710>
- Nguyen, H. M. (2022). The Family in Contemporary Viet Nam. In J.D. London (Eds.), *Routledge handbook of contemporary Vietnam* (1st ed., pp. 392–403). Routledge. <https://doi.org/10.4324/9781315762302>
- Pham, T.-V., Hsu, H.-C., Zaidi, A., & Chen, Y.-M. (2020). Active aging index in Vietnam relative to China, South Korea, Taiwan, and 28 European Union countries. *Research on Aging*, 42(9–10), 312–325. <https://doi.org/10.1177/0164027520934049>
- Pike, D. (1986). PAVN: People's Army of Vietnam. *Presidio Press*.
- Settersten, R. A. (2006). When nations call: How wartime military service matters for the life course and aging. *Research on Aging*, 28(1), 12–36. <https://doi.org/10.1177/0164027505281577>
- Silverstein, M., Conroy, S. J., Wang, H., Giarrusso, R., & Bengtson, V. L. (2002). Reciprocity in parent-child relations over the adult life course. *The Journals of Gerontology: Series B*, 57(1), S3–S13. <https://doi.org/10.1093/geronb/57.1.S3>
- Teerawichitchainan, B. (2009). Trends in military service in Northern Vietnam, 1950–1995: A sociodemographic approach. *Journal of Vietnamese Studies*, 4(3), 61–97. <https://doi.org/10.1525/vs.2009.4.3.61>
- Tengku Mohd, T. A. M., Yunus, R. M., Hairi, F., Hairi, N. N., & Choo, W. Y. (2019). Social support and depression among community dwelling older adults in Asia: A systematic review. *BMJ Open*, 9(7), e026667. <https://doi.org/10.1136/bmjopen-2018-026667>
- Thomas, P. A. (2012). Trajectories of social engagement and mortality in late life. *Journal of Aging and Health*, 24(4), 547–568. <https://doi.org/10.1177/0898264311432310>
- Wanchai, A., & Phrompayak, D. (2019). Social participation types and benefits on health outcomes for elder people: A systematic review. *Ageing International*, 44(3), 223–233. <https://doi.org/10.1007/s12126-018-9338-6>
- Wilson, S. E., & Ruger, W. (2021). Military service, combat experience, and civic participation. *Armed Forces & Society*, 47(3), 551–585. <https://doi.org/10.1177/0095327X20934885>
- Zimmer, Z., Korinek, K., Young, Y., Teerawichitchainan, B., & Toan, T. K. (2021). Early-life war exposure and later-life frailty among older adults in Vietnam: Does war hasten aging? *The Journals of Gerontology: Series B*, 77(9), 1674–1685. <https://doi.org/10.1093/geronb/gbab190>

FRIENDS FOREVER?

DETERMINANTS OF MILITARY FRIENDSHIP QUALITY AMONG VHAS PARTICIPANTS

Friends can be a significant source of social support for older people. Given that older Vietnamese spent a significant proportion of their early adulthood in military service, it raises the question of whether friendships forged during military service would last through late adulthood.

To investigate late-life military friendships among the VHAS participants, we reviewed responses to three questions documenting how often they are in contact with military friends, how often they receive support from military friends, and how close they feel to their military friends. We combined responses to these three questions into a Military Friendship Quality Index.

Military Friendship Quality Index

Frequency of contact with military friends

Frequency of receiving support from military friends

Feeling of closeness to military friends

74%
OF VETERANS STILL HAVE FRIENDS FROM THEIR TIME IN THE MILITARY

In statistical models that account for type of military service, duration of service, final military rank, and sociodemographic characteristics we found the following:

- Heavier exposure to wartime violence and combat is associated with greater military friendship quality (see Figure 5.7).
- Older Vietnamese with the highest military ranks (Captain, Major, Lt. Colonel, and Colonel) tend to report greater military friendship quality than those with the lowest military ranks (Private, PFC, and Corporal). However, the difference does not persist across other intermediated ranks. Differences in military friendship can be partly explained by service duration and war invalid status.

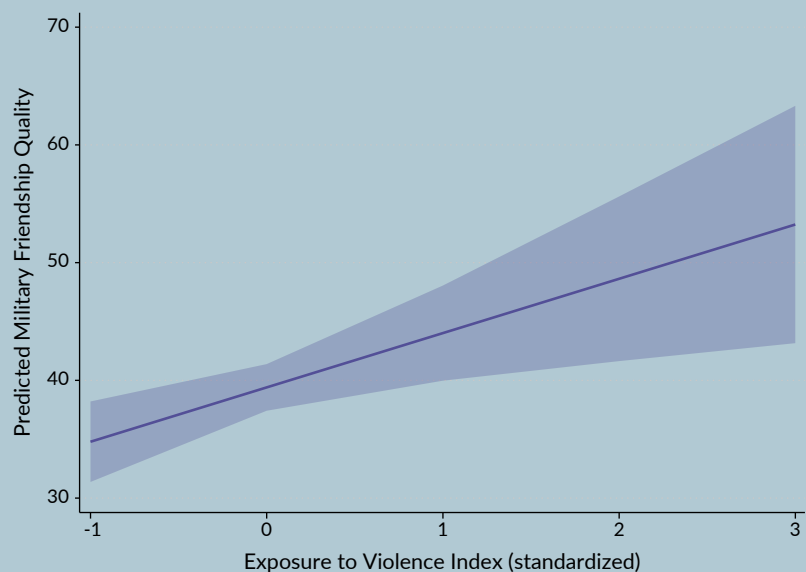


Figure 5.7 Predicted percentile of Military Friendship Quality Index

Note: Shaded areas show the margin of error for the predictions.

WAR ITSELF DID NOT
AFFECT PEOPLE'S
LIFE-LONG ECONOMIC
CIRCUMSTANCES...

MILITARY SERVICE DID





CHAPTER 6

SOCIOECONOMIC CONDITIONS

YVETTE YOUNG, TRẦN THỊ HỒNG, TRẦN QUÝ LONG, LÊ THỊ HỒNG HẢI

The three primary measures of individuals' and families' **economic wellbeing**—whether they have sufficient resources to meet their fundamental needs—are **occupation, income, and wealth**. All are affected by the level of development and affluence in one's nation and local community. In addition to these country-level contextual determinants, individual characteristics, such as education, work experience, and intergenerational wealth, shape lifelong economic circumstances. Historical events such as wars can disrupt education and employment paths and damage people's physical assets, such as land and buildings, interfering with traditional patterns of economic mobility (Elder, 1987).

Research has also documented some economic benefits of war. For example, military service has the potential to spur socioeconomic mobility and narrow nationwide socioeconomic disparities (Teachman, 2004; Wilmoth & London, 2012). On the other hand, war and military service can also be sources of psychological stress and physical disability, each of which can diminish economic opportunities after war (MacLean, 2010).

War-related disruptions to education and work have lasting effects that can ripple across the lifespan affecting income and economic security into old age (London & Wilmoth, 2006). Given war's complex and seemingly contradictory effects on economic attainment, the VHAS provides a unique opportunity to examine how early-life experiences of war impact economic wellbeing in late life. The VHAS contains extensive information about war experiences and military activities. It also includes a battery of questions detailing work history, income sufficiency, debt, household assets, and living conditions.

WARS CAN DISRUPT EDUCATION AND THE ACCUMULATION OF WORK EXPERIENCE

Most prior research on the economic consequences of war and military service focused on earlier wars, such as World War II, or studied U.S. veterans of the American War in Việt Nam. Little research investigates how war and military service affected

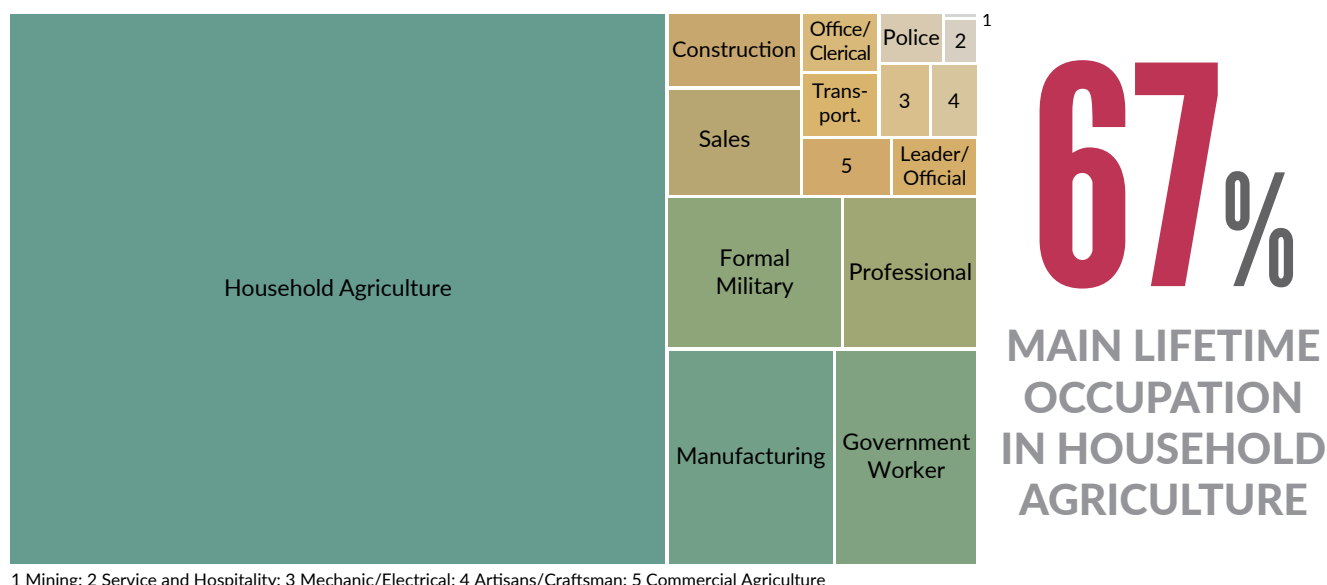


Figure 6.1 Distribution of VHAS participants' main lifetime occupations

the economic lives of the Vietnamese people. The VHAS data gives us unique insights into war's effect on the occupations, income, and wealth across the life span of now older adults who were youth and young adults during the American War.

MEASUREMENT

The VHAS includes several measures describing participants' work history, economic resources, and living conditions. Participants described their main lifetime occupation, current employment status, and current occupation if employed. Figure 6.1 presents participants' main lifetime occupations in 16 groups. For simplicity, we grouped the occupations into three categories in most analyses: household agriculture, professional or technical occupations, and occupations in manufacturing or service. Sixty-seven percent of VHAS participants described their main lifetime occupation as household agriculture. Forty-two percent of participants were employed in 2018, but not all remained employed in their main lifetime occupation.

Participants were also asked their perceptions of their income with the question, "Do you feel that your income is usually more than enough, just enough, or less than enough to meet your expenses?" Sixty-five percent described their income as just enough to meet their expenses, while 25% reported having less than enough to meet their expenses. To capture living conditions, the VHAS asked about household assets, including television, phone, fridge, air conditioner, motorcycle, car, computer, and home internet. We summarize these in a weighted index of self-reported household assets.

Following prior researchers, we generated weights using principal component analysis (Filmer and Pritchett, 2001). Possible index scores range from 0 to 4.17. The average assets index score for VHAS participants is 2.36, or 57% of the maximum possible score.

KEY FINDINGS

Two-thirds of VHAS participants spent their working lives working in household agriculture. Few held professional or technical occupations. Since more men than women held professional or technical positions as their main lifetime occupation, **men's average lifetime socioeconomic status was higher than women's**. Socioeconomic index scores rank occupations from 0 to 100 based on the average education required for a given occupation and the average income earned in that occupation (Ganzenboom et al., 1992). Figure

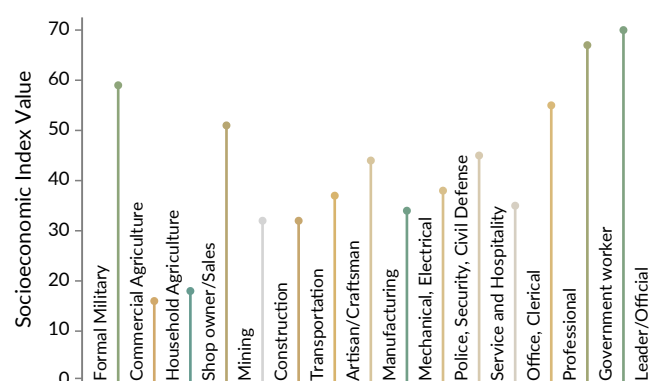


Figure 6.2 Socioeconomic Index values for main lifetime occupations in 16 categories (Range: 0 to 100)

6.2 presents the average socioeconomic index scores for the 16 occupational groups in which the VHAS respondents worked. In the VHAS sample, men's occupational attainment was roughly 6% higher than women's.

Men who did not serve in the military made up the highest percentage of people who held professional and technical occupations. In contrast, women with informal military service comprised the smallest shares of those in professional and technical occupations, while women who served in the formal military made up the largest portion of those in the service and manufacturing industries (see Figure 6.3).

Many in the VHAS sample were still employed in 2018, though the oldest among them were least likely to be working. Among those who are working, most (86%) work in household agriculture; few are in professional fields (2%). Eighty-nine percent of this group continue to work in their main lifetime occupation. Of those who changed occupations, half worked in lower-status occupations than they had for most of their lives. Among those whose occupational status improved, several transitioned to functionally similar positions (e.g., from career military to security or civil defense). Others are retirees holding community leadership positions. Though the status of these positions is elevated, the economic benefit of these positions is minimal. In general, most of the VHAS participants who continue to work in their later years do so because they are economically disadvantaged to some extent.

The majority of the VHAS participants described their current income as sufficient to meet their needs (Figure 6.4). However, this subjective assessment of income differed by gender, with women being more likely to view their income as insufficient to meet their needs.

MULTIVARIATE ANALYSES

While accounting for the impact of gender, marital status, childhood health, education, and province of residence, we modeled the effects of military service history, exposure to war violence, and experience of inhospitable living conditions on participants' economic circumstances. Since two-thirds of the participants reported their main lifetime occupation as household agriculture, we explored whether military service and war exposure was associated with working in other occupations, such as professional positions, or jobs in manufacturing or service. **For women, participating in informal military activities**, such as militias and the Thanh Niên Xung Phong (TNXP), during the American War **reduced their likelihood of attaining a professional occupation** rather than agriculture. In contrast, service in

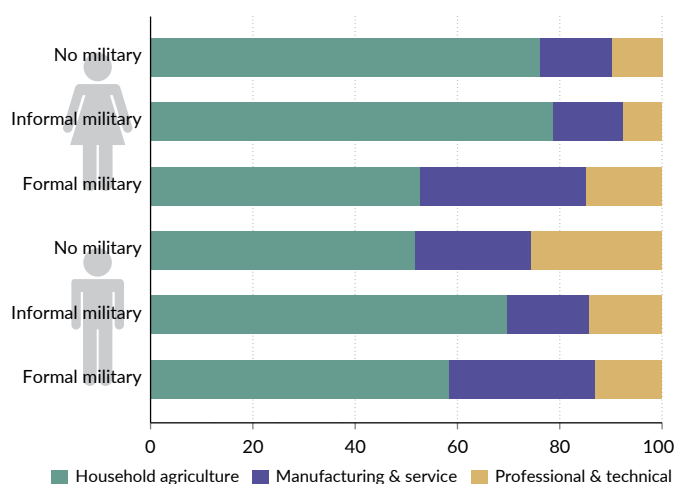


Figure 6.3 Main lifetime occupation by gender and military service status

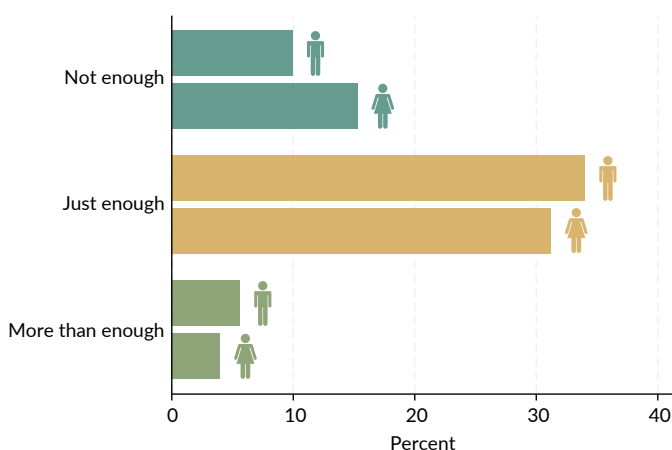


Figure 6.4 Perceived income sufficiency by gender

the formal military increased women's likelihood of working in manufacturing or service positions. **Men lacking military service were most likely to have worked in professional or technical occupations.** Formal military service was, for men, associated with working in manufacturing or service occupations rather than agriculture. However, war exposure was not related to occupational attainment. For women, these patterns equate to a 9% increase in socioeconomic status¹ resulting from military service, while for men, not serving in the military equates to a 6.5% boost in socioeconomic status (Figure 6.5). Formal military service also helped men's socioeconomic status in that it improved the odds of gaining non-agricultural employment, such as work in manufacturing or service. Still, it did not improve the likelihood of entering professional or technical occupations.

¹ As captured by their 100-point Socioeconomic Index score.

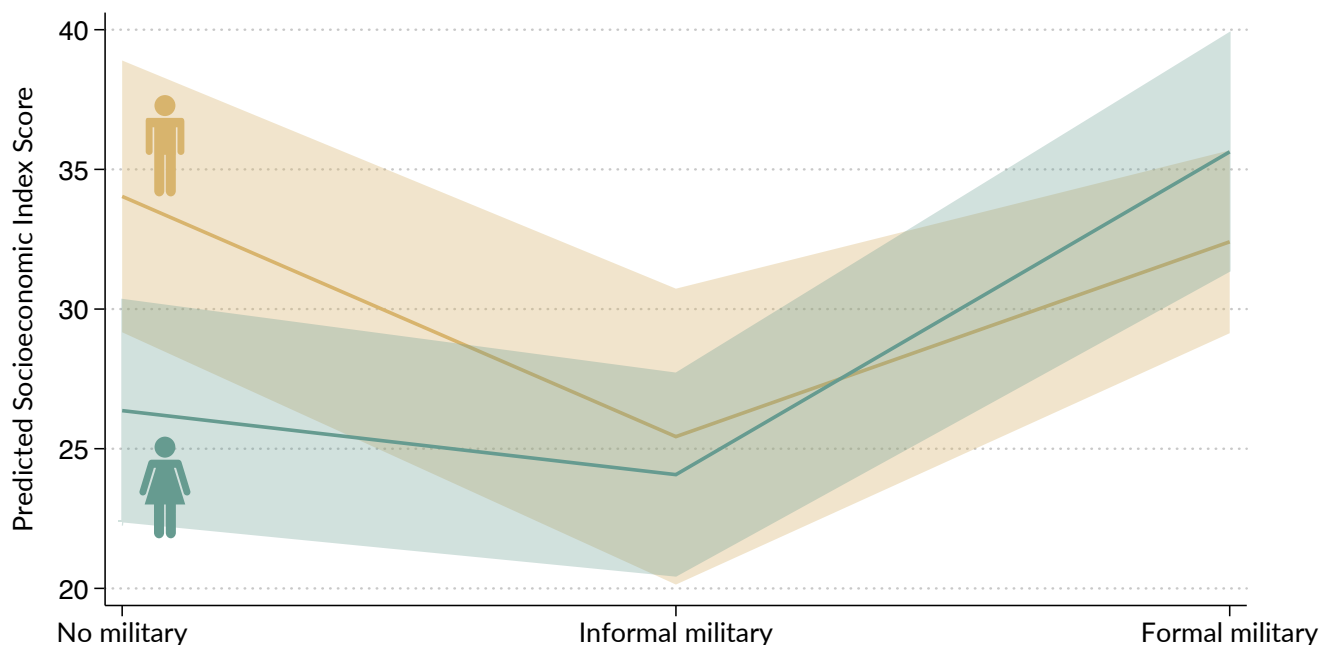


Figure 6.5 Predicted SEI for main lifetime occupation by gender and military service status

Note: Predictions account for war exposure, age, marital status, childhood health, and current province. Shaded area shows the margin of error for the predictions.

To capture the effect of war on the economic conditions of all respondents, regardless of occupation, we also evaluated self-reported income sufficiency and household assets using multivariate statistical models. Once again, the men in the VHAS sample were more likely than women to view their income as sufficient or more than sufficient to meet their needs. This was especially true of men who did not serve in the military and men with backgrounds in the formal military.

Finally, when considering assets possessed by the participant and members of their household, such as televisions, cars, computers, etc., we found that women who served in the formal military and men with no military service reported the highest number of assets. VHAS's Wave 1 survey did not include questions that would allow us to investigate the reasons for this pattern. The models also demonstrated that exposure to war violence or malevolent conditions was not associated with household assets.

CONCLUSION

Though exposure to war violence and inhospitable conditions are associated with many aspects of health and wellbeing, these experiences generally did not impact the lifelong economic circumstances of the VHAS participants. In contrast, military service is profoundly implicated in the lifetime economic circumstances of these participants. Formal military

service was economically beneficial for women, improving occupational opportunities and economic resources. For men, not serving in the military was the most economically advantageous. Men exempted from military service may have family or personal attributes positively associated with socioeconomic status. Participating in the formal military was

FORMAL MILITARY SERVICE AFFECTED MEN'S AND WOMEN'S LIFETIME OCCUPATIONS AND ECONOMIC RESOURCES DIFFERENTLY.

also beneficial for men. The skills, training, and social standing they gained from their military service may have partially offset war's interruptions to their work and education. Thus, while military service was economically beneficial overall, for men, service interrupted traditional educational and work trajectories. The benefits of military service that accrued to men in the formal military are evident only in comparison to the economic lives of men who served in militias, but these benefits remain slightly lower than those reaped by men whose education and work histories were unimpeded by war and military service.

MEASURING INCOME

Assessing income among the older generations of Vietnamese people is not as simple as asking the question “What is your annual income?” For those who support their households with a small family farm, the full picture of their **income can’t be captured in đồng**.

To capture the economic wellbeing of this generation whose “income” often took the form of farm yields, cash sales of produce or crafts in the local markets, and sometimes wage income, it is important to ask about many dimensions of income and wealth.

The VHAS survey asked about:

- Primary lifetime occupation and current occupation (if any)
- Main source of income
- Cash, in-kind, and other transfers from family members
- Perceived income sufficiency
- Household debt
- Household assets



REFERENCES

- Angrist, J.D., Chen, S.H., & Song, J. (2011). Long-term consequences of Vietnam-era conscription: New Estimates using social security data. *American Economic Review*, 101(3), 334-38. <https://doi.org/10.2139/ssrn.1214917>
- Elder, G.H. (1987). War mobilization and the life course: A cohort of World War II veterans. *Sociological Forum*, 2(3), 449-472. <https://doi.org/10.1007/BF01106621>
- Filmer, D., & Pritchett, L. H. (2001). Estimating Wealth Effects without Expenditure Data—Or Tears: An Application to Educational Enrollments in States of India. *Demography* 38(1), 18.
- Ganzeboom, H., De Graaf, P. M., & Treiman, D. J. (1992). A Standard International Socio-Economic Index of Occupational Status. *Social Science Research*, 21, 1–57.
- London, A.S. & Wilmoth, J.M. (2006). Military service and (dis)continuity in the life course: Evidence on disadvantage and mortality from the Health and Retirement Study and the Study of Assets and Health Dynamics among the Oldest-Old. *Research on Aging*, 28(1), 135-159. <https://doi.org/10.1177/0164027505281572>
- MacLean, A. (2010). The things they carry: Combat, disability, and unemployment among US men. *American Sociological Review*, 75(4), 563-585. <https://doi.org/10.1177/0003122410374085>
- Sheehan, C. M., & Hayward, M. D. (2019). Black/white differences in mortality among veteran and non-veteran males. *Social Science Research*, 79, 101-114. <https://doi.org/10.1016/j.ssresearch.2019.02.006>
- Teachman, J. (2004). Military service during the Vietnam era: Were there consequences for subsequent civilian earnings? *Social Forces*, 83(2), 709-730. <https://doi.org/10.1353/sof.2005.0021>

MIGRATION FOR WORK
AND EDUCATION PERSIST
DURING WAR BUT
ARE SUPPLEMENTED
BY DEPLOYMENTS AND
DISPLACEMENTS





MIGRATION HISTORIES

YVETTE YOUNG, TRẦN THỊ CẨM NHUNG

Migration has played a critical role in Việt Nam across numerous historical eras. In many societies, migration is a tool for enhancing socioeconomic status with the pull of economic opportunity stimulating both internal and international migration. People migrate for education, work, and marriage, typically when they are in their early twenties (Findlay et al., 2015). Under French colonialism, migration patterns in Việt Nam paralleled those of other pre-industrial nations, taking the form of rural-to-urban migration and wage-laborer migration between rural villages. After gaining independence from the French, a divided Việt Nam adopted different regional forms of migration. The North engaged in centralized planning and instituted the *hộ khẩu* system, while urbanization and economically motivated migration persisted in the South (Dang et al., 1997).

During the American War in Việt Nam, migration patterns shifted again. **War reduced economically motivated migration and delayed moves undertaken for education and marriage** (Williams, 2015). A new form of population mobility—village evacuations and displacement due to

bombing—became frequent. Further, Việt Nam's population-wide military mobilization brought extensive migration in the form of military deployment. Though there are extensive historical records and scholarly research focused on refugees who fled former South Việt Nam to resettle in the U.S. and other countries, we know little about the wartime migration patterns of people from former North Việt Nam. The VHAS, with its extensive migration data, contributes to our knowledge of wartime migration in the northern populace.

MEASUREMENT

The VHAS collected information about participants' major migrations and wartime displacements. Each participant was asked where they were born, their location at the start of the peak decade of the American War (1965–1975), whether they moved during the peak decade of the war, their location at the end of the war in 1975, and whether they moved in the subsequent decade (1976–1985). Migration histories documented wartime migrations during which the participant crossed province boundaries and remained for three months or longer. For each enumerated move, the participant

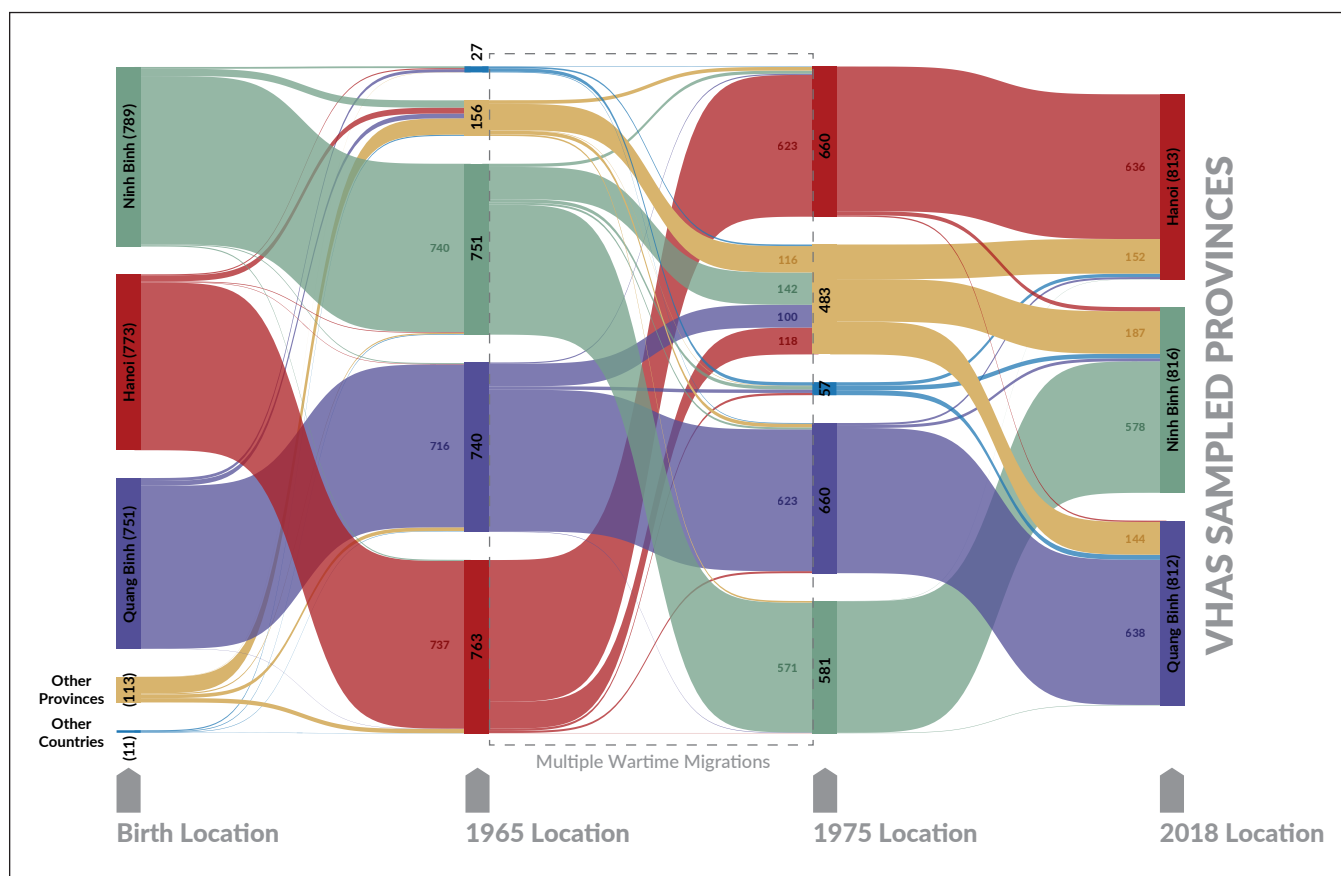


Figure 7.1 Migration flows

specified the year, the province to which they moved, and the primary reason for their move. Reasons for moving included military deployment and village evacuations, along with more traditional reasons such as education, employment, caring for family members, and marriage. The VHAS also asked how often people had to move during the war due to bombings or village evacuations. These questions capture war-related forced displacements of any distance and duration.

KEY FINDINGS

BIVARIATE RESULTS

In 2018, when the VHAS collected its first wave of data, 94% of participants were living in the province where they were born. Apart from the peak war decade when migration was more common, most participants resided nearly continually in their province of birth. Figure 7.1 shows how limited migration was for this population of northern and north-central Vietnamese outside the historical period of the American War. However, **30% of participants crossed province borders during the war**, residing outside their home province for three months or more. When displacements of shorter durations and distances

80% OF WARTIME MIGRATIONS WERE MILITARY DEPLOYMENTS

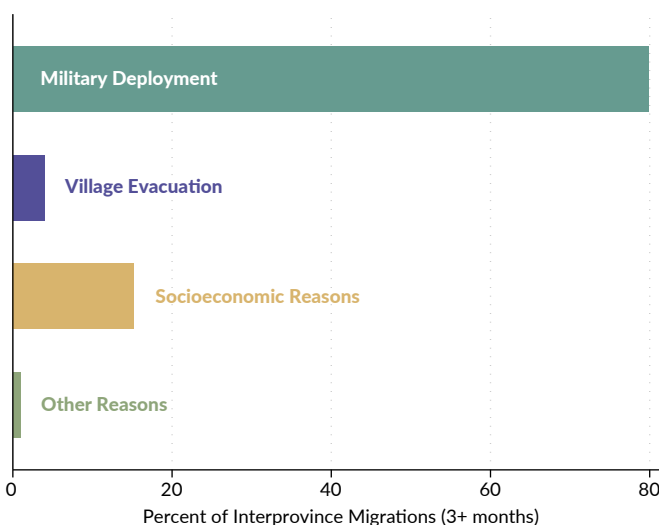


Figure 7.2 Reasons for migrating during the war

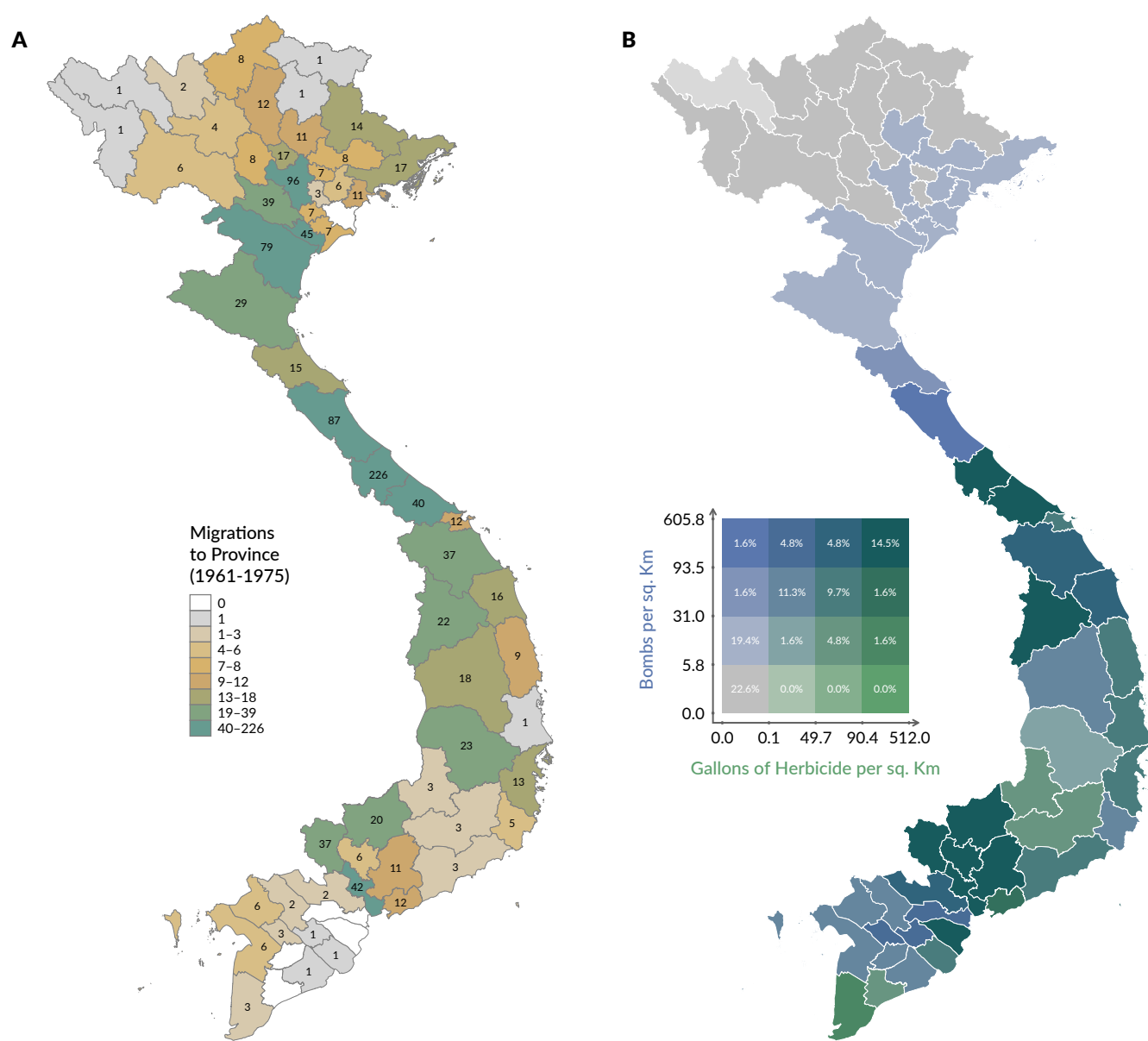


Figure 7.3 Comparison of the geographic intensity of bombings and herbicide spray with migrations to the affected provinces

are added, **53% of participants migrated during the war, and many migrated more than once** during that time.

The vast majority (80%) of wartime interprovince migrations occurred for military deployments (see Figure 7.2). Though short-term and limited distance displacements, such as village evacuations, were commonplace, longer-term displacements made up only 4% of migrations, and all were formal village evacuations. Economically motivated migrations, such as those for work, education, and, for women, marriage, made up 15% of wartime migrations. The remaining migrations (less than 1%) occurred to care for elderly relatives, to meet other family obligations, and for unspecified reasons.

Figure 7.3 juxtaposes wartime migrations against the intensity of wartime violence. Provinces that experienced more intense bombing (measured in bombs per square kilometer) and more foreign military missions that sprayed herbicides also received more migrants, predominantly due to military deployment.

Given the high proportion of migrations that occurred for military deployment, it is no surprise that migration patterns differ by participants' gender and history of military service. Figure 7.4 shows that those with military experience, especially combat experience, were more likely to migrate during the war. Men were more frequent participants in the formal military and more likely than women soldiers to engage



The Vịnh Mốc tunnels in Quảng Trị Province, built to shelter people evacuated from their village during periods of intense bombing. Photo: Yvette Young

in combat. Consequently, **41% of men in the VHAS study were deployed to other provinces during the war**, but only 7% of women were similarly deployed away from their home province.

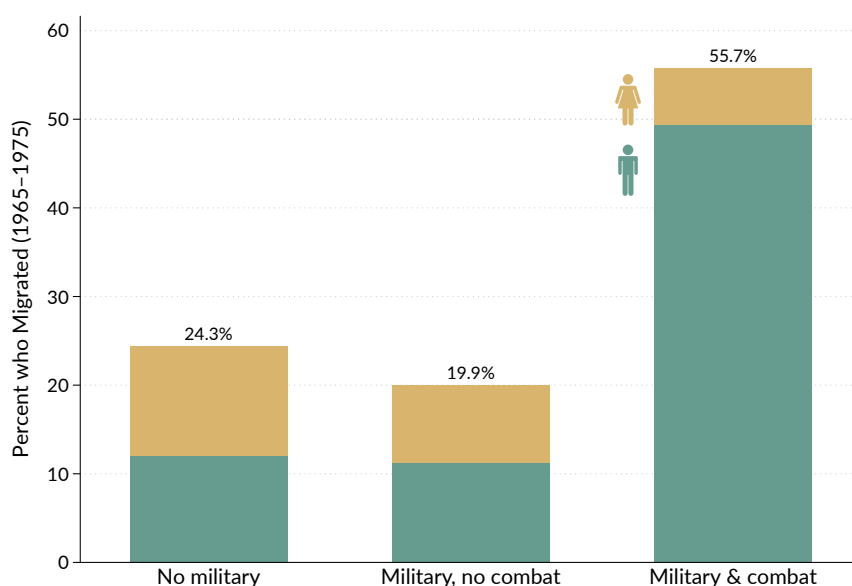


Figure 7.4 Wartime migration and combat experience by gender

MULTIVARIATE RESULTS

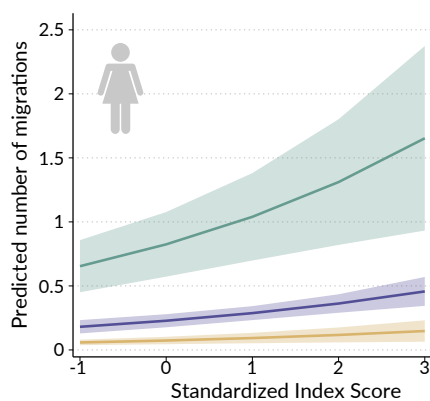
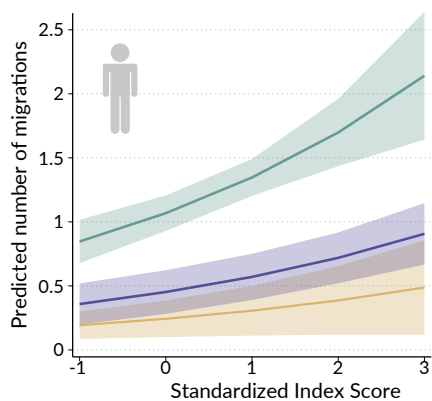
The following multivariate analyses of VHAS participants' migration histories examine the effects of military service, experiencing or witnessing war violence, and exposure to malevolent conditions while accounting for participant characteristics such as age, gender, marital status, childhood health status, education, and province of residence. These analyses show that the connection between migration and war is substantial and robust, undiminished by variability in individual characteristics. The total number of moves experienced by participants is substantially higher for people who served in the formal military. Among those who served, men report moving more frequently than women. This would be expected for those serving in the formal military, given the frequency of deployment. However, it holds true even when deployments are excluded from analyses. In contrast, military service is not associated with experiencing more war-related displacements, such as village evacuations, a pattern reflecting the preponderance of civilians residing in villages and subject to evacuations during this decade of the war.

Exposure to combat, war casualties, toxic chemicals, and inhospitable conditions are also associated with elevated migration, regardless of the type of migration. Figure 7.5 shows the predicted number of wartime moves for people with different levels of exposure to war violence and malevolent conditions. The distance between the margins of error (the shaded regions) shows that migration frequency differed significantly by gender and military service type. It should be noted that in any cross-sectional retrospective study, associations do not necessarily indicate causality. While the

VHAS participants might have migrated in response to war exposures, those who migrated were likely at greater risk for encountering these wartime stressors and hazards (for example, due to their geographic location). They also may have encountered such hazards in the process of migrating.

However, differences in migration patterns are primarily driven by deployments. In Figure 7.6, we see that the lines (and margins of error) for predicted deployments are discrete (non-overlapping) for the different types of military service but not for gender. Thus, there is a statistically significant difference in the predicted number of migrations between those who were civilians, militia or youth military

A Exposure to Violence Index



B Malevolent Conditions Index

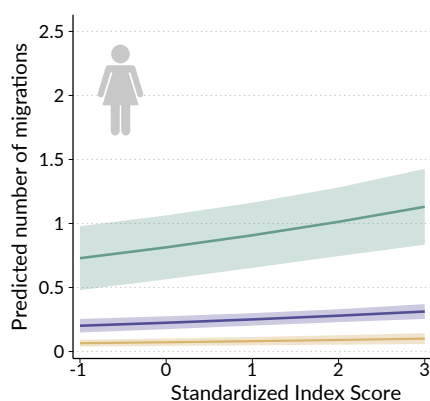
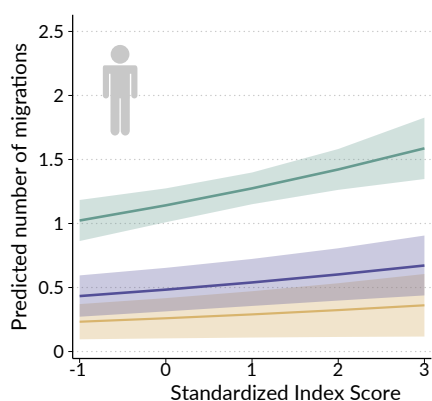
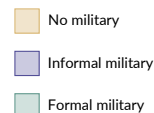
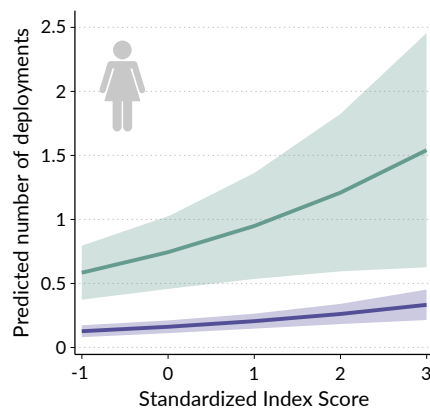
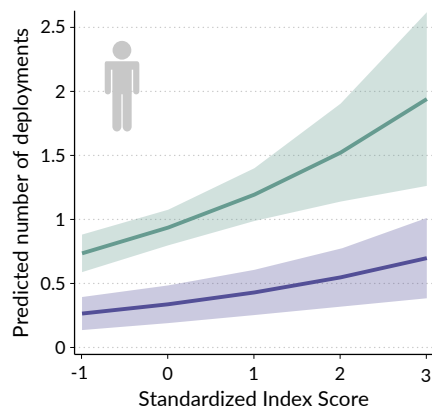


Figure 7.5 Predicted **wartime migrations** by levels of exposure to violence (A) and malevolent conditions (B)

Note: Predictions account for age, marital status, childhood health, and current province. Shaded areas show the margin of error for the predictions.



A Exposure to Violence Index



B Malevolent Conditions Index

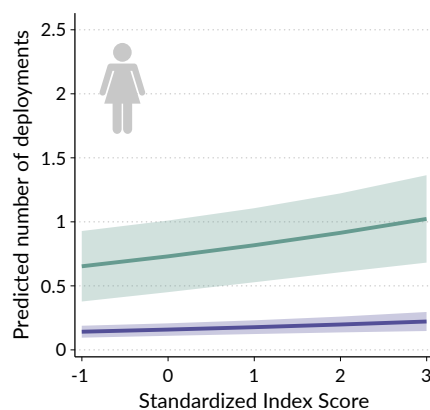
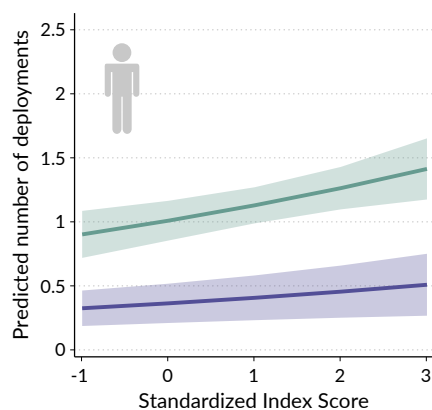
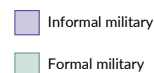


Figure 7.6 Predicted **military deployments** by levels of exposure to violence (A) and malevolent conditions (B)

Note: Predictions account for age, marital status, childhood health, and current province. Shaded areas show the margin of error for the predictions.



support volunteers, and soldiers in the formal military. In contrast, predicted displacements (not shown) are nearly indistinguishable by military service and gender. Forced displacement impacts men and women, soldiers and civilians, in equal measure.

CONCLUSION

The VHAS data shows us that patterns of Vietnamese migration shifted during wartime. **Rural-to-urban migration driven by the pursuit of economic goals declined, and war-related migration grew.** Extensive military deployments supplanted more traditional forms of migration. Though deployments dominated wartime migration in the VHAS study locations, moves for work, education, marriage, and family support still occurred. The effect of exposure to war violence and malevolent conditions on deployments varied by gender and type of military service. However, evacuations and other forms of wartime displacement affected the populace more

uniformly. These experiences did not discriminate based on gender or military service.

After the conclusion of the American War, migration patterns shifted again. Rural-to-urban migration increased, but centralized planning intended to modernize rural areas of the country involved transferring skilled labor from cities to rural regions. With the advent of Đổi Mới, it is possible that economic migrants were again drawn to cities (Dang, 1999). However, given that in 2018, nearly all VHAS participants were living in their province of birth, we presume that, in the absence of war, migration for this older generation living in northern and north-central Việt Nam remained rare. As migration for work, marriage, and education traditionally occur in early adulthood, Đổi Mới's effect on migration likely affected younger cohorts in the North. However, the 2018 VHAS data provides insights into the early life mobility of these now-older adults.

REFERENCES

- Dang, N. A. (1999). Market Reforms and Internal Labor Migration in Vietnam. *Asian and Pacific Migration Journal*, 8(3), 381–409. <https://doi.org/10.1177/011719689900800307>
- Dang, N. A., Goldstein, S., & McNally, J. (1997). Internal Migration and Development in Vietnam. *International Migration Review*, 31(2), 312–337. <https://doi.org/10.1177/019791839703100203>
- Findlay, A., McCollum, D., Coulter, R., & Gayle, V. (2015). New Mobilities Across the Life Course: A Framework for Analysing Demographically Linked Drivers of Migration. *Population, Space and Place*, 21(4), 390–402. <https://doi.org/10.1002/psp.1956>
- Williams, N. E. (2015). Mixed and Complex Mixed Migration during Armed Conflict: Multidimensional Empirical Evidence from Nepal. *International Journal of Sociology*, 45(1), 44–63. <https://doi.org/10.1080/00207659.2015.1005434>
- Young, Y., Korinek, K., & Nguyen, H. M. (2021). A Life Course Perspective on the Wartime Migrations of Northern Vietnamese War Survivors. *Asian Population Studies*, 17(3), 308–331. <https://doi.org/10.1080/17441730.2021.1956722>
- Young, Y., Korinek, K., & Nguyen, H. M. (2023). The Trauma of Flight or Flight from Trauma? Untangling the Relationship Between War, Migration, and PTSD in a Vietnamese Cohort.

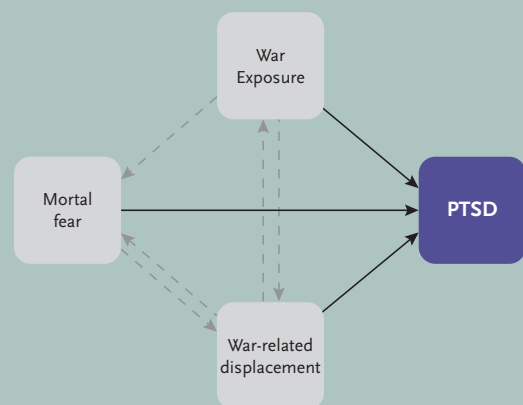
WARTIME DISPLACEMENT AND POSTTRAUMATIC STRESS

Village evacuations requiring residents to move across province boundaries for long periods were uncommon, even in the most heavily bombed areas of the former DRV. Only 4% of VHAS participants reported extended displacements such as these. However, short-term evacuations to nearby shelter areas were common. **Thirty-five percent of participants reported being displaced at least once** during the peak decade of the American War.

Among war survivors worldwide who experienced displacement, posttraumatic stress disorder (PTSD) is a common malady. Existing research suggests PTSD after war-related displacement might stem from the following:

- Exposure to war violence, destruction, and other potentially traumatic events
- Experiences of mortal fear that induce migration
- The uncertainty and vulnerability of being displaced

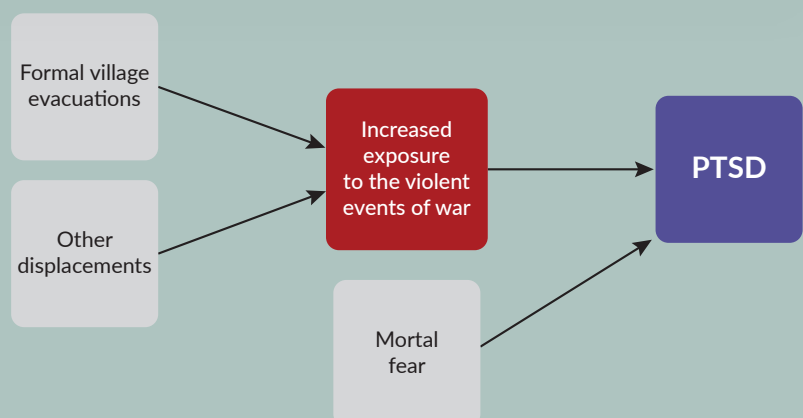
However, existing research is not definitive about the causes. In other words, scholars do not know the sequence of events—the “recipe” of war exposure and reaction—that cause PTSD. With its in-depth battery of exposure questions, the VHAS is uniquely positioned to investigate this relationship for older Vietnamese adults who survived the American War.



Causal analysis of the VHAS data found that **fear was not the cause of displacement** for these older adults.

Fifty percent of displacements were formal evacuations arranged by the government (Young et al., 2021). Thus, these displacements were not precipitated by mortal fear or perceived threats (Young et al., 2023). However, as shown below, displacement increased people’s exposure to the potentially traumatic events of war.

50%
OF DISPLACEMENTS
WERE FORMAL
VILLAGE
EVACUATIONS



Displacement itself is not a cause of PTSD for older Vietnamese adults. Instead, **the wartime violence experienced while displaced is the source of PTSD symptoms** that have extended into older adulthood.

WAR'S IMPACTS ON
PHYSICAL HEALTH
EXTEND LONG AFTER
THE WAR HAS ENDED





CHAPTER 8

PHYSICAL HEALTH STATUS THROUGH THE LENS OF MULTIMORBIDITY AND SELF-RATED HEALTH

KIM KORINEK, DELANEY GLASS, TRẦN KHÁNH TOÀN

Physical health and chronic conditions are major concerns among the elderly population. Chronic conditions such as arthritis, diabetes, and cardiovascular disease (CVD) are prevalent among older adults and can significantly impact their functional ability and quality of life. As individuals age, the prevalence of chronic conditions rises, accompanied by an elevated likelihood of experiencing multiple concurrent chronic conditions. Self-rated health is a robust predictor of all-cause mortality, and poor self-rated health often co-occurs with chronic conditions (Fan & He, 2022).

Wartime exposures to psychological stress and violence may heighten risks of developing multimorbidity (co-occurrence of multiple chronic conditions), poor self-rated health (Wang et al., 2015), and chronic conditions such as CVD (Korinek et al., 2020) and liver disease (Kelsall et al., 2009). The rising prevalence of multimorbidity in low-and middle-income

countries (LMICs) presents significant social and financial implications in the coming decades as LMICs continue to grapple with unresolved challenges of disease burden. These countries now face the additional burden of managing chronic conditions alongside limited resources and constrained healthcare systems (Garin et al., 2016). Moreover, these countries are coping with dual burdens of infectious and non-infectious diseases, where chronic conditions are rapidly increasing and occurring at relatively younger ages (Basto-Abreu et al., 2022). The increasing prevalence of communicable and non-communicable diseases in LMICs may be related to the fundamental environmental and social/economic transformations that occur in the wake of armed conflict, exacerbating multimorbidity (Xu et al., 2017).

While the consequences of war can affect various population groups (Glass et al., 2023), older adults are particularly



VHAS field researcher conducting an in-home interview during Wave 1 data collection. Photo: **Bussarawan Teerawichitchainan**

vulnerable to both the immediate and long-term effects of war (Murthy & Lakshminarayana, 2006). However, research on the long-term impacts of war has primarily focused on veterans in high-income countries. Little is known about the chronic disease burden related to wartime trauma on the health of LMIC populations in conflict-affected and post-conflict areas, especially among older adults. Of the few studies examining multimorbidity in post-conflict settings (e.g., Kosovo), most find that non-communicable disease burden is negatively associated with self-rated health (Milošević et al., 2021) and that individuals affected by armed conflict and displacement have high rates of multimorbidity (Pfortmueller et al., 2013).

The majority of older adults in Việt Nam experienced wars earlier in their life course and endured and witnessed different levels of trauma and loss during wartime. Those who survived the American War are now entering the final stage of life and are burdened with a high prevalence of non-communicable chronic diseases. A preliminary study conducted in a rural area of Việt Nam in 2012 revealed that 42% of older adults had been diagnosed with at least one non-communicable disease (Teerawichitchainan & Korinek, 2012). Due to urgent need, the VHAS project was implemented to assess the health status of older adults in Việt Nam in the context of population aging and enduring consequences of war. The findings from Wave 1 have revealed that wartime experiences not only affect the mental health status of older adults, particularly in terms of PTSD (Kovnick et al., 2021), but also have implications for specific

physical health conditions such as CVD (Korinek et al., 2020), respiratory illness (Teerawichitchainan et al., 2023), and somatic health complaints (Glass et al., 2023). Focusing upon two comprehensive indicators of health status—multimorbidity and self-reported health—this chapter provides an overview of physical health status and chronic conditions among VHAS participants in relation to their early-life wartime experiences.

MEASUREMENT AND ANALYSIS

In the VHAS, participants were interviewed at home using a structured questionnaire and invited to the commune health center for a physical examination that included anthropometric and physical functional measurements, blood pressure measurement, and blood and hair sample collection. This data collection approach yielded a broad and diverse set of physical health conditions for analysis. For the sake of brevity, we focus this chapter on two robust indicators of older adult health status: Self-rated health and multimorbidity assessed by a count of self-reported chronic conditions.

We assess self-rated health based on participants' responses to the question, "Would you say your health is very good, good, fair, poor, or very poor?" Due to participants' limited use of the endpoint categories, we classify participants' self-rated health as "poor or very poor" or "fair to very good." To assess multimorbidity, we construct a count measure indicating the number of diagnosed chronic conditions and illnesses reported by the participant. The following 12 illnesses and conditions are counted in the multimorbidity measure: hypertension, dyslipidemia, chronic obstructive pulmonary disorder (COPD) or other chronic respiratory illnesses, heart disease, diabetes, stroke, arthritis, hip fracture, asthma, memory or cognitive disorder, cancer, and liver disease. We recognize that relying upon diagnosed conditions can bias measurement, especially when certain chronic conditions, such as hypertension, are widely underdiagnosed in the population (Son et al., 2012). We also acknowledge the potential for error in self-report data and that certain index items, such as cancer, lack detailed specifications. Alternative specifications are possible, and in one sensitivity analysis, relying upon the Charlson Comorbidity Index (Charlson et al., 1987), a weighted sum of chronic conditions predictive of mortality, we obtained regression results similar in magnitude and direction.

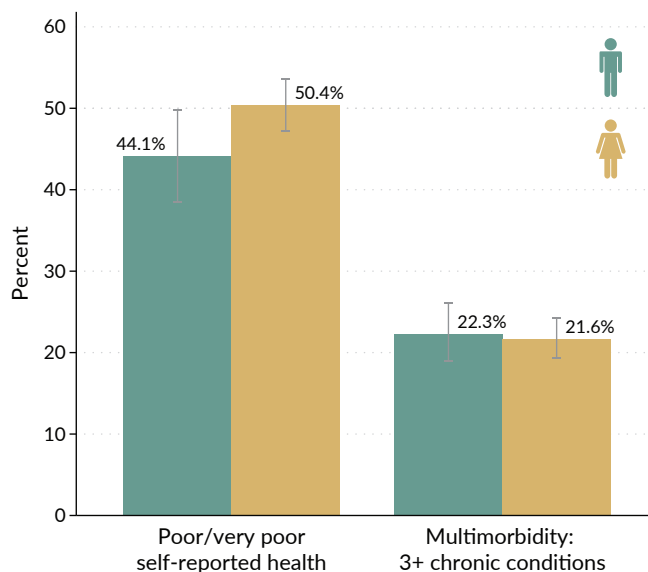


Figure 8.1 Physical health status by gender

To better elucidate chronic disease burden within the VHAS sample and to illustrate how the chronic conditions most prevalent within the multimorbidity index vary across older adults, we also present a series of bivariate analyses of two self-reported chronic conditions prevalent in the VHAS sample, hypertension, and dyslipidemia, and the five most prevalent chronic diseases among those assessed in the VHAS questionnaire. These include arthritis, heart disease, COPD, cancer, and liver disease.

KEY FINDINGS

BIVARIATE RESULTS

About 22% of women and men in the VHAS reported being diagnosed with three or more of the chronic health conditions queried in the interview. A higher percentage of women (50.4%) than men (44.1%) have poor or very poor self-rated health (Figure 8.1). Across age groups, the proportion of VHAS participants reporting poor or very poor self-rated health increases by nearly 20 percentage points from the youngest (59–64) to the oldest (85+) age group (Figure 8.2). Bivariate analyses of multimorbidity do not demonstrate such a linear association with age. The prevalence of multimorbidity increases across the four youngest age groups and then declines for those aged 80 and older (Figure 8.2).

To further explicate the associations between age and multimorbidity, we show prevalence by age for diagnosed chronic conditions with prevalence rates of 10% or higher in the VHAS sample. The trends across age groups in Figure 8.3 suggest that several chronic conditions (e.g., hypertension, dyslipidemia, liver disease) are significantly less prevalent in the older age groups than the younger age groups.

We also consider our physical health indicators by degrees of war stress exposure. Figure 8.4 demonstrates individuals with above-average wartime malevolent conditions and violence exposures have a larger proportion reporting poor or very poor health than those with lower exposures. Similarly, individuals

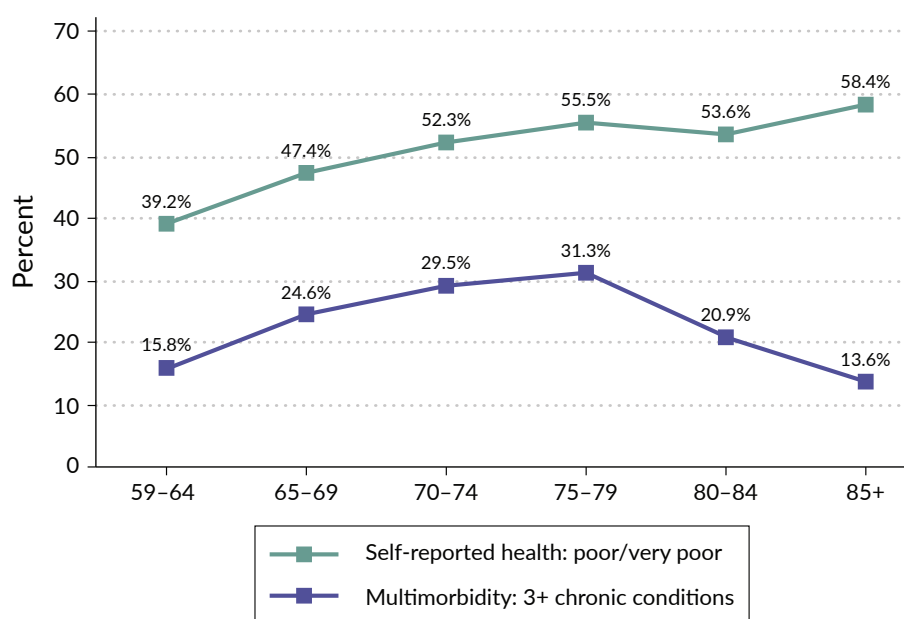


Figure 8.2 Physical health status by age

22%
HAVE BEEN
DIAGNOSED WITH
THREE OR MORE
CHRONIC HEALTH
CONDITIONS

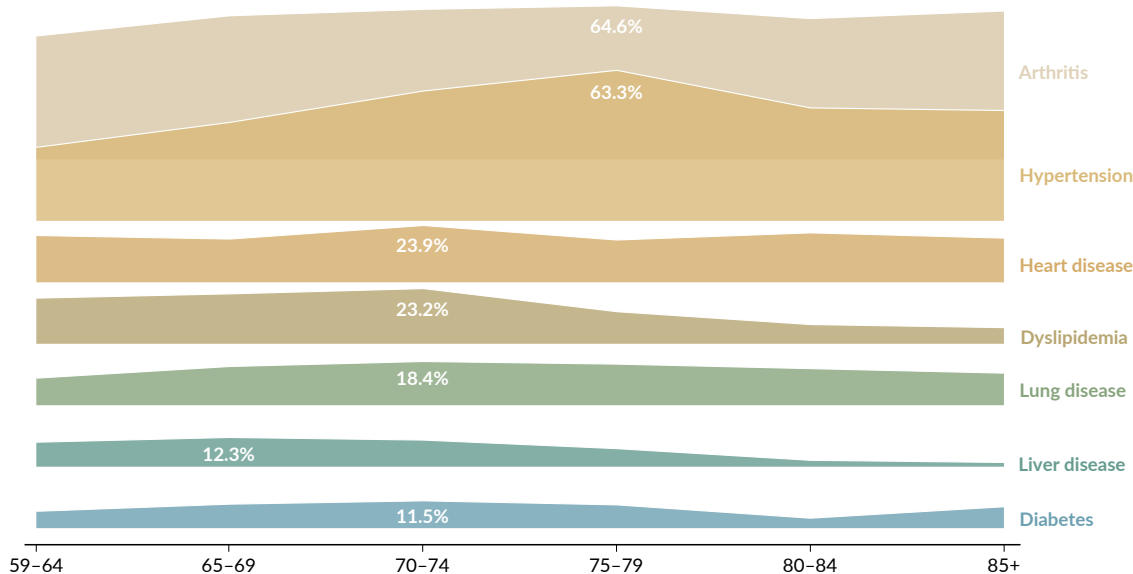


Figure 8.3 Prevalence of select chronic conditions by age

with above-average wartime malevolent conditions and violence exposures have higher multimorbidity scores than those with below-average exposures.

MULTIVARIATE RESULTS

To examine gendered military service and war exposure as correlates of physical health status among VHAS older adults, we estimate poor self-reported health and multimorbidity scores using regression analyses. Consistent with other analyses in this report, the models account for the following sociodemographic characteristics: sex, age group, marital

status, education level, household assets, household income level, early childhood health status, and province of residence. The main results for war-related covariates are shown for Self-rated health and multimorbidity in Table 8.1.

We find that greater exposures to violence and malevolent conditions are positively associated with the likelihood of having poor or very poor health, whereas we do not find significant associations between Self-rated health and military service status categorized by gender (Table 8.1). In the regression models predicting multimorbidity, as assessed by a count of 12 chronic conditions, we find that women

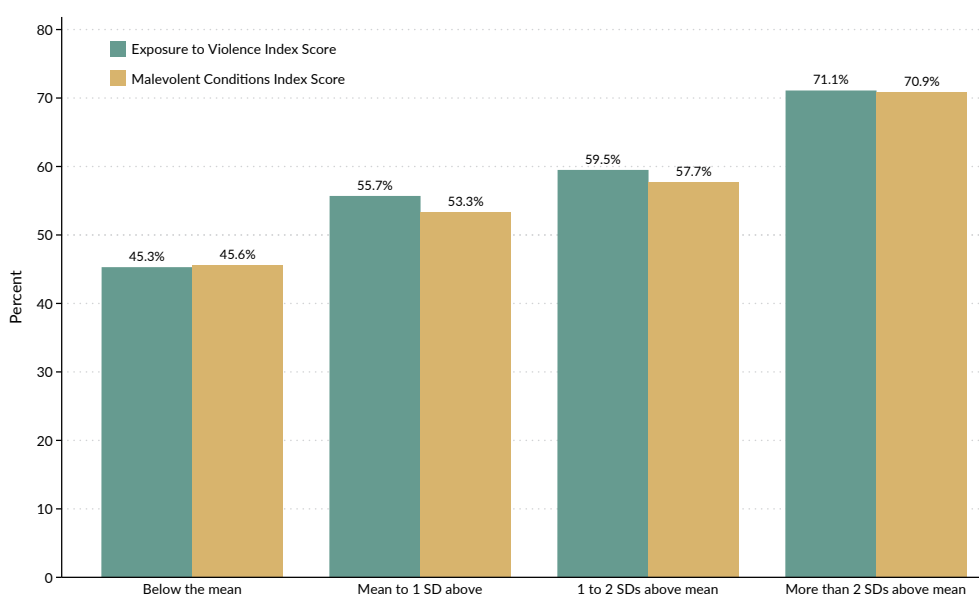


Figure 8.4 Percent with poor or very poor self-rated health by level of exposure to violence and malevolent conditions

Table 8.1 Regression models predicting self-rated health (SRH) and multimorbidity scores

	Poor/very poor SRH	Multi-morbidity score
Gender and Military Service (ref: Female, civilian)		
Female, informal military	1.03	1.10*
Female, formal military	1.03	1.02
Male, civilian	0.77	0.85
Male, informal military	1.06	1.17
Male, formal military	0.95	1.02
Exposure to War Violence Index	1.21**	1.12***
Exposure to Malevolent Conditions Index	1.17**	1.08*

Note: Coefficients represent the multiplicative odds (SRH) and multiplicative change in expected number of multimorbidities. Values below 1 represent negative associations, while values above 1 are positive. Stars indicate statistical significance. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

who served in the informal military report significantly more diagnosed chronic conditions (Table 8.1). Additionally, exposures to war stress—wartime malevolent conditions and especially war violence—are associated with significantly higher multimorbidity scores among VHAS respondents.

CONCLUSION

This chapter highlights a multitude of physical health concerns in the American War cohort featured in the VHAS which warrant significant attention and care. The analyses demonstrate significant associations between violent and malevolent war exposures in early life and both poor self-rated health and

multimorbidity in late adulthood among Vietnamese survivors of the American War.

We observed that military service status was not related to poor self-rated health in this sample, whereas it was associated with the prevalence of chronic health conditions. Compared to civilian women, civilian men and those in the informal military were more likely to report three or more chronic conditions. This likely reflects a range of factors that make certain men more susceptible to non-communicable chronic conditions. For instance, these men may have engaged in more risky health behaviors over their life course (e.g., smoking, alcohol use), or they may have engaged in more stressful or hazardous occupations than women. The fact that the multimorbidity penalty does not carry over to men who served in the formal military may represent

positive selection, health buffering, or resilience related to their service. These gender and military service status patterns warrant further investigation.

The current chapter briefly presents just two comprehensive indicators of older adults' physical health status among VHAS participants. Past research conducted by VHAS investigators further explores associations between war-related experiences and exposures and late-life health conditions. For example, in an analysis of late-life respiratory illness published by Teerawichitchainan and colleagues (2023), a striking interaction is observed between military service status

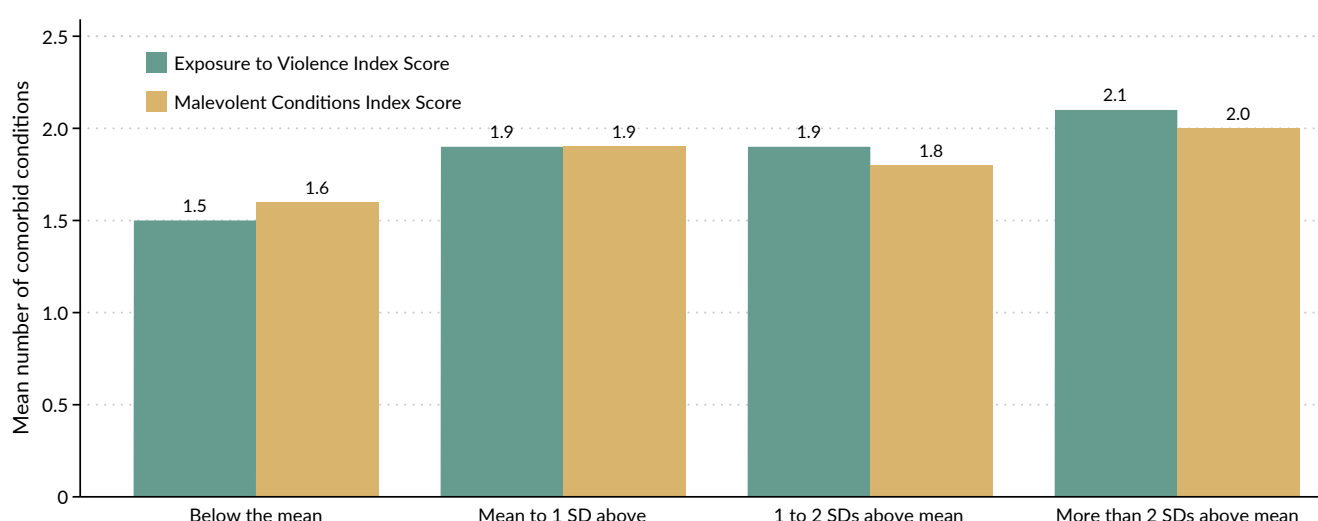


Figure 8.5 Mean number of comorbid conditions by level of exposure to violence and malevolent conditions

and severity of war exposure, suggesting that among those experiencing relatively frequent exposures to war stressors, civilians experience more numerous respiratory problems than their counterparts who engaged in the military and informal military institutions (see Figure 8.6). The study authors posit that civilians' greater respiratory health penalty associated with war stress exposure may be due to mortality selection or to military members' life experiences and access to benefits that may protectively buffer respiratory health. They conclude that more research on risk factors and protective mechanisms is necessary to enhance understanding of respiratory health in conflict-affected populations.

Several other studies conducted in Việt Nam have commented upon high levels of undiagnosed chronic illness in the population (e.g., Son et al., 2012), and our study is not immune from this limitation. For instance, by comparing self-reported diagnosed hypertension with hypertension measured in the VHAS biomarker data collection, we are aware that approximately 30% of VHAS participants have undiagnosed hypertension. In addition to selective mortality and its influence on the health characteristics of older adults sampled for the VHAS, an additional limitation of the current chapter analyses is the latency between war exposures and the measurement of outcomes in this aging population. Nevertheless, we provide needed insight into the potential impacts of war exposures on health and aging. Specifically, the results provide an initial look at war exposures, such as violence and malevolent conditions, as potential accelerants for physiological aging as assessed by self-rated health and multimorbidity. Further meticulous and specialized analyses are imperative to comprehensively evaluate the impacts of wartime exposure and its association with specific chronic health conditions among the elderly population in Việt Nam.

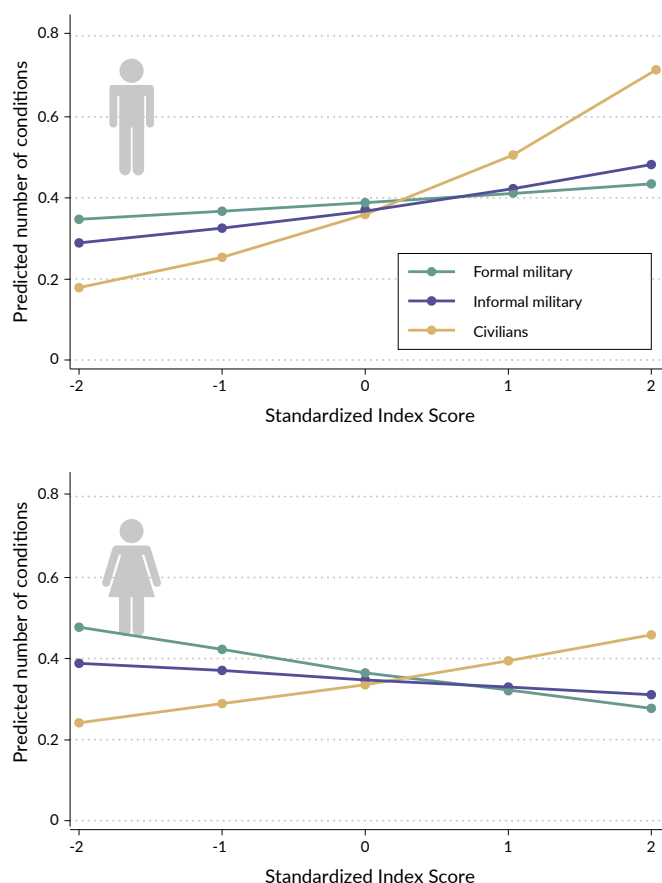


Figure 8.6 Predicted number of respiratory conditions by military service status and intensity of war exposure (Teerawichitchainan et al., 2023)

REFERENCES

- Basto-Abreu, A., Barrientos-Gutierrez, T., Wade, A. N., Oliveira de Melo, D., Semeão de Souza, A. S., ... Miranda, J. J. (2022). Multimorbidity matters in low and middle-income countries. *Journal of Multimorbidity and Comorbidity*, 12, 26335565221106070. <https://doi.org/10.1177/26335565221106074>
- Charlson, M. E., Pompei, P., Ales, K. L., & MacKenzie, R. (1987). Charlson comorbidity index. *J Chronic Dis*, 40(5), 373-383. <https://blog.summit-education.com/wp-content/uploads/CCI-Scale.pdf>

- Fan, Y., & He, D. (2022). Self-rated health, socioeconomic status and all-cause mortality in Chinese middle-aged and elderly adults. *Scientific Reports*, 12(1), Article 1. <https://doi.org/10.1038/s41598-022-13502-9>
- Garin, N., Koyanagi, A., Chatterji, S., Tyrovolas, S., Olaya, B., Leonardi, M., Lara, E., Koskinen, S., Tobiasz-Adamczyk, B., Ayuso-Mateos, J. L., & Haro, J. M. (2016). Global Multimorbidity Patterns: A Cross-Sectional, Population-Based, Multi-Country Study. *The Journals of Gerontology: Series A*, 71(2), 205–214. <https://doi.org/10.1093/gerona/glv128>
- Glass, D. J., Young, Y. M., Tran, T. K., Clarkin, P., & Korinek, K. (2023). Weathering within war: Somatic health complaints among Vietnamese older adults exposed to bombing and violence as adolescents in the American war. *Journal of Psychosomatic Research*, 165, 111080. <https://doi.org/10.1016/j.jpsychores.2022.111080>
- Kelsall, H. L., McKenzie, D. P., Sim, M. R., Leder, K., Forbes, A. B., & Dwyer, T. (2009). Physical, Psychological, and Functional Comorbidities of Multisymptom Illness in Australian Male Veterans of the 1991 Gulf War. *American Journal of Epidemiology*, 170(8), 1048–1056. <https://doi.org/10.1093/aje/kwp238>
- Korinek, K., Young, Y., Teerawichitchainan, B., Kim Chuc, N. T., Kovnick, M., & Zimmer, Z. (2020). Is war hard on the heart? Gender, wartime stress and late life cardiovascular conditions in a population of Vietnamese older adults. *Social Science & Medicine*, 265, 113380. <https://doi.org/10.1016/j.socscimed.2020.113380>
- Kovnick, M. O., Young, Y., Tran, N., Teerawichitchainan, B., Tran, T. K., & Korinek, K. (2021). The Impact of Early Life War Exposure on Mental Health among Older Adults in Northern and Central Vietnam. *Journal of Health and Social Behavior*, 62(4), 526–544. <https://doi.org/10.1177/00221465211039239>
- Milošević, J., Milić, M., Mirković, M., Milošević, N., Novaković, T., Vitošević, Z., Đurić, S., Stojanović-Tasić, M. & Kulić, L. (2021). Association between non-communicable diseases and satisfaction with healthcare and self-rated health: experiences from post-conflict communities. *Srpski arhiv za celokupno lekarstvo*, 149(1-2), 16-23.
- Murthy, R. S., & Lakshminarayana, R. (2006). Mental health consequences of war: a brief review of research findings. *World Psychiatry*, 5(1), 25-30. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/16757987>
- Pfortmueller, C. A., Stotz, M., Lindner, G., Müller, T., Rodondi, N., & Exadaktylos, A. K. (2013). Multimorbidity in Adult Asylum Seekers: A First Overview. *PLOS ONE*, 8(12), e82671. <https://doi.org/10.1371/journal.pone.0082671>
- Son, P. T., Quang, N. N., Viet, N. L., Khai, P. G., Wall, S., Weinehall, L., Bonita, R., & Byass, P. (2012). Prevalence, awareness, treatment and control of hypertension in Vietnam—Results from a national survey. *Journal of Human Hypertension*, 26(4), Article 4. <https://doi.org/10.1038/jhh.2011.18>
- Teerawichitchainan, B., & Korinek, K. (2012). The long-term impact of war on health and wellbeing in Northern Vietnam: Some glimpses from a recent survey. *Social Science & Medicine*, 74(12), 1995–2004. <https://doi.org/10.1016/j.socscimed.2012.01.040>
- Teerawichitchainan, B., Zimmer, Z., Low, T. Q. Y., & Toan, T. K. (2023). Respiratory Health Among Older Adults in Vietnam: Does Earlier-Life Military Role and War Exposure Matter? *Journal of Aging and Health*, 35(3-4), 168-181. <https://doi.org/10.1177/08982643221118445>
- Wang, J. M., Lee, L. O., & Spiro, A. (2015). Gender Differences in the Impact of Warfare Exposure on Self-Rated Health. *Women's Health Issues*, 25(1), 35–41. <https://doi.org/10.1016/j.whi.2014.09.003>
- Xu, X., Mishra, G. D., & Jones, M. (2017). Evidence on multimorbidity from definition to intervention: An overview of systematic reviews. *Ageing Research Reviews*, 37, 53–68. <https://doi.org/10.1016/j.arr.2017.05.003>

THE DESTRUCTION,
DEPRIVATION, AND
UNCERTAINTIES OF
WAR HARM LATE-LIFE
COGNITIVE HEALTH





CHAPTER 9

COGNITIVE IMPAIRMENT

KIM KORINEK, JARED M. POFF

The prevalence of Alzheimer's disease and related dementias (ADRD) is rising significantly across the globe as populations age. The majority of people living with ADRD reside in low- and middle-income countries that are poorly equipped to meet the financial and health pressures that ADRD places upon families, caregivers, and health and social welfare systems (Mattap et al., 2022). In Việt Nam, an estimated 660,000 people were living with dementia in 2015, a figure predicted to reach 1.2 million by 2030 (Rees, 2018). Studies of cognitive function and risk factors for cognitive decline remain limited in Việt Nam, despite the country's rapidly aging population (Saito et al., 2022). With ADRD on the rise, and substantial gaps in diagnosis, care, and services for persons with dementia and their families, it is critical that the country plan strategically to meet emerging challenges associated with ADRD (Nguyen et al., 2020; Hinton et al., 2020).

Research conducted among American veterans of the Việt Nam War reveals numerous cognitive risk factors associated with military service, including the degree of combat exposure,

history of traumatic brain injury, and posttraumatic stress disorder (Barnes et al., 2018; Veitch et al., 2013). However, we possess very little parallel information about the war's impacts on Vietnamese older adults who experienced the war firsthand. The VHAS can provide valuable insights into the American War's associated impacts on cognitive decline and risks for ADRD among this relatively unstudied group.

**IN VIỆT NAM, 660,000 PEOPLE
WERE LIVING WITH DEMENTIA IN
2015. THAT FIGURE IS EXPECTED
TO REACH 1.2 MILLION BY 2030
AS THE POPULATION AGES.**

MEASUREMENT AND ANALYSIS

The two main measures of cognitive functioning and impairment included in the VHAS and adopted in this chapter

are 1) Cognitive impairment and 2) Self-assessed memory. Cognitive impairment represents participant scores on the Mini-Mental State Examination (MMSE) adapted for the VHAS. The MMSE has been adopted in clinical and research settings globally, including in Việt Nam (Bich et al. 2019; Leggett et al. 2013), as a brief test of “mental state,” or cognitive function. An abridged version of the MMSE, which assesses six areas of mental ability through a set of 11 question sequences, was created for the VHAS data collection, which utilized a subset of MMSE questions and cognitive domains. The VHAS MMSE score represents the total number of correct answers to questions in the domains of orientation, attention and calculation, and memory. The VHAS’ modified MMSE incorporates the MMSE Serial 7s arithmetic questions (repeated subtraction of 7); questions asking participants to correctly identify the current day of the week, date, and season; and a five-word repeat and recall. With one point for each correct answer, the MMSE ranges from 0 to 17 (with a sample mean of 11.2). We then classify respondents as having no, mild, or severe cognitive impairment based on thresholds established in previous research (Leggett et al., 2013; Feinberg & Whitlach, 2001).

Self-assessed memory is based on the question, “How would you rate your memory at the present time? Would you say it is very good, good, fair, poor or very poor?”

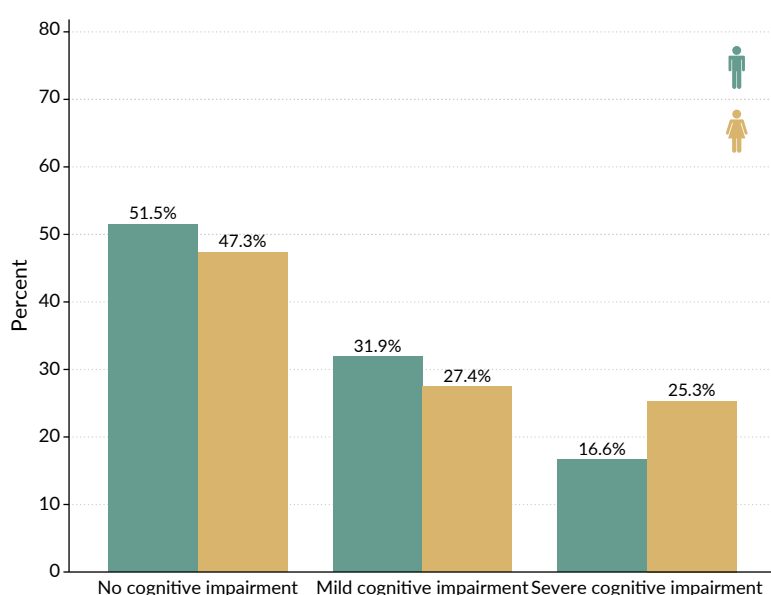
Participants requiring a proxy interview due to physical frailty, cognitive health problems, or other factors are



VHAS participant completing MMSE tasks during a Wave 2 interview in Quảng Bình province. Photo: Yvette Young

omitted from VHAS analyses of cognitive functioning. It warrants mention that 70% of proxy participants (typically a spouse, child, or other close kin) indicated that their family members participating in the VHAS (N=90) have poor or very poor memory. Since participants using a proxy were omitted from the analysis, and since they were judged to have disproportionately high rates of poor and very poor memory, the VHAS data and analyses may under-represent the levels of cognitive impairment in these districts.

A Cognitive Impairment (based on Mini Mental State Exam score)



B Self-reported Memory

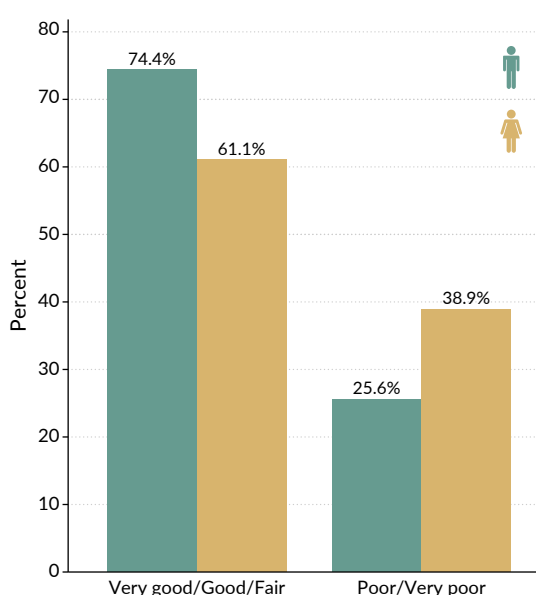
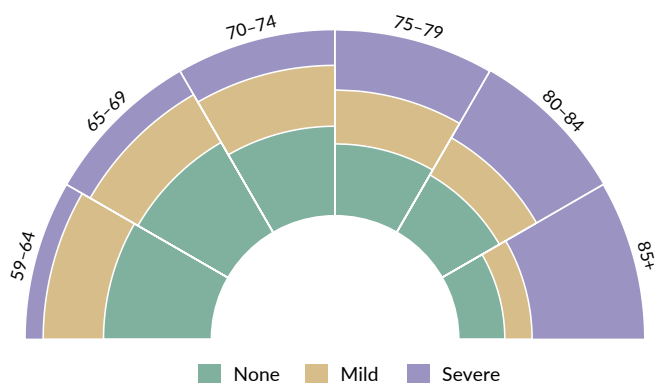


Figure 9.1 Cognitive health by gender

A Cognitive Impairment



B Self-reported Memory

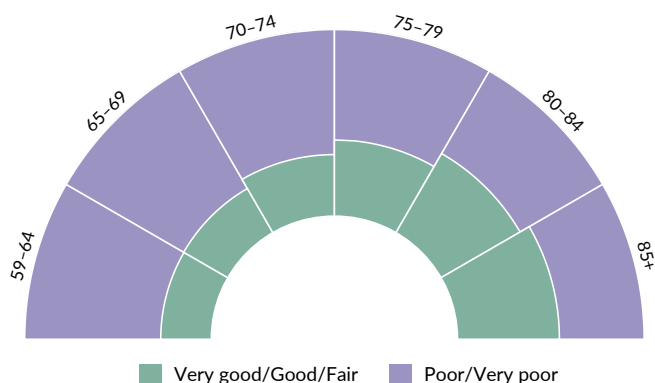


Figure 9.2 Cognitive health by age

KEY FINDINGS

BIVARIATE RESULTS

In the VHAS sample, MMSE cognitive impairment and self-assessed memory vary significantly by gender and age. We find that **more women are severely cognitively impaired than men** (Figure 9.1). Furthermore, severe cognitive impairment is more prevalent in older age groups (Figure 9.2). Specifically, 9.8% of those aged 59–64 in the VHAS sample are severely cognitively impaired. Comparatively, the rate of severe cognitive impairment rises to 60.7% for those 85 and older. It is important to note that, on average, women

in the sample tend to be older than men. Thus, multivariate analyses that account for age and other factors associated with both gender and cognitive function are necessary to examine gender-based differences in cognitive impairment.

Gender and age-graded patterns are similar for self-assessed memory. More women than sampled men describe their own memory as poor or very poor—38.9% versus 25.6% (Figure 9.1). The prevalence of poor and very poor self-assessed memory increases with age in the VHAS sample, rising from 26.8% among those aged 59–64 to 54.4% among those aged 85 and older (Figure 9.2). We also observe significant bivariate associations between participants’ forms of military participation, their exposures to war-related violence and malevolent conditions, and cognitive impairment. Across both men and women, those with formal military service have the lowest prevalence of severe cognitive impairment and the lowest prevalence of poor and very poor self-assessed memory (Figure 9.3). Among women, 27.4% of civilians and those who volunteered for informal military service have severe cognitive impairment, and roughly 40% describe their memory as poor or very poor. Fewer women who served in the formal military are similarly impacted (15.2% with severe cognitive impairment and 21.5% with poor or very poor self-assessed memory). Among men in the VHAS sample, those who served in the informal military have the highest prevalence of severe cognitive impairment (33.1%), while those who served in the formal military have the lowest prevalence (15.3%). We caution that these bivariate analyses may reflect age-related associations with both military service status and cognitive impairment, which could cause an overestimation of the association between military service status and cognitive impairment. Therefore, in subsequent multivariate analyses, we examine the association of military

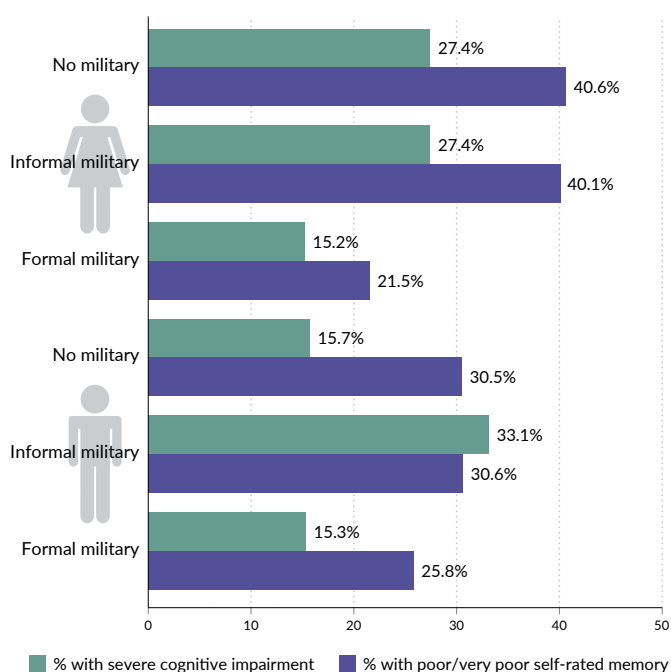


Figure 9.3 Cognitive health by military service status

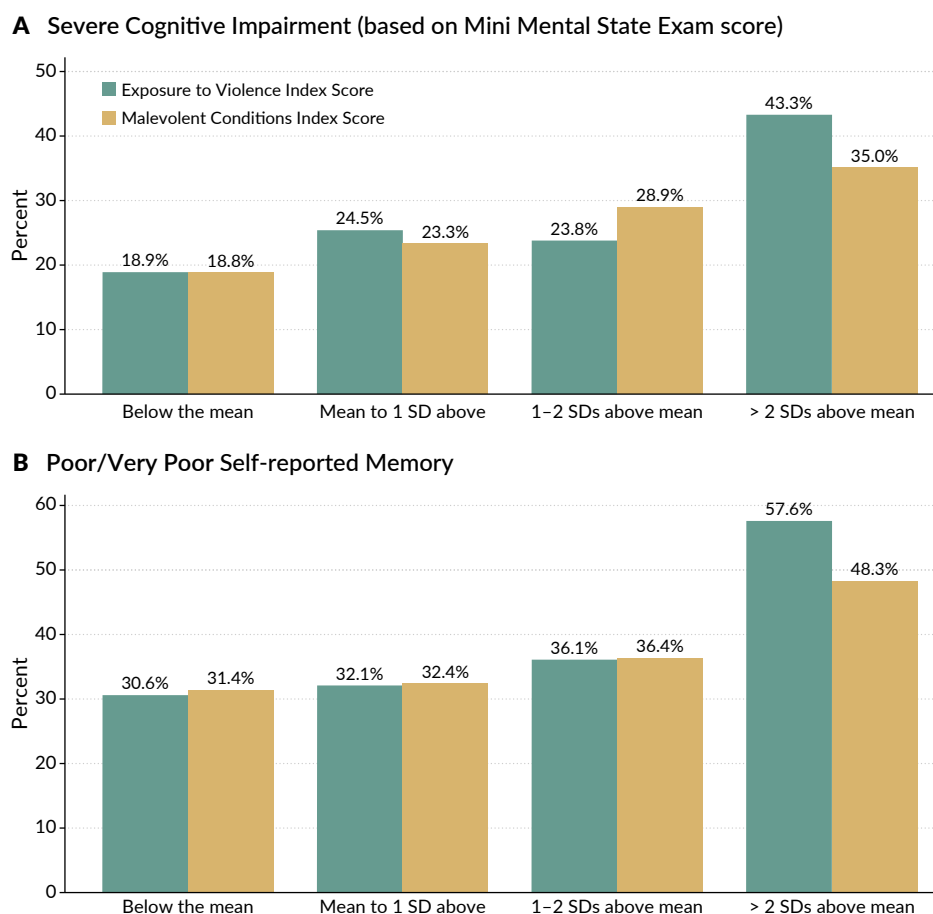


Figure 9.4 War exposure and cognitive health

service with cognitive impairment while accounting for other potentially confounding factors.

The data also show a positive association between severe cognitive impairment and poor self-assessed memory and the severity of wartime violence exposure and wartime

malevolent conditions (Figure 9.4). For each index of wartime stress exposure, we assess severity of exposure relative to the sample mean in increments of the sample standard deviation. We find that the prevalence of severe cognitive impairment is highest for participants with the most numerous wartime violence and malevolent conditions exposures.

Table 9.1 Models of cognitive impairment and self-assessed memory

	Cognitive Impairment		Self-assessed Memory	
Gender and Military Service (ref: Female, no military)				
Female, informal military	0.990	1.038	0.964	1.320
Female, formal military	0.860	0.952	0.622	0.723
Male, no military	0.797*	0.806*	0.745	0.740
Male, informal military	0.938	0.960	0.580	0.585
Male, formal military	0.798	0.787	0.636*	0.610*
Exposure to War Violence Index		1.098		1.198**
Exposure to Malevolent Conditions Index		1.153**		1.157*

Note: Coefficients represent the multiplicative odds. Values below 1.0 represent negative associations while values above 1 are positive. Stars indicate statistical significance. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

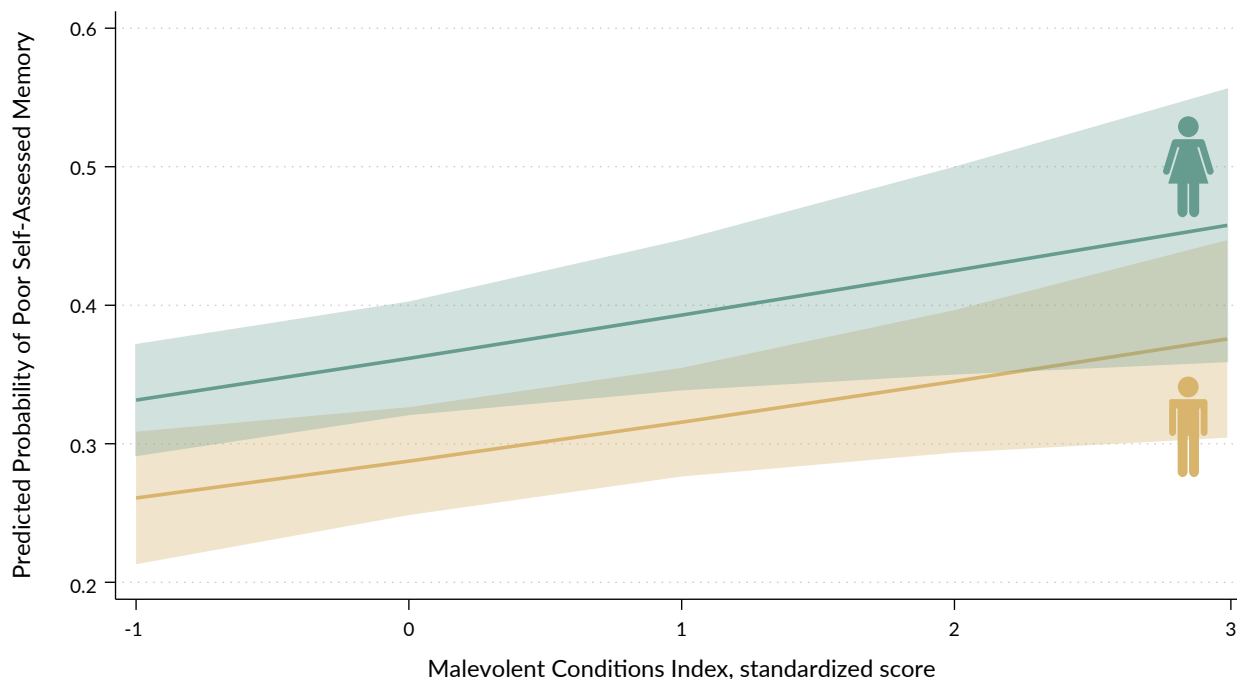


Figure 9.5 Predicted memory by gender

MULTIVARIATE RESULTS

We conduct regression analyses of cognitive impairment and self-assessed memory, evaluating the impact of participant sex, military service history, wartime violence exposure, and wartime malevolent conditions exposure. We also account for age, household assets, current marital status, childhood health, and current province of residence. Select results are shown in Table 9.1.

The multivariate analysis shows few significant associations between gender, military service status, and cognitive impairment. However, results indicate that men who did not serve in the military are less likely than female civilians to experience cognitive impairment. We find that greater exposure to wartime malevolent environment conditions increases the probability of severe cognitive impairment. Compared to the reference category of civilian women, male veterans of the formal military are less likely to have poor self-assessed memory. Both types of war stress exposure—violence and malevolent conditions—increase the probability of poor self-assessed memory among all VHAS participants.

Predicted probabilities of poor self-assessed memory by gender and exposure to malevolent conditions are shown in Figure 9.5. These results show a consistent gender advantage favoring men and a rising risk of poor self-assessed memory with greater exposure to wartime malevolent conditions.

CONCLUSION

Analyses of the VHAS data reveal that experiences of war are associated with late-life cognitive impairment and self-assessed memory. Older adults in the VHAS sample who experienced more severe exposures to malevolent conditions, such as forced migration, shortages of food and clean water, and experiencing fear of death in wartime, are more likely to experience late-life cognitive impairment. In addition, individuals with more intense exposures to wartime violence and malevolent conditions exhibit significantly greater odds of poor self-assessed memory.

Certain wartime experiences appear to enhance cognitive function in late life or protect against cognitive decline. Compared to other gender-military service categories, men who served in the formal military have the lowest odds of poor self-assessed memory. These results suggest that aspects of military service and post-war military service resources, whether social, psychological, or institutional, may be protective of late-life cognitive functioning. Further research will aid in identifying the mechanisms which underlie this association and will more clearly delineate trajectories of cognitive function in late life associated with personal characteristics and early-life stress exposures.

Supplementary analyses provide insights into the mechanisms underlying the superior cognitive function of members of the formal military relative to civilians and informal military

veterans. In models predicting the MMSE cognitive score while accounting for diverse types of social engagement, the positive association between formal military service and cognitive score is rendered statistically insignificant (see “Social Engagement and Cognitive Health”). This suggests that military veterans exhibit higher cognitive function because of their more diverse and frequent social engagement.

We conclude that one of the enduring consequences of the American War in Việt Nam is the impaired later-life cognitive performance of those who experienced severe exposure to

malevolent conditions during the war. However, for those who maintain diverse forms of social engagement—engagements that tend to be enhanced among military participants—risks of cognitive decline are significantly reduced. These results point to possible interventions that may protect against cognitive decline, Alzheimer’s disease, and related dementias. Social clubs and organized activities conducted in community centers with groups of older adults who are at risk of social isolation may reduce the prevalence of cognitive impairment.

REFERENCES

- Barnes, D. E., Byers, A. L., Gardner, R. C., Seal, K. H., Boscardin, W. J., & Yaffe, K. (2018). Association of mild traumatic brain injury with and without loss of consciousness with dementia in US military veterans. *JAMA neurology*, 75(9), 1055-1061. <https://doi.org/10.1001/jamaneurol.w2018.0815>
- Bich, N. N., Dung, N. T. T., Vu, T., Quy, L. T., Tuan, N. A., Binh, N. T. T., ... & Anh, L. V. (2019). Dementia and associated factors among the elderly in Vietnam: a cross-sectional study. *International Journal of Mental Health Systems*, 13(1), 1-7. <https://doi.org/10.1186/s13033-019-0314-7>
- Feinberg, L. F., & Whitlatch, C. J. (2001). Are persons with cognitive impairment able to state consistent choices? *The Gerontologist*, 41(3), 374-382. <https://doi.org/10.1093/geront/41.3.374>
- Hinton, L., Nguyen, H., Nguyen, H. T., Harvey, D. J., Nichols, L., Martindale-Adams, J., ... & Pham, T. (2020). Advancing family dementia caregiver interventions in low-and middle-income countries: A pilot cluster randomized controlled trial of Resources for Advancing Alzheimer’s Caregiver Health in Vietnam (REACH VN). *Alzheimer’s & Dementia: Translational Research & Clinical Interventions*, 6(1), e12063. <https://doi.org/10.1002/trc2.12063>
- Leggett, A., Zarit, S. H., Hoang, C. N., & Nguyen, H. T. (2013). Correlates of cognitive impairment in older Vietnamese. *Aging & Mental Health*, 17(8), 915-923. <https://doi.org/10.1080/13607863.2013.799116>
- Mattap, S. M., Mohan, D., McGrattan, A. M., Allotey, P., Stephan, B. C., Reidpath, D. D., ... & Chaiyakunapruk, N. (2022). The economic burden of dementia in low-and middle-income countries (LMICs): A systematic review. *BMJ Global Health*, 7(4), e007409. <https://doi.org/10.1136/bmjgh-2021-007409>
- Nguyen, T. A., Pham, T., Dang, T. H., Hinton, W. L., Nguyen, A. T., Pham, T. L., ... & Roughead, E. E. (2020). Towards the development of Vietnam’s national dementia plan—The first step of action. *Australasian Journal on Ageing*, 39(2), 137-141. <https://doi.org/10.1111/ajag.12755>
- Rees, G. (2018, September 7). *Developing national dementia plans and setting priorities* [Conference presentation]. 1st Vietnam National Dementia Conference, Hanoi, Vietnam.
- Saito, Y., Chei, C. L., Vu, N., & Dong, L. (2022). Factors associated with cognitive function among older adults in Vietnam. *Innovation in Aging*, 6(Suppl 1), 545. <https://doi.org/10.1093/geroni/igac059.2067>
- Veitch, P.D., E Friedl, K., & W Weiner, M. (2013). Military risk factors for cognitive decline, dementia and Alzheimer’s disease. *Current Alzheimer Research*, 10(9), 907-930. <https://doi.org/10.2174/15672050113109990142>

SOCIAL ENGAGEMENT AND COGNITIVE HEALTH

Early-life adversity and stressful experiences may make people more susceptible to cognitive decline in later life. However, research finds that social engagement can have a protective effect. People with more diverse social networks experience **cognitively stimulating social environments**, which contribute to cognitive reserve or, in other words, bolster cognitive health (Peng et al., 2022). In contrast, those who do not engage in regular social activity in older ages may experience feelings of loneliness, which have been associated with poorer cognitive functioning and an increased incidence of dementia (Salinas et al., 2022).

To understand how the adverse effects of early-life war exposure and the protective effects of social engagement work in concert to shape late-life cognitive health, we conducted supplementary analyses of the VHAS incorporating the following types of social engagement.

- Living with others versus living alone
- Membership and regular participation in clubs or social organizations
- Participating in formal social activities (e.g., attending community meetings and organized activities or events)
- Engagement in informal social activities (e.g., socializing with friends or neighbors)
- Playing games with others (e.g., cognitively stimulating games such as chess or cards)

Most VHAS respondents engage in informal social activity on a weekly basis. However, few participate in formal social activities or play games regularly.



Family playing chess in Hoi An, Việt Nam.
Photo: Laura Dibiase

70% VERSUS 7% WEEKLY INFORMAL SOCIAL ACTIVITIES VERSUS PLAYING GAMES WITH OTHERS MONTHLY OR WEEKLY

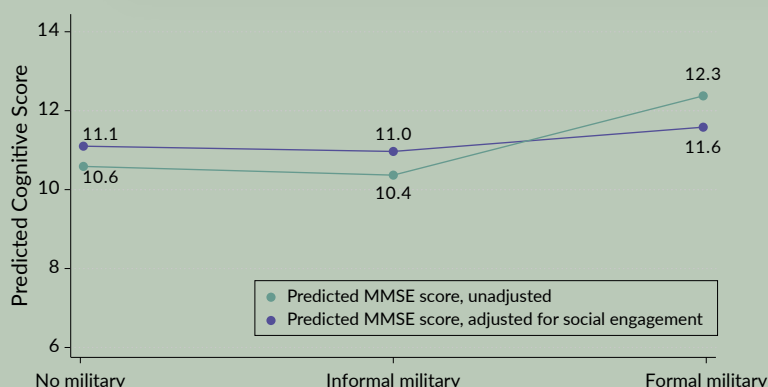


Figure 9.6 MMSE memory by military service status

In models predicting MMSE scores, formal military service is beneficial to cognitive health. However, after accounting for diverse forms of social engagement, formal military service is no longer associated with cognitive health. Figure 9.6 shows the predicted MMSE scores before and after accounting for social engagement. Thus, it is not military service that protects cognitive health. Instead, military veterans engage in more frequent and diverse cognitively protective social activities.

WOMEN FACE MORE
FUNCTIONAL LIMITATIONS
AND FRAILITY THAN MEN





CHAPTER 10

FUNCTIONAL HEALTH AND FRAILITY

ZACHARY ZIMMER, DELANEY GLASS, SAHLIL AHMED, PHAN THANH THUỖ

Functional health generally refers to one's ability to perform daily tasks that require a degree of physical functioning. Therefore, functional health is a critical determinant of quality of life over the life course, especially in older adulthood. According to a popular conceptualization, this is composed of two overarching concepts: functional limitation and disability (Guralnik & Ferrucci, 2003; Verbrugge & Jette, 1994). **Functional limitations** are restrictions in one's ability to conduct daily living tasks that require basic physical movements and dexterity, such as walking a given distance, reaching, and picking up small objects. **Disability** is the inability to conduct activities of daily living required for daily maintenance of oneself and one's living environment, such as dressing, bathing, and cooking (Verbrugge & Jette, 1994). Being incapable of carrying out daily life tasks necessitates formal (i.e., institutional) and informal care (i.e., family-based). It impacts what older adults can and cannot do on their own and, consequently, their independence and quality of life. **Frailty** is closely associated with the ability to live independently, although no singular agreed-upon standard exists for its measurement (Pel-Littel et al., 2009). Scholars generally concur that frailty is a gauge of an

individual's vulnerability to physical deterioration and death. Frailty, therefore, relates to physical functioning, quality of life, and the need for support. To understand the health of older adults within a social context, it is crucial to go beyond conventional aspects of disease and biological impairment and contemplate functional health and frailty.

The scientific literature on functional limitation, disability, and frailty has revealed a common set of biological and social determinants. Age and gender are critical determinants of functional health. Frailty is widely considered a proxy indicator of biological age (Mitnitski et al., 2001). A functional health paradox is common, whereby **women live longer but are more likely to suffer from functional health disorders** (Arber & Cooper, 1999). Other social determinants commonly implicated in functional health include socioeconomic factors, marital status, social support, and behaviors like cigarette smoking, diet, and exercise (Strawbridge et al., 1992). VHAS contributes to the current understanding of functional health determinants in several ways. First, the Vietnamese sample provides much-needed insights into functional health risk

factors in a non-Western sample. The degree to which the gender paradox or the socioeconomic connection holds outside the U.S. and Europe requires testing and further research. Second, little is known about the impact of war trauma on functional health, especially trauma's long-lasting influences. There has been some analysis of the impact of war trauma in late life among American veterans (Spiro & Settersten, 2012), but this area of study has been neglected among non-Americans. One study examined the long-term effects of bombing on disability in Việt Nam using macro-level indicators of disability (Palmer et al., 2019). Still, little is understood in terms of individual-level factors and the effects of different levels of war trauma on later life functional health.

MEASUREMENT

In this chapter, we assess three functional health and frailty measures: functional limitation, disability, and frailty.

FUNCTIONAL LIMITATION

This is measured by asking whether the participant has difficulty doing any of the following tasks: walking 200–300 meters; getting up from a chair after sitting for a long period; climbing several stairs without resting, stooping, kneeling, or crouching; reaching or extending arms above shoulder; lifting or carrying objects that weigh more than 10 kg; and picking up a small coin off a table. These tasks are sometimes called Nagi measures of functionality (Nagi, 1979). If a participant reports any degree of difficulty with one or more tasks, they are classified as having a functional limitation.

DISABILITY

Disability is measured by asking whether the participant has difficulty doing any of the following tasks due to a health or memory problem: dressing, bathing, eating, getting in or out of bed, or using the toilet. These tasks are sometimes referred to as Activities of Daily Living (ADLs) (Katz et al., 1963). If participants report any degree of difficulty with one or more ADLs, they are classified as having a disability.

FRAILTY

Frailty is defined by an index score that takes a value between 0 and 1, depending upon the proportion of health deficits or problems that are reported, using every possible health item available in VHAS (Rockwood & Mitnitski, 2007; Zimmer et al., 2022). A Frailty Index score over 0.30 indicates being frail.¹

¹ Frailty Indexes of 0.30 can be interpreted as severe based on past evidence. For instance, index scores between 0.25 and 0.35 are levels at which mortality rates begin to accelerate and at which a 5-year risk of death exceeds 50% (Armstrong et al., 2015).

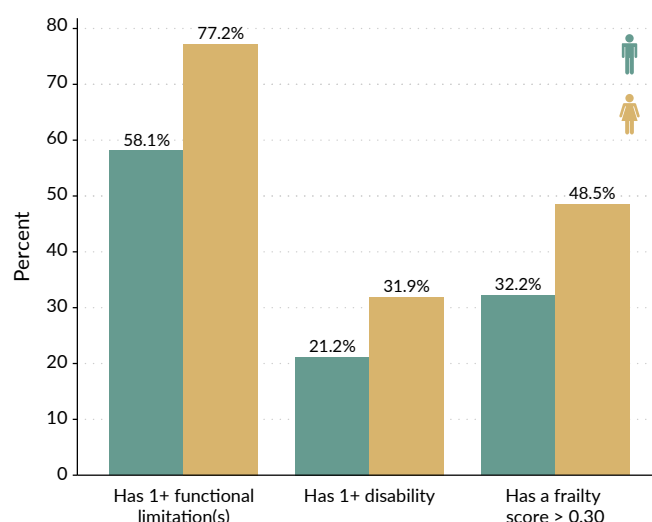


Figure 10.1 Measures of physical functioning

KEY FINDINGS

BIVARIATE RESULTS

Of participants sampled in the VHAS, we find differences in physical functioning by gender and age. We also find variability in physical function by military service status and gender. These bivariate findings suggest that, overall, women experience greater functional limitations than men (see Figure 10.1). The results also indicate that reporting one or more disabilities or functional limitations and being frail consistently increase with age (Figure 10.2). Some of these gender differences may be attributed to military service status.

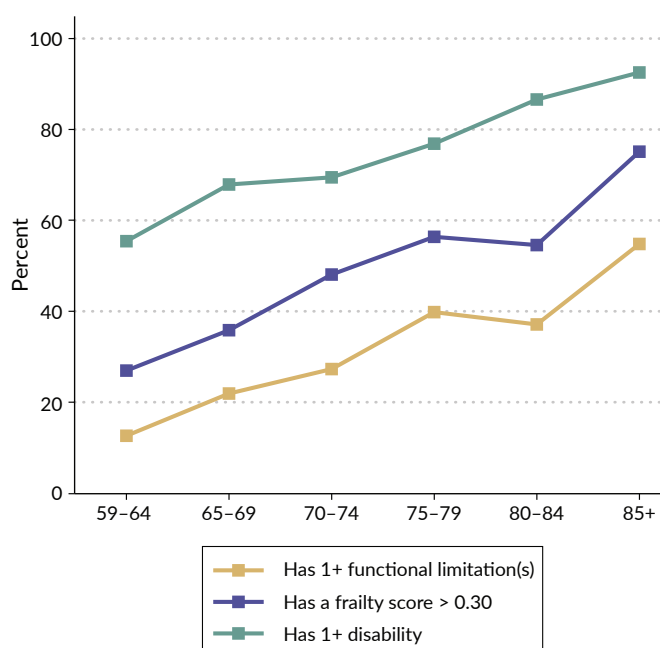
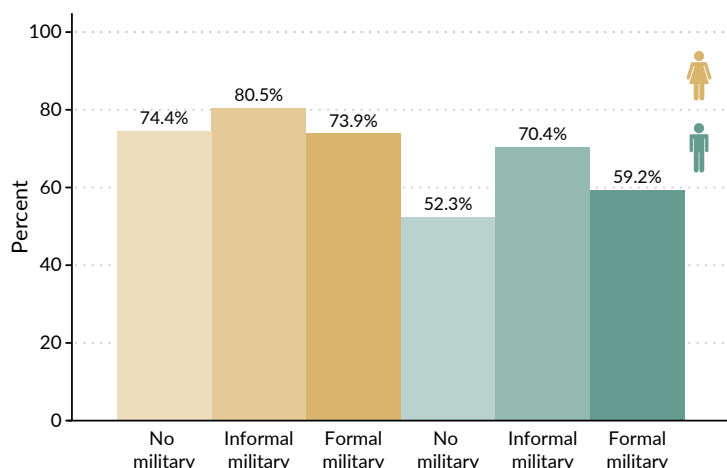


Figure 10.2 Measures of physical functioning by age

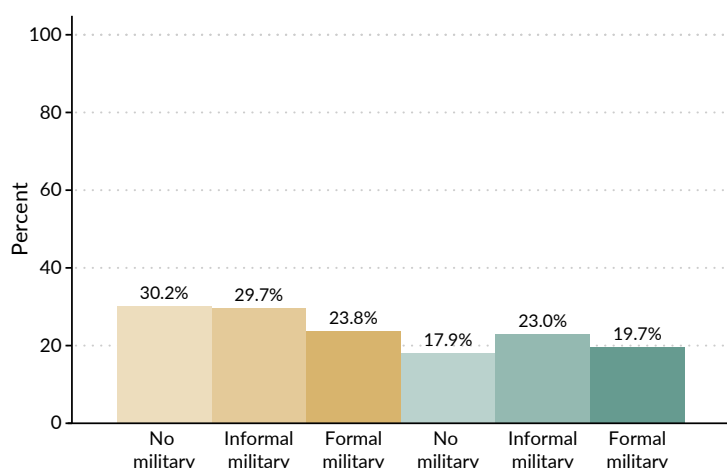
A Has one or more functional limitation(s)



Women who were civilians or in the informal military tend to report functional limitations, disabilities, and frailty at a higher rate than those who served in the formal military. In contrast, there are fewer gender differences among those with formal and informal military service.

EXPOSURE TO WARTIME VIOLENCE AND MALEVOLENT CONDITIONS INCREASES THE CHANCES OF LATE-LIFE FUNCTIONAL LIMITATIONS, DISABILITY, AND FRAILTY.

B Has one or more disabilities



MULTIVARIATE RESULTS

Regression models predicting one or more functional limitations, one or more disabilities, and frailty scores greater than 0.30 include the following predictors: gender, military service status, exposure to wartime violence and malevolent conditions, age, education level, childhood health, and province of residence. We find statistically significant positive associations between gender (being a woman) and all three outcomes, with larger effects for one or more functional limitations and one or more disabilities compared to frailty. We also find that age, military service, province, and exposure to violence have significant positive associations with having one or more functional limitations (Figure 10.4). Overall, **women are more likely than men to have physical functional limitations.** Exposure to wartime violence,

C Has a frailty score greater than 0.30

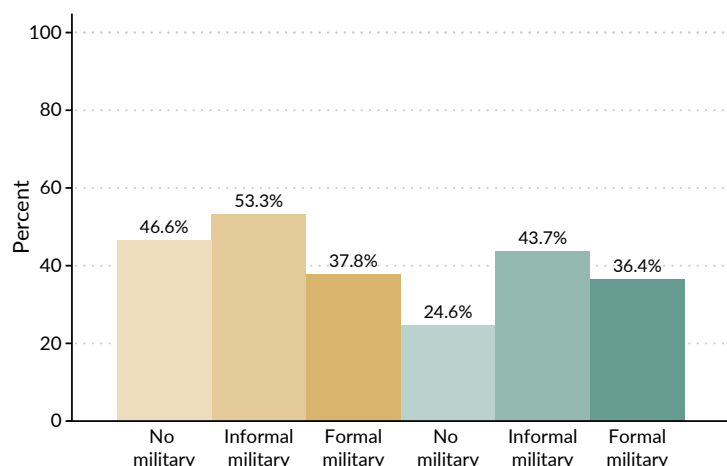


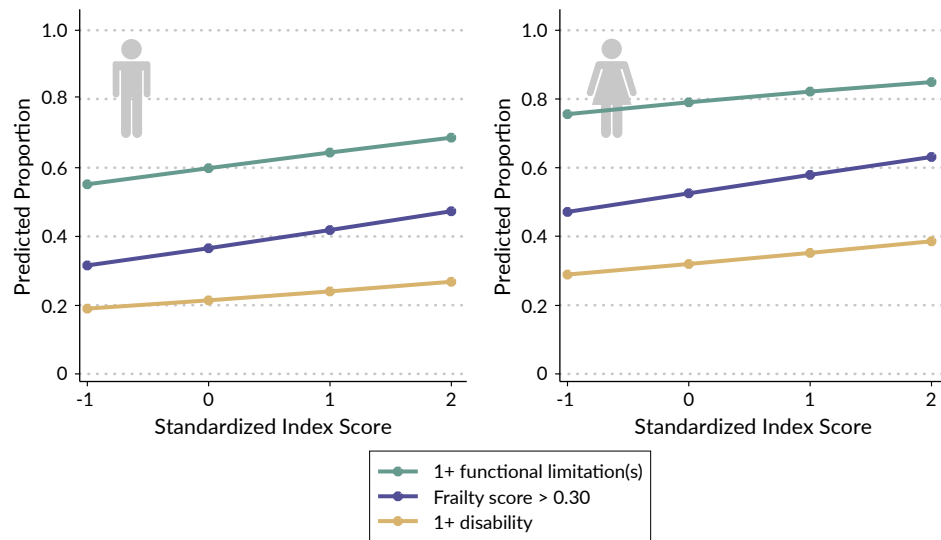
Figure 10.3 Measures of physical functioning by gender and military service status

As Figure 10.3 makes evident, there are particularly robust differences in physical functioning across gender for civilians.

70%

OF PARTICIPANTS HAVE AT LEAST ONE FUNCTIONAL DIFFICULTY OR DISABILITY OR ARE GENERALLY FRAIL

A Exposure to Violence Index



B Malevolent Conditions Index

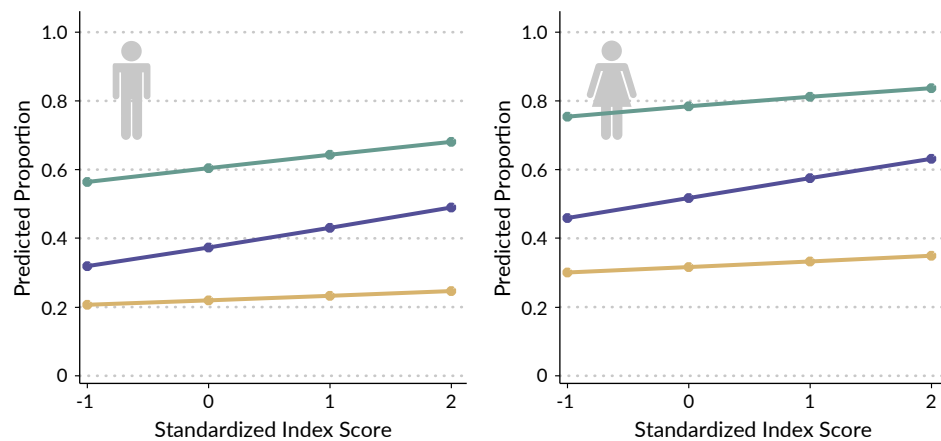


Figure 10.4 Predicted probability of having one or more functional limitations, disabilities, or having a frailty score of 0.30 or higher by gender and exposure to violence (A) and malevolent conditions (B)

which includes being wounded and witnessing casualties and other violence, and malevolent conditions, including food and clean water shortages, sleep deprivation, and other hardships, result in an increased chance of having functional limitations, disability, and frailty. (Figure 10.4).

CONCLUSION

In this chapter, we have explored sources of variation in functional health and frailty, two critical components of older adults' quality of life among older adults, across VHAS participants. Functional health refers to the ability to perform basic physical movements, like walking. Disability refers to the ability to do things required for daily maintenance, like bathing. Frailty refers to the broadest possible set of health indicators, with frail individuals being those who have multiple

health deficits. While functional health deterioration and frailty are deeply intertwined with advancing age, older adults' early life experiences in the war are also relevant to their functional health. This chapter demonstrates that, adjusting for other factors, higher exposure to wartime stressors and trauma results in a higher probability of having at least one functional limitation or disability and having a frailty score of over 0.30, a level we deem to indicate a high level of frailty. It is also noteworthy that women, especially those who were not in the formal military, tend to have a much higher probability of functional health problems and high frailty scores when compared to men. In contrast, women and men in the formal military have similar probabilities of functional limitation, disability, and frailty. Thus, military experience may be somewhat protective of later-life functional health.

EDUCATION AND FUNCTIONAL HEALTH

A much-discussed determinant of physical functioning is education. People with higher education are consistently found to be functionally healthier than their less educated peers (Rohrmann, 2020; Zimmer & House, 2003). While the evidence is limited, the negative association between educational attainment and functional health appears to hold in Việt Nam (Vu et al., 2017). In the VHAS sample, variation in education is quite narrow. This is partly a function of the war since war disrupted the education of many VHAS participants. In our sample, few participants completed anything above Junior or Senior Secondary education. Variation in education is even narrower among women than men (Figure 10.5). Today, education levels in the Vietnamese population are much higher on average and are characterized by greater degrees of variation (Rew, 2009).

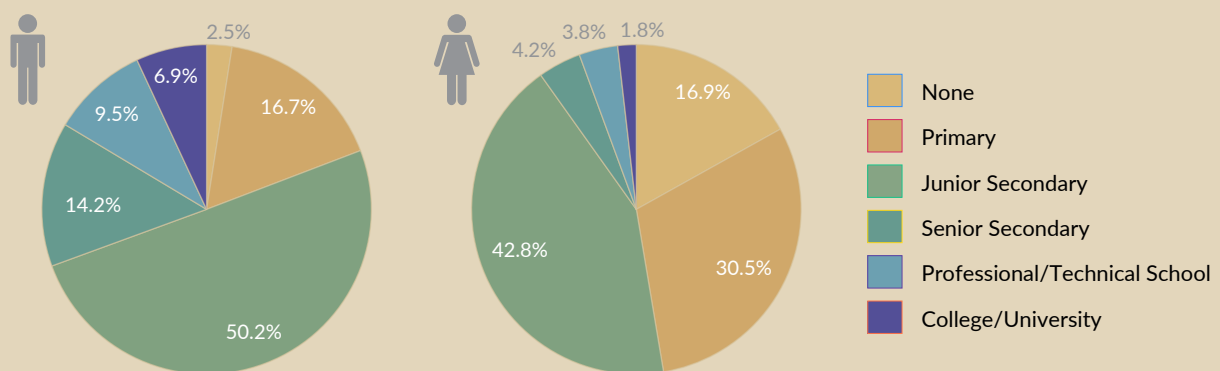


Figure 10.5 Distribution of education by gender in the VHAS sample



Schoolroom in Việt Nam. Photo: **Nam Hoang**

Is there an association between education and functional health in Việt Nam? Figure 10.6 plots this association across five levels of education. The results indicate a strong bivariate relationship whereby fewer of those with higher levels of education experience functional health problems. For instance, 52% of men with no education report a disability, compared to 12% with higher education. For women, the trend continues, with 53% of women with no education reporting a disability versus 22% of women with higher education. The association is slightly more mixed for functional limitations and more robust for frailty.¹

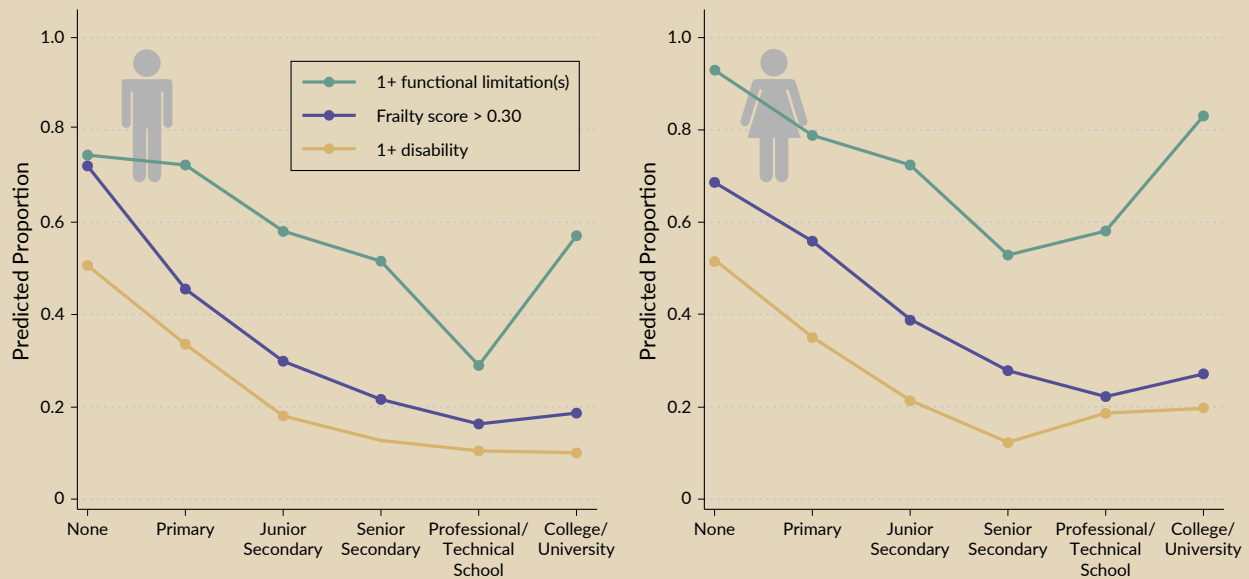


Figure 10.6 Predicted probability of having one or more functional limitations, disabilities, or having a frailty score of 0.30 or higher by education level and gender

¹ Notice in Figure 10.7 that for functional limitations there is a rise in probability for the most highly educated. This may be difficult to explain, but there are some likely possibilities. For instance, this could be due to people who are most highly educated living longer, and as shown in an earlier graph (10.2), those that live longer are more likely to have functional limitations. Note also that disability and frailty do not see this uptick. It could be that the highest educated are best able to cope with functional limitations so that it does not turn into disability or frailty.

REFERENCES

- Arber, S., & Cooper, H. (1999). Gender differences in health in later life: The new paradox? *Social Science & Medicine*, 48(1), 61-76. [https://doi.org/10.1016/S0277-9536\(98\)00289-5](https://doi.org/10.1016/S0277-9536(98)00289-5)
- Armstrong, J. J., Mitnitski, A., Launer, L. J., White, L. R., & Rockwood, K. (2015). Frailty in the Honolulu-Asia Aging Study: Deficit accumulation in a male cohort followed to 90% mortality. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, 70(1), 125-131. <https://doi.org/10.1093/gerona/glu089>
- Guralnik, J. M., & Ferrucci, L. (2003). Assessing the building blocks of function: Utilizing measures of functional limitation. *American Journal of Preventive Medicine*, 25(3), 112-121. [https://doi.org/10.1016/s0749-3797\(03\)00174-0](https://doi.org/10.1016/s0749-3797(03)00174-0)
- Katz, S., Ford, A. B., Moskowitz, R. W., Jackson, B. A., & Jaffee, M. W. (1963). Studies of illness in the aged: The index of ADL, a standardized measure of biological and psychosocial function. *Journal of the American Medical Association*, 185(12), 914-919. <https://doi.org/10.1001/jama.1963.03060120024016>
- Miller, N.L., Matsangas, P., & Shattuck, L.G. (2007). Fatigue and its effect on performance in military environments. *Performance Under Stress* (P.A. Hancock & J.L. Szalma, Eds.; pp. 231 -250). Ashgate Publications. <https://doi.org/10.1201/9781315599946>
- Mitnitski, A., Mogilner, A. J., & Rockwood, K. (2001). Accumulation of deficits as a proxy measure of aging. *The Scientific World Journal*, 1, 323-336. <https://doi.org/10.1100%2Ftsw.2001.58>
- Nagi, Saad Z. (1979). The concept and measurement of disability. *Disability Policies and Government Programs* (E. D. Berkowitz, Eds.; pg. 1-15). Praeger.
- Palmer, M., Nguyen, C. V., Mitra, S., Mont, D., & Groce, N. E. (2019). Long lasting consequences of war on disability. *Journal of Peace Research*, 56(6), 860-875. <https://doi.org/10.1177/0022343319846545>
- Pel-Little, R. E., Schuurmans, M. J., Emmelot-Vonk, M. H., & Verharr, H. J. J. (2009). Frailty: Defining and measuring of a concept. *The Journal of Nutrition, Health and Aging*, 13, 390-394. <https://doi.org/10.1007/s12603-009-0051-8>
- Rew, W. J. (2009). Provincial, ethnic, and gender disparities in education: A descriptive study of Vietnam. *Inequality in education: Comparative and International Perspectives*. (D. B. Holsinger, W. J. Jacob, Eds.; 307-323. Springer. <https://doi.org/10.1007/978-90-481-2652-1>
- Rockwood, K., & Mitnitski, A. (2007). Frailty in relation to the accumulation of deficits. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, 62(7), 722-727. <https://doi.org/10.1093/gerona/62.7.722>
- Rohrmann, S. (2020). Epidemiology of frailty in older people. *Frailty and Cardiovascular Diseases. Advances in Experimental Medicine and Biology*. (N. Veronese, Ed.; 21-27). Springer, Cham. https://doi.org/10.1007/978-3-030-33330-0_3
- Spiro, A., & Settersten, R. A., Jr. (2012). Long-term implications of military service for later-life health and well-being. *Research in Human Development*, 9(3), 183-190. <https://doi.org/10.1080/15427609.2012.705551>
- Strawbridge, W. J., Kaplan, G. A., Camacho, T., & Cohen, R. D. (1992). The dynamics of disability and functional change in an elderly cohort: Results from the Alameda County Study. *Journal of the American Geriatrics Society*, 40(8), 799-806. <https://doi.org/10.1111/j.1532-5415.1992.tb01852.x>
- Verbrugge, L. M., & Jette, A. M. (1994). The disablement process. *Social Science and Medicine*, 38(1), 1-14. [https://doi.org/10.1016/0277-9536\(94\)90294-1](https://doi.org/10.1016/0277-9536(94)90294-1)
- Vu, H. T. T., Nguyen, T. X., Nguyen, T. N., Nguyen, A. T., Cumming, R., Hilmer, S., & Pham, T. (2017). Prevalence of frailty and its associated factors in older hospitalised patients in Vietnam. *BMC Geriatrics*, 17, 1-7.
- Zimmer, Z., & House, J. S. (2003). Education, income, and functional limitation transitions among American adults: contrasting onset and progression. *International Journal of Epidemiology*, 32(6), 1089-1097.
- Zimmer, Z., Korinek, K., Young, Y., Teerawichitchainan, B., & Toan, T. K. (2022). Early-life war exposure and later-life frailty among older adults in Vietnam: Does war hasten aging? *The Journals of Gerontology: Series B*, 77(9), 1674-1685. <https://doi.org/10.1093/geronb/gbab190>

DESPITE EARLY-LIFE
TRAUMATIC EXPERIENCES,
FEW OLDER VIETNAMESE
ADULTS HAVE MENTAL
HEALTH IMPAIRMENTS





POSTTRAUMATIC STRESS DISORDER AND PSYCHOLOGICAL DISTRESS

SARA HAMM, ZACHARY ZIMMER, PHẠM THỊ NGỌC BÍCH,
TRẦN THỊ THANH LOAN

Experiencing violent events and inhospitable environments or war can have a significant impact on mental health and well-being. Individuals who faced potentially traumatic events and circumstances such as these may be at a higher risk for **posttraumatic stress disorder (PTSD)**, a mental health condition that affects daily life functioning and includes symptoms such as intrusive memories, avoidance behaviors, and an exaggerated startle response (Bryant, 2019). Epidemiological studies have found that individuals with PTSD show an elevated risk for other co-occurring mental health conditions, including depression, anxiety, and somatoform disorders (Brady et al., 2000; Gupta, 2013)

A study of American veterans of the war in Việt Nam found that 4.5% of men and 6.1% of women met the criteria for a current diagnosis of PTSD forty years after the war. Of those diagnosed with PTSD, 37% also met the criteria for major depression (Marmar et al., 2015). Regrettably, less is known

about the mental health and well-being of Vietnamese older adults who lived through this same conflict. This may be partly due to cultural factors that can influence the expression of PTSD, making psychiatric labels potentially irrelevant in a Vietnamese context (Stratton et al., 2014). To address this, the Vietnam Health and Aging Study (VHAS) offers culturally adapted measures of mental health and wellbeing to assess the long-term mental health impacts of the American War on older Vietnamese adults.

MEASUREMENT

Our analysis focuses on two mental health outcomes: 1) prevalence of PTSD in the past 12 months and 2) current psychological distress.

PTSD. We measure PTSD using participants' scores on an adapted PTSD Checklist from the DSM-5 (PCL-5; see Young et al., 2022). Participants were asked nine questions about

the extent to which they are bothered—not at all, a little bit, moderately, a lot—by symptoms of PTSD such as intrusive thoughts, irritability, and difficulty sleeping related to their experiences during wartime. Each PTSD item is scored from zero to three, depending upon the level of severity, for a maximum possible score of 27. We summarize the PTSD score based on established thresholds for subclinical and provisional PTSD. Subclinical PTSD scores (i.e., a score of 6–9) indicate the presence of some PTSD symptoms, which may negatively impact daily life, while provisional PTSD indicates more extensive symptoms (i.e., a score of 10) and potential impairment. Participants categorized with provisional PTSD meet the criteria for potential diagnosis and, thus, for referral for full clinical evaluation.¹

Psychological Distress. We assess psychological distress using participants’ scores on the 10-item version of the Self-Reporting Questionnaire, which the World Health Organization developed to screen for non-specific psychological distress (SRQ-10; see Kovnick et al., 2021; Beusenberg et al., 1994). The SRQ-10, previously validated in Việt Nam, represents the weighted sum of affirmative responses to 10 questions about psychological distress in the past 30 days (e.g., crying more than usual, difficulty enjoying life, feeling tired all the time). Additionally, we summarize psychological distress based on the threshold score for potential clinical psychopathology established in previous research (Beusenberg et al., 1994; Chipimo & Fylkesnes, 2013). Accordingly, VHAS participants are characterized as experiencing psychological distress if their score on the SRQ-10 is eight or higher out of a possible score of 20).

¹ We caution that these scores do not represent a diagnosis. PTSD cannot be diagnosed without in-person evaluations by qualified clinicians familiar with the Vietnamese mental-health context.

We exclude participants who required a proxy interview (N=75), as proxy participants were not asked to answer questions related to PTSD or psychological distress on behalf of VHAS participants.

SYMPTOMS OF POSTTRAUMATIC STRESS THAT PERSIST IN LATER LIFE MAY STEM FROM EARLY-LIFE EXPOSURE TO WARTIME VIOLENCE AND INHOSPITABLE LIVING ENVIRONMENTS.

KEY FINDINGS

POSTTRAUMATIC STRESS DISORDER

Bivariate Results. In the VHAS sample, the mean score for PTSD symptoms is 3.2 (out of a maximum possible score of 27), which accounts for both the number of symptoms and their severity. Seven percent of the sample scored above the threshold for provisional PTSD. PTSD symptoms vary significantly by gender. Mean PTSD scores are moderately higher for men than women—3.4 for men versus 3.0 for women (Figure 11.1). Since men are more likely to have participated in formal military activities (75% for men versus 8% for women) and to have been more heavily exposed to war-related violence as a result, gendered differences in violence exposure likely explain why men report greater PTSD symptom severity than women on average (Young et al., 2022). Bivariate analyses of PTSD symptoms by age are generally statistically insignificant.

Both exposure to violence and malevolent conditions are strongly associated with provisional PTSD (Figure 11.2). Among

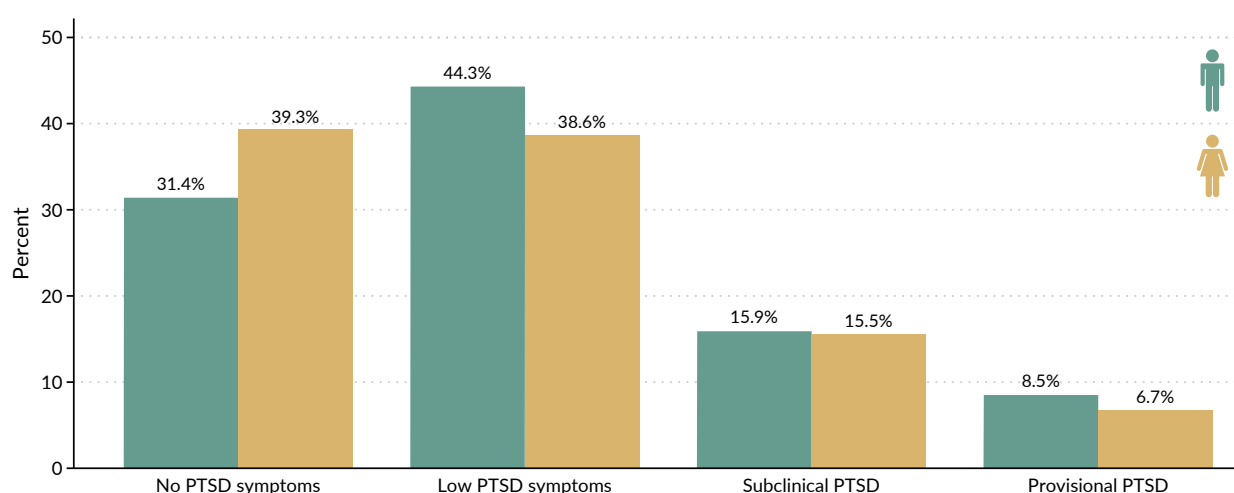


Figure 11.1 Posttraumatic stress by gender

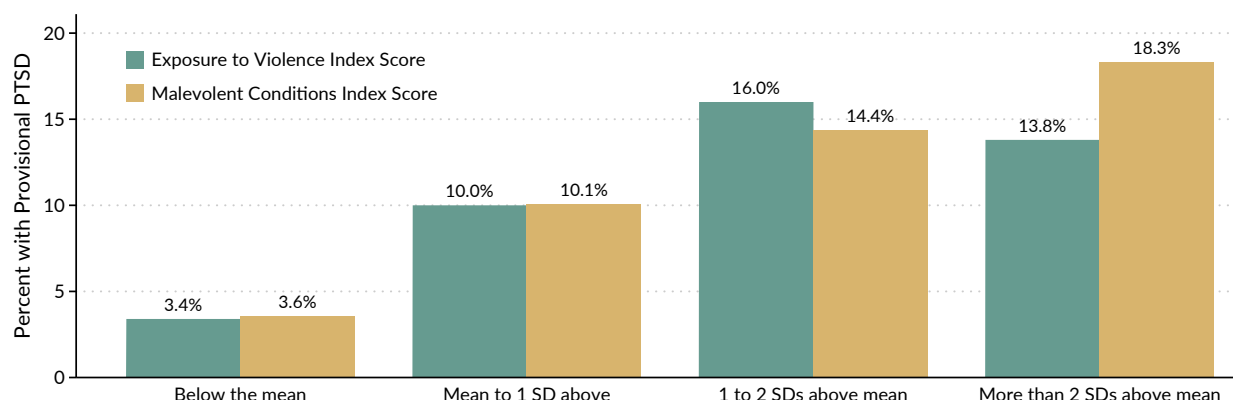


Figure 11.2 Posttraumatic stress by exposure to wartime violence and malevolent conditions

VHAS participants with the lowest exposure to war-related violence, 3.4% reported symptoms sufficient for provisional PTSD. In contrast, 13.8% of those with the highest exposure to war-related violence reported symptoms sufficient for provisional PTSD. Similarly, the prevalence of provisional PTSD ranges from 3.6% of participants who experienced the lowest exposure to malevolent conditions compared to 18.3% of participants who experienced the highest exposure to malevolent conditions.

Additional bivariate analyses reveal that informal military service is associated with the highest rates of provisional PTSD for both men (9.7%) and women (8.8%). However, men who served in the formal military have rates of provisional PTSD (9.1%) comparable to men who served in the informal military.

Multivariate Results. We use regression models to examine the relationship between gender, military status, and PTSD symptoms while accounting for other potential sources of

PTSD. Our findings reveal that women who served in both the formal and informal military report greater PTSD symptom severity than civilian women with similar characteristics (Table 11.1). Similarly, formal military service is predictive of elevated PTSD symptoms for men. Paralleling the bivariate analysis, we find that more extensive exposure to violence and malevolent conditions is associated with more numerous or severe PTSD symptoms, even after accounting for individual sociodemographic characteristics.

PSYCHOLOGICAL DISTRESS

Bivariate Results. The mean psychological distress score in the sample is 5.2 out of 20 possible points. Furthermore, 24.5% of participants scored above the threshold for possible clinical psychopathology. Figure 11.3 shows that approximately 10% more women than men experience psychological distress. Unlike gender, psychological distress does not differ significantly by age. Women are more likely to experience psychological distress than men, possibly because

Table 11.1 Statistical models predicting PTSD score

	PTSD Score	
	Model 1	Model 2
Gender and Military Service (ref: Female, civilian)		
Female, informal military	0.691**	1.010***
Female, formal military	0.615*	1.449***
Male, civilian	-0.399	-0.494
Male, informal military	0.432	0.411
Male, formal military	1.351***	1.159***
Exposure to War Violence Index		0.983***
Exposure to Malevolent Conditions Index		0.552***

Note: Stars indicate statistical significance. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

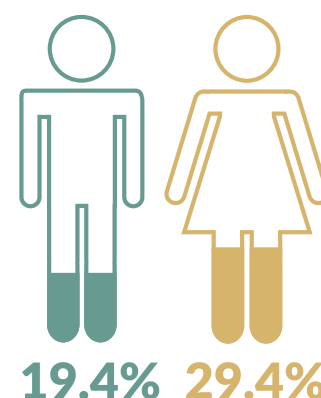


Figure 11.3 Percent with a psychological distress score above eight (by gender)

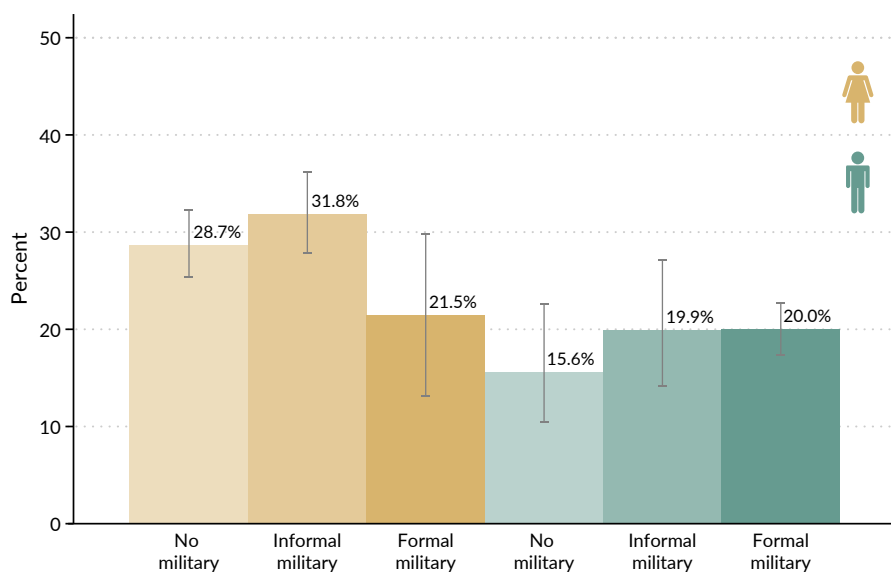


Figure 11.4 Percent with psychological distress by gender and military service status

they receive less social-emotional support (see section on Social and Emotional Support). Previous analyses of the VHAS data suggest that women experience more stress related to difficult major life events (e.g., residential moves, divorce, or financial strain) than men. They also report lower levels of social support. As social support tends to exert a protective effect on mental health, gendered differences in support could explain why women report more psychological distress than men.

Civilian women and those who served in the informal military have the highest rates of psychological distress, while civilian men have the lowest rate (Figure 11.4). Exposure to war-related violence and malevolent conditions are both strongly associated with psychological distress (Figure 11.5). Among those with the lowest levels of violence exposure, 21.3% can be classified as psychologically distressed. In contrast, 33.7% of those with the highest levels of violence exposure can be classified as psychologically distressed. For malevolent conditions, the estimated prevalence rates are 20.8% for the lowest levels of exposure and 38.0% for the highest levels of exposure.

Multivariate Results. To disentangle the relationship between mental

health and war exposure, we use regression models that test for associations between psychological distress and gender, military service, and war exposure. The models also account for potential sources of psychological distress, including individual sociodemographic characteristics. Our analyses indicate that civilian men and men who served in the formal military exhibit fewer symptoms of psychological distress than civilian women. However, men who served in the informal military do not differ significantly from civilian women in their levels of distress. Additionally, exposure to both war-related violence and malevolent conditions are associated with higher

psychological distress scores. Predicted probabilities of psychological distress by gender and malevolent conditions are illustrated in Figure 11.6. Areas of the figure where the predictions' margins of error (the shaded regions) do not overlap show where the effect of malevolent conditions on distress scores differ by gender. Although, for the most part, women exhibit significantly higher levels of psychological distress than men, men and women converge when their exposures to malevolent wartime conditions are more numerous than average.

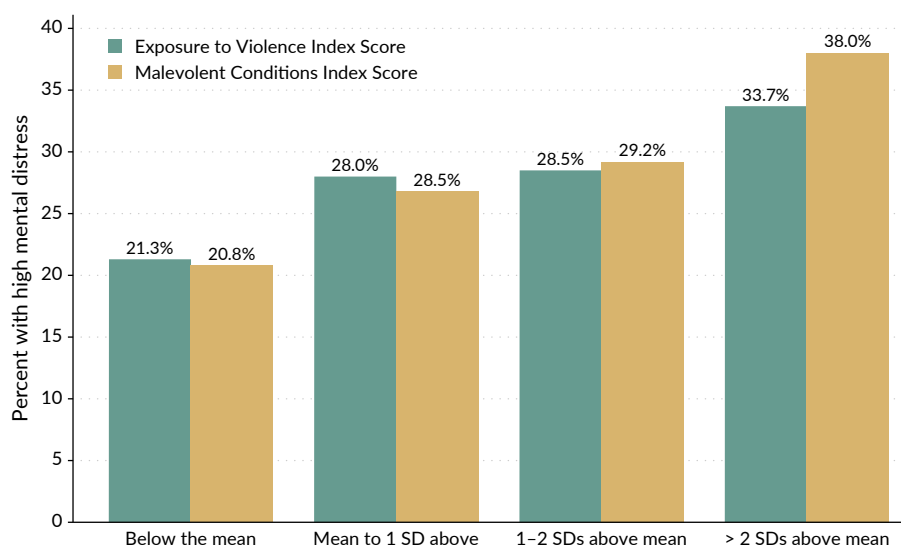


Figure 11.5 Percent experiencing psychological distress by war exposure severity

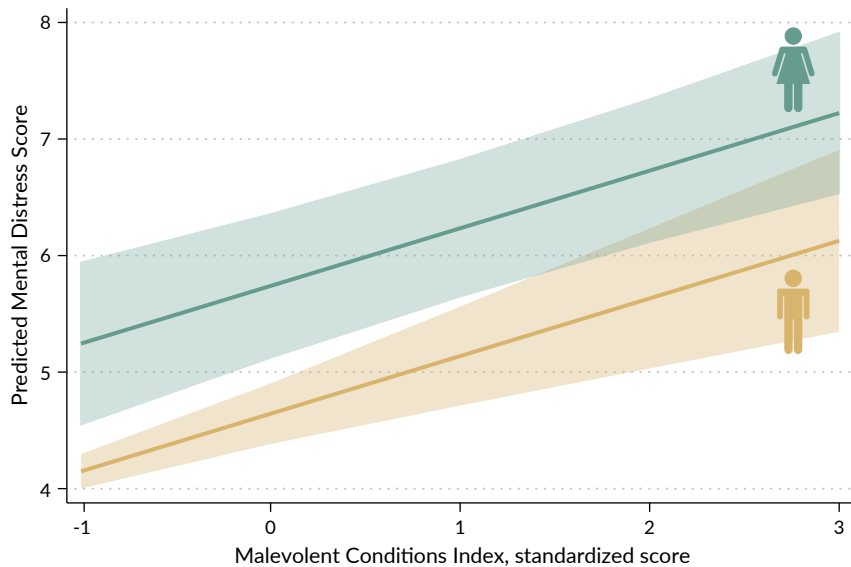


Figure 11.6 Predicted psychological distress scores by malevolent conditions exposure

CONCLUSION

Our analyses of the VHAS sample find that approximately 8.5% of Vietnamese men and 6.7% of Vietnamese women report disruptive symptoms of PTSD nearly 45 years after the end of the American War. Men more frequently report ongoing PTSD symptomatology than women, likely due to their higher rates of formal military participation and exposure to violence. However, one study published using the VHAS data found that with equivalent exposure to potentially traumatic wartime events, women reported experiencing more PTSD symptoms than men (Young et al., 2022). Compared to American veterans of the war and other conflict-affected populations, however, rates of provisional PTSD in this sample are quite low given the participants' wartime experiences (Goldberg et al., 2016). Possible explanations lie in Việt Nam's culture and norms around mental health and in the post-conflict experiences and resilience of Vietnamese older adults. Cultural beliefs and stigmatization around mental illness can result in somatic expressions of embodied stress and trauma rather than

manifestation of psychological distress or disturbance (Glass et al., 2023). Additionally, compared to U.S. veterans, the relatively positive reception and treatment afforded veterans in northern Việt Nam may have generated resilience to ongoing or reemergent PTSD (Marini et al., 2020).

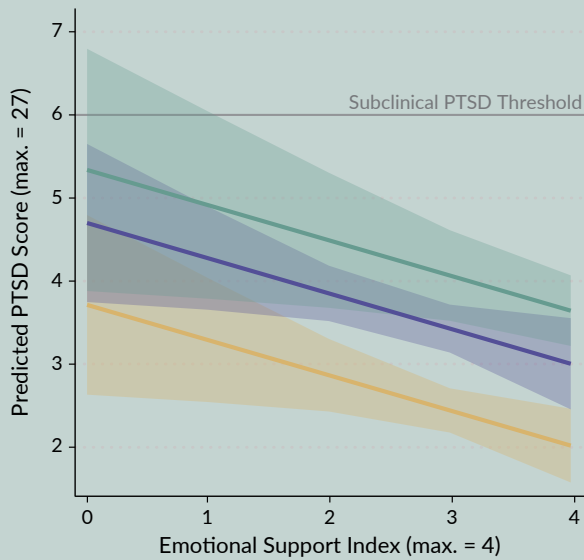
While PTSD is trauma-related by definition, psychological distress encompasses a wider range of mental health diagnoses that may not be related to traumatic events. Additionally, the sources of distress are more diverse than those for PTSD. This may help to explain why women in the VHAS sample are more likely to report psychological distress than men. While exposure to war can cause various mental health

conditions, other factors, such as low socio-economic status or stressful life events, can lead to the development of psychological distress (Droždek et al., 2020). In the section below highlighting VHAS research on **social and emotional support**, we illustrate how family-based social-emotional support (e.g., emotional closeness and relationship satisfaction with children and spouse) can protect against psychological distress and PTSD symptoms.

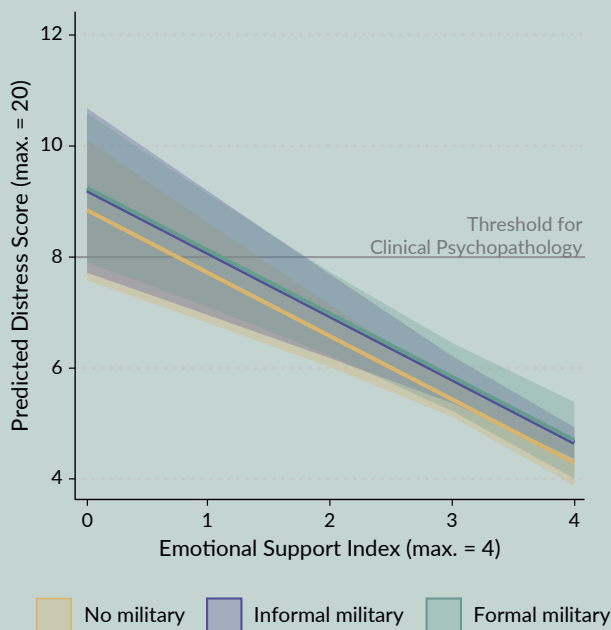
Overall, our results suggest that the American War continues to have an enduring impact on the mental health and wellbeing of older Vietnamese adults who experienced potentially traumatic wartime events of varying types and intensity. Our results also point to the importance of gender in structuring the risk and resilience factors that influence distinct mental health outcomes. Future investigations of mental health in Việt Nam and other post-conflict settings should attend to culturally-specific gender expectations and exposures during the war and in the years of post-war recovery.

SOCIAL AND EMOTIONAL SUPPORT

A Predicted PTSD Score (from PCL-5)



B Predicted Distress Score (from SRQ-10)



Previous literature has shown that social support can protect against PTSD, depression, and other mental health conditions (Ozbay et al., 2007). Using social and emotional support variables available in the VHAS, we conducted multivariate regression analyses to investigate how these factors affect the mental health of older Vietnamese adults. Our analyses found the following.

- The social-emotional support index (range: 0-4) represents the total amount of support participants report receiving from their familial relationships.
- Receiving greater social-emotional support is associated with lower PTSD and psychological distress scores for all military groups.
- Civilians' predicted PTSD scores are lower than the scores of those who served in the military. However, distress scores do not differ by military service status.

Figure 11.7 Predicted PTSD and predicted psychological distress scores

REFERENCES

- Beusenberg, M., Orley, J. H., & World Health Organization. (1994). *A User's guide to the self reporting questionnaire* (SRQ (No. WHO/MNH/PSF/94.8. Unpublished). World Health Organization.
- Brady, K. T., Killeen, T. K., Brewerton, T., & Lucerini, S. (2000). Comorbidity of psychiatric disorders and posttraumatic stress disorder. *Journal of Clinical Psychiatry*, 61(Suppl 7), 22-32.
- Bryant, R. A. (2019). Posttraumatic stress disorder: A state-of-the-art review of the evidence and challenges. *World Psychiatry*, 18(3), 259-269. <https://doi.org/10.1002/wps.20656>
- Chipimo, P.J., & Fylkesnes, K. (2013). Case-finding for mental distress in primary health care: An evaluation of the performance of a five-item screening instrument. *Health*, 5(3a), 627-636. <https://doi.org/10.4236/health.2013.53A083>
- Drozdek, B., Rodenburg, J., & Moyene-Jansen, A. (2020). "Hidden" and Diverse Long-Term Impacts of Exposure to War and Violence. *Frontiers in Psychiatry*, 10, Article 975. <https://doi.org/10.3389/fpsy.2019.00975>
- Glass, D. J., Young, Y. M., Tran, T. K., Clarkin, P., & Korinek, K. (2023). Weathering within war: Somatic health complaints among Vietnamese older adults exposed to bombing and violence as adolescents in the American war. *Journal of Psychosomatic Research*, 165, Article 111080. <https://doi.org/10.1016/j.jpsychores.2022.111080>
- Goldberg, J., Magruder, K. M., Forsberg, C. W., Friedman, M. J., Litz, B. T., Vaccarino, V., ... & Smith, N. L. (2016). Prevalence of posttraumatic stress disorder in aging Vietnam-era veterans: veterans administration cooperative study 569: course and consequences of posttraumatic stress disorder in Vietnam-era veteran twins. *The American Journal of Geriatric Psychiatry*, 24(3), 181-191. <https://doi.org/10.1016/j.jagp.2015.05.004>
- Gupta, M. A. (2013). Review of somatic symptoms in posttraumatic stress disorder. *International Review of Psychiatry*, 25(1), 86-99. <https://doi.org/10.3109/09540261.2012.736367>
- Kovnick, M. O., Young, Y., Tran, N., Teerawichitchainan, B., Tran, T. K., & Korinek, K (2021). The impact of early life war exposure on mental health among older adults in Northern and Central Vietnam. *Journal of Health and Social Behavior*, 62(4), 526-544. <https://doi.org/10.1177/00221465211039239>
- Marini, C. M., Fiori, K. L., Wilmoth, J. M., Kaiser, A. P., & Martire, L. M. (2020). Psychological adjustment of aging Vietnam veterans: the role of social network ties in reengaging with wartime memories. *Gerontology*, 66(2), 138-148.
- Marmar, C. R., Schlenger, W., Henn-Haase, C., Qian, M., Purchia, E., Li, M., Corry, N., Williams, C. S., Ho, C., Horesh, D., Karstoft, K., Shalev, A., & Kulka, R. A. (2015). Course of posttraumatic stress disorder 40 years after the Vietnam War: Findings from the National Vietnam Veterans Longitudinal Study. *JAMA Psychiatry*, 72(9), 875-881. <https://doi.org/10.1001/jamapsychiatry.2015.0803>
- Ozbay, F., Johnson, D. C., Dimoulas, E., Morgan, C. A., Charney, D., & Southwick, S. (2007). Social support and resilience to stress. *Psychiatry*, 4(5), 35-40.
- Stratton, K. J., Aggen, S. H., Richardson, L. K., Berenz, E. C., Tran, T. L., Trung, L. T., Tam, N. T., Tuan, T., Buoi, L. T., Ha, T. T., Thach, T. D., & Amstadter, A. B. (2014). Using the SRQ-20 factor structure to examine changes in mental distress following typhoon exposure. *Psychological Assessment*, 26(2), 528-538. <https://doi.org/10.1037%2Fa0035871>
- Young, Y., Kovnick, M. O., Korinek, K., & Minh, N. H. (2022). Gendered exposure, gendered response: Exposure to wartime stressors and PTSD in older Vietnamese war survivors. *Gender and Society*, 36(5), 704-734. <https://doi.org/10.1177/08912432221113744>

THE VHAS AIMS TO
UNDERSTAND THE
EFFECTS OF WAR ON
HEALTH AND WELLBEING...
OUR FUTURE WORK
WILL EXPAND ON THIS
ENDEAVOR





CONCLUSION—LESSONS FOR POLICYMAKERS AND PRACTITIONERS

BUSSARAWAN TEERAWICHITCHAINAN, ZOE M. BROWN, ZACHARY ZIMMER, KIM KORINEK, TRẦN KHÁNH TOÀN

The Vietnam Health and Aging Study (VHAS) is the first interdisciplinary research project that systematically investigates how war exposure impacts the long-term health and aging of Vietnamese war survivors. To achieve this, the VHAS collected survey, biomarker, and anthropometric data from a sample of 2,447 older adults in north and north-central Việt Nam (see Chapters 1 and 3). This chapter reviews the results presented in the report; describes some lessons from conducting research on this topic in Việt Nam; discusses future directions for this research; and provides recommendations for **evidence-based policy directions and clinical practices**.

WHAT WE HAVE LEARNED

The VHAS offers one of the most comprehensive investigations of war exposure and military experience among conflict-affected populations worldwide (see Chapter 2). VHAS participants, all of whom were born before 1959, were exposed to the American War during their adolescence and young

adulthood. Most participants faced potentially traumatizing events, often repeatedly, over the course of the war (Young et al., 2021). The majority of men and a significant minority of women from these cohorts participated in formal and informal military forces and typically experienced various forms and degrees of war stressors as a result. Many of those involved in military activities were gravely injured, took hostile fire, and witnessed the deaths of comrades, civilians, and enemy forces. Civilians were not exempt from war traumas and were also exposed to the stresses of war. Many lived on the periphery of war zones, enduring malevolent conditions, while others experienced family separation or the loss of loved ones to war-related causes. The VHAS seeks to determine how these events continue to impact those who experienced the American War in their earlier life, investigating the extent to which they have overcome these distressing experiences and the extent to which they continue to feel war's impacts. This report, along with several published articles based on the VHAS, provides

glimpses into these questions and the underlying mechanisms of the long-term effects of war on health.

WAR'S IMPACTS ON PHYSICAL HEALTH

Evidence from the VHAS demonstrates that war stressors are critical in shaping the etiology of late-life health among Vietnamese war survivors (Zimmer et al., 2021). War exposure earlier in life continues to have negative impacts on many older adults' health status more than four decades later (see Chapters 8–10). Intensive exposure to war stressors, such as forced migration, water and food shortages, experiencing fear of death, and witnessing war-related death, is consistently linked to a greater likelihood of developing functional limitations, disability, and chronic illness (Teerawichitchainan et al., 2023; Zimmer et al., 2022). Analysis of the VHAS data has found that a increased exposure to war-related violence is associated with more lung conditions (Teerawichitchainan et al., 2023). Experiencing war trauma also hastens aging, as evidenced by significantly greater levels of frailty among those more intensely exposed. For example, among men the probability of being classified as frail increases from 27% among those exposed to the lowest level of war violence to 40% for those with the most severe exposure (see Chapter 10). Such associations are independent of common confounders such as age, gender, socioeconomic status, and risky health behaviors (e.g., smoking). These associations are persistent, regardless of whether respective health outcomes are self-reported or measured with biomarkers and anthropometric data (Zimmer et al., 2021).

WAR'S IMPACTS ON PSYCHOLOGICAL HEALTH

In addition to physical health, results demonstrate war's enduring impacts on the mental health of older Vietnamese who were directly or indirectly exposed to war traumas. Participants who previously experienced war violence and malevolent conditions demonstrate a greater likelihood of psychological distress in late adulthood (see Chapter 11). Rates of psychological distress described in Chapter 11 are 21% for those with the lowest degree of violence exposure, compared to 34% among those with the highest levels of violence exposure. There are also strong linkages between war stressors and post-traumatic stress disorder (PTSD). Both men and women who served in the formal military have a notably greater likelihood of reporting provisional PTSD than other respondents. Rates of provisional PTSD range from 3% for the lowest violence exposure to 14% for the highest. Evidence from VHAS additionally suggests that somatic complaints may be more easily assessed in the Vietnamese context



Older woman walking to the market in Central Việt Nam.

compared to certain psychological constructs like PTSD that come from western psychiatry (Glass et al., 2023; Korinek et al., 2017). Nevertheless, nearly 9% of men and nearly 7% of women report probable war-related PTSD nearly 45 years after the end of the American War. Results further indicate that PTSD is an important mediator linking war exposure and chronic conditions such as cardiovascular diseases and respiratory conditions in older Vietnamese adults (Korinek et al., 2020; Teerawichitchainan et al., 2023).

SOCIAL IMPACTS OF WAR

Not only do war traumas adversely impact health, but they also have profound social implications for survivors who are now reaching late adulthood. Our analyses suggest that the war significantly altered life chances of the Vietnamese (see Chapter 6). While exposure to war violence and inhospitable conditions, as measured in the VHAS, did not affect the lifelong economic circumstances of participants, participation in the formal military, regardless of gender, demonstrates a significant positive association with socioeconomic status. Formal military veterans experienced greater chances of working in manufacturing or service sectors, which require more education and provide higher earnings, versus the agricultural sector. Among VHAS women, serving in the formal military results in a 9% increase in socioeconomic index score, which summarizes the differences in prestige between occupational sectors. It is important to note that

men who remained in civilian roles through the war era are more likely to have attained professional occupations (e.g., government officers, teachers, highly skilled workers) than those who served in either formal or informal military roles, perhaps due to selection or because their educational attainment was not disrupted by military service.

Alongside the challenges faced by those exposed to war, some social benefits are associated with war exposure. Evidence from VHAS suggests that war exposure is positively linked to social engagement in late adulthood (see Chapter 5). Wartime military service possibly enabled older Vietnamese to connect with individuals from diverse backgrounds, broadening their social networks and enhancing their social participation later in life. For example, Chapter 5 shows that increased exposure to war violence is associated with higher levels of informal social participation (e.g., socializing with friends and neighbors) in later life. Among male veterans, greater exposure to war violence is associated with a greater sense of camaraderie and stronger friendship bonds with military peers. It is possible that older Vietnamese adults view social interaction, particularly informal engagement such as socializing with friends, as an opportunity to relate their war experiences to peers and help them better cope with traumatic memories. These patterns suggest that the war's potentially traumatizing violence can also be a transformative experience by deepening human connections.



Grandmother and granddaughter. Photo: Oanh M.J.

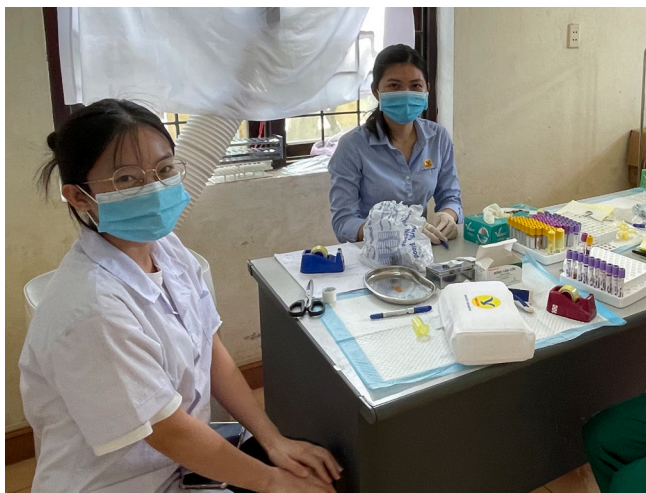
MILITARY EXPERIENCE AS A SOURCE OF RESILIENCE

Given its long-lasting potential to enhance one's life chances and social connectedness, military experience is shown to moderate the association between war stressors and ill health. Both formal and informal military personnel could benefit from their military roles. They may have acquired various training during wartime, which could improve their physical wellbeing, labor force opportunities, and lifelong resilience skills, thereby enabling them to better withstand the adverse impact of war stressors on their health. Additionally, they may enjoy improved healthcare accessibility compared to civilians, leading to long-term benefits for their overall health. Evidence from VHAS shows that social-emotional support reduces the likelihood of developing PTSD and psychological distress among formal and informal military veterans (see Chapter 11). Moreover, while severe exposure to wartime malevolent conditions tends to exert enduring adverse effects on cognitive functioning, older adults who maintain active social engagements, which are often more prevalent among former military personnel, experience significantly lower risks of cognitive decline (see Chapter 9).

A few exceptions notwithstanding (see Aldwin et al., 1994; Teerawichitchainan & Korinek, 2012), much of the literature on the effects of war assumes or examines only the harmful aspects. In contrast, the VHAS study suggests that the impact of war is not solely negative. There are adverse effects when it comes to some health outcomes, like frailty and psychological well-being, and there are some positive effects when it comes to social support and resilience. How these patterns balance out is an important question that VHAS and similar studies can continue to investigate.

WAR'S IMPACTS THROUGH A GENDER LENS

Việt Nam presents a unique opportunity to employ a gender-informed perspective on the long-term effects of war, particularly given women's diverse wartime roles as formal military personnel, members of the Thanh Niên Xung Phong (TNXP), and civilians. Analyses of the VHAS data demonstrate that while men were more likely to be involved in combat, thus facing more war traumas, women experience greater degrees of ill health associated with certain war stress exposures. For instance, women suffer a greater PTSD penalty associated with certain stressful experiences in war (Young et al., 2022). Female vulnerabilities might be explained by the fact that women were burdened with the added responsibilities of protecting their families during wartime and were incorporated into military and paramilitary roles with less preparation, training,



VHAS Wave 2 medical examination staff awaiting the next participant. Photo: Yvette Young

and support than men. Attention should nevertheless be paid to diverse war impacts within VHAS female participants. For example, women who served in the formal military in young adulthood tend to experience significant improvements in occupational opportunities and economic resources over their life course (see Chapter 6). Furthermore, while women, especially those who never served, face worse functional health and greater frailty than men, our evidence suggests that the experience of being in the formal military may be protective of functional health and frailty for women (see Chapter 10).

LESSONS FROM THE FIELD

The VHAS team drew many lessons from our multi-national, interdisciplinary research collaboration. We encountered many positive experiences in the field, particularly from participants who welcomed our interviewers into their homes and eagerly shared their stories and reflections about war exposure. While war conjured distressing memories in some survey participants, none of them required any psychiatric counseling intervention, which the VHAS team had duly prepared for all participants in case of psychological distress resulting from our survey data collection. Compared to other community-based health and demographic surveys, VHAS achieved a relatively high response rate for survey participation (85%) and biomarker collection (96% of those who completed the survey). This reflects the excellent preparation and skilled social interaction by the data collection team, as well as an enthusiasm for engagement in the data collection activities by older adults. Furthermore, the VHAS team was impressed by the enthusiasm and professionalism of local researchers and



VHAS medical doctor discussing ultrasound results with Wave 2 VHAS participant. Photo: Yvette Young

public health officers for collective training and knowledge transfers during biomarker data collection.

The VHAS team also faced certain obstacles. Our international collaboration encountered intensive communication and logistical challenges. This included but was not limited to, conducting regular meetings across different time zones; dealing with differences in academic and governmental structures and cultures; and following different, evolving government policies regarding the importation of supplies for laboratory assays. During the COVID-19 pandemic, the team experienced training and implementation interruptions. We were required to adopt several modifications during the Wave 2 data collection to protect the safety of our study participants and fieldwork interviewers. This included removing peak expiratory flow tests from Wave 2's biomarker data collection, adopting masking and other public health measures in the field, and requiring regular COVID testing among our field team.

In addition to logistical challenges, the VHAS team also encountered various limitations. For example, there are significant challenges in translating and measuring certain key concepts (e.g., PTSD, end-of-life planning) in the Vietnamese context. Moreover, selective mortality among formal and informal military personnel is another notable limitation. Formal military and militia members who were gravely affected by war violence may have already died before the survey was conducted. The extensive familial losses due to war that are documented in Chapter 2, particularly the loss of brothers and sisters, are indicative of the excess mortality and selective survivorship which characterize the American War generation. Furthermore, there may be differing degrees

and types of selection into military service by gender, socioeconomic status, and other social characteristics. Give the various types of selection, the observed associations between war exposure and various later-life outcomes should be interpreted with caution.

FUTURE DIRECTIONS

The analyses presented in this report are based on the Wave 1 VHAS data and have uncovered several notable patterns of the war's enduring impacts on health and aging in Việt Nam. Soon, the team will analyze Wave 2 data, which were collected in 2021–2022, to understand health transitions among VHAS participants and to better ascertain the mechanisms through which war stressors influence changes in late-life health and other indicators of wellbeing. A project grant from the Canadian Institute of Health Research, which funds additional analysis of blood for epigenetic outcomes and analysis of hair for cortisol outputs, allows the team to conduct deeper investigation of biological mechanisms that link war trauma, health, and physiological aging. Moreover, a research supplement from the National Institute on Aging will enable the VHAS team to examine war-related risk factors for cognitive impairment and Alzheimer's Disease and Related Dementia (ADRD) in a VHAS subsample. This is important because the prevalence of ADRD in Việt Nam is estimated to rise exponentially from 660,000 to 1.2 million by 2030 (Rees, 2018).

Apart from these immediate plans, the VHAS team is exploring several potential directions for future research. First, we intend to conduct additional follow-up studies of the VHAS sample

and expand our research to involve not only the cohorts of war survivors but also family members (e.g., adult children and grandchildren) of current VHAS participants to evaluate the intergenerational transmission of trauma. Given that the current VHAS coverage is limited to four districts in northern and north-central Việt Nam, a future research direction may incorporate older adults in other parts of Việt Nam (e.g., southern provinces) to understand more completely the extent of war exposure and its consequences. Additionally, we may consider a cross-national, comparative investigation of older-aged war survivors in Việt Nam and overseas Vietnamese or those in other post-conflict settings in Southeast Asia (e.g., Cambodia, Laos) and beyond.

LESSONS FOR POLICY AND PRACTICE

Việt Nam has a rapidly aging population that was exposed to war traumas in their youth and early adulthood. As with any aging population, Vietnamese often must contend with chronic diseases and functional decline. Evidence from VHAS suggests that war exposure significantly contributes to the burden of disease in these cohorts, particularly with regard to mental health issues. This, in turn, poses considerable challenges for Việt Nam with respect to meeting the healthcare demands of its older-adult population. It is thus vital for policymakers and practitioners to adopt comprehensive, continuous, and long-term national healthcare policies that prioritize not only physical health but also the mental and social wellbeing of their older population.



Fields in Ninh Bình Province. Photo: Bussarawan Teerawichitchainan

VHAS findings suggest prioritizing social engagement in health policies and intervention programs to enhance the overall well-being of older Vietnamese. This can, for example, be achieved through educational programs that raise awareness about the benefits of social engagement and community involvement for late-life physical and mental health. Additionally, it is crucial to establish and improve social infrastructure (e.g., community centers and clubs) and to introduce a variety of social activities that cater to older persons' diverse needs and preferences. Policymakers may consider encouraging the active participation of family members, volunteers, and the broader community in socializing and assisting older persons during social activities.

Furthermore, it is important for policymakers and practitioners to recognize the unique and distinct healthcare needs of former TNXP members. These informal militias were comprised of young women who voluntarily participated in informal military service and typically experienced educational disruption and endured various war-related traumas as a result. VHAS findings suggest that these now older women have higher rates of widowhood compared to male veterans and tend to face many long-term war-related physical and mental health issues (see Chapter 2). Moreover, the TNXP's lack of official recognition as military veterans has deprived them of several benefits, such as full health insurance coverage and well-endowed social support systems available to other veterans. To address these disparities, it is vital for the government to reinstate the veteran health insurance scheme for former TNXP members and implement supportive policies to facilitate their social integration and community engagement. This may

include social bonding opportunities that help foster a sense of camaraderie among former TNXP members.

In clinical practice, healthcare practitioners should conduct comprehensive evaluations of health determinants among older adults. Gaining insights from one's life history is valuable for effective clinician engagement. This requires clinicians to probe an older person's past experiences (e.g., military participation and war trauma exposure) in order to fully comprehend their present health status. Our results also point to the benefits of employing screening tools for early detection of any mental or cognitive health conditions (e.g., depression, PTSD, cognitive impairment) and older persons' needs for psychosocial care. It is thus essential to adopt a holistic, personalized, and patient-centered care plan, that emphasizes addressing older persons' social-emotional support and community integration.

Finally, VHAS is the first research initiative in Việt Nam to explore aging-related biomarkers in older adults. Our study has laid a crucial groundwork for future research endeavors that may use comprehensive indices to understand multifaceted aspects of biological aging within the Vietnamese population. For instance, VHAS biomarker data allow for the construction of indices such as allostatic load, metabolic syndrome, and physiological dysregulation. Such indices would provide an evidence-based foundation for the development of policies and healthcare strategies targeted at meeting the needs of Việt Nam's rapidly aging population, ultimately leading to enhanced efficacy and improved health outcomes.



REFERENCES

- Aldwin, C.M., Levenson, M.R., & Spiro III, R. (1994). Vulnerability and resilience to combat exposure: Can stress have lifelong effects? *Psychology & Aging*, 9(1), 34-44. <https://doi.org/10.1037/0882-7974.9.1.34>
- Glass, D. J., Young, Y. M., Tran, T. K., Clarkin, P., & Korinek, K. (2023). Weathering within war: Somatic health complaints among Vietnamese older adults exposed to bombing and violence as adolescents in the American war. *Journal of Psychosomatic Research*, 165, Article 111080. <https://doi.org/10.1016/j.jpsychores.2022.111080>
- Korinek, K., Loebach, P., & Teerawichitchainan, B. (2017). Physical and mental health consequences of war-related stressors among older adults: An analysis of posttraumatic stress disorder and arthritis in northern Vietnamese war survivors. *Journals of Gerontology Series B: Psychological Sciences & Social Sciences*, 72(6), 1090-1102. <https://doi.org/10.1093/geronb/gbv157>
- Korinek, K., Young, Y., Teerawichitchainan, B., Nguyen, C.T.H., Kovnick, M., & Zimmer, Z. (2020). Is war hard on the heart? Gender, wartime stress and late life cardiovascular conditions in a population of Vietnamese older adults. *Social Science & Medicine*, 265, 113380. <https://doi.org/10.1016/j.socscimed.2020.113380>
- Korinek, K., Zimmer, Z., Teerawichitchainan, B., Young, Y., Long, C., & Tran, T.K. (2021, May 5-8). *Cognitive function in the context of early life wartime stress exposure: An analysis of cognitive decline in a cohort of Vietnamese older adults* [Conference presentation]. Population Association of America Annual Meeting, Online.
- Rees, G. (2018, September 7). National dementia plans and priority setting [Speech]. First Vietnam National Dementia Conference. Hanoi, Vietnam.
- Teerawichitchainan, B., & Korinek, K. (2012). The long-term impact of war on health and wellbeing in Northern Vietnam: Some glimpses from a recent survey. *Social Science & Medicine*, 74(12), 1995-2004. <https://doi.org/10.1016/j.socscimed.2012.01.040>
- Teerawichitchainan, B., Zimmer, Z., Low, T., & Tran, T. (2023). Respiratory health among older adults in Vietnam: Does earlier-life military role and war exposure matter? *Journal of Aging & Health*, 35(3-4), 168-181. <https://doi.org/10.1177/08982643221118445>
- Young, Y., Korinek, K., Zimmer, Z., & Toan, T. K. (2021). Assessing exposure to war-related traumatic events in older Vietnamese war survivors. *Conflict & Health*, 15(1), 1-16. <https://doi.org/10.1186/s13031-021-00343-y>
- Young, Y., Kovnick, M. O., Korinek, K., & Huu Minh, N. (2022). Gendered exposure, gendered response: Exposure to wartime stressors and PTSD in older Vietnamese war survivors. *Gender & Society*, 36(5), 704 -734. <https://doi.org/10.1177/08912432221113744>
- Zimmer, Z., Fraser, K., Korinek, K., Akbulut-Yuksel, M., Young, Y. M., & Toan, T. K. (2021). War across the life course: examining the impact of exposure to conflict on a comprehensive inventory of health measures in an aging Vietnamese population. *International Journal of Epidemiology*, 50(3), 866-879. <https://doi.org/10.1093/ije/dyaa247>
- Zimmer, Z., Korinek, K., Young, Y., Teerawichitchainan, B., & Toan, T. K. (2022). Early-life war exposure and later-life frailty among older adults in Vietnam: Does war hasten aging? *Journals of Gerontology Series B: Psychological Sciences & Social Sciences*, 77(9), 1674-1685. <https://doi.org/10.1093/geronb/gbab190>

CONTRIBUTING AUTHORS

Sahlil Ahmed, Master of Public Health, M.S. (Sociology), Department of Sociology, University of Utah, USA

Zoe M. Brown, Undergraduate Research Assistant, VHAS, University of Utah, USA

Bùi Thị Hương Trâm, Ph.D. (Sociology), Institute for Family and Gender Studies, Vietnam Academy of Social Sciences, Việt Nam

Delaney J. Glass, Ph.D. Candidate (Biological Anthropology), Department of Anthropology, University of Washington, USA

Sara I. Hamm, Master of Health Promotion, Research Associate, Mount Saint Vincent University, Halifax, Canada

Kim Korinek, Ph.D. (Sociology), Professor of Sociology and Director of Asia Center, University of Utah, USA

Timothy Qing Ying Low, B.Soc.Sci., Graduate Student, Department of Sociology and Anthropology, National University of Singapore, Singapore

Lê Thị Hồng Hải, M.Sc., Researcher, Institute for Family and Gender Studies, Vietnam Academy of Social Sciences, Việt Nam

Melanie A. Martin, Ph.D., Assistant Professor, Department of Anthropology, University of Washington, USA

Nguyễn Đức Tuyển, Researcher, Institute for Family and Gender Studies, Vietnam Academy of Social Sciences, Việt Nam

Nguyễn Hà Đông, M.A., Institute for Family and Gender Studies, Vietnam Academy of Social Sciences, Việt Nam

Nguyễn Hữu Minh, Ph.D. (Sociology), Professor, Institute for Family and Gender Studies, Vietnam Academy of Social Sciences, Việt Nam

Tiffany Pan, Ph.D. (Anthropology) and Master of Public Health (Epidemiology), Research Scientist and Biodemography Lab Director, Center for Studies in Demography and Ecology, University of Washington, USA

Jared M. Poff, M.S., Graduate Student, Department of Sociology, University of Utah, USA

Phạm Thị Ngọc Bích, Ph.D. Candidate, M.D., M.Sc., Main Lecturer, Department of Family Medicine, Hanoi Medical University, Việt Nam

Phan Thanh Thủy, Ph.D. Candidate, Master of Public Health, Hanoi Medical University and Ministry of Health, Việt Nam

Phương Anh Tuyết, B.A., Research Assistant (VHAS), Hanoi Medical University, Việt Nam

Bussarawan (Puk) Teerawichitchainan, Ph.D. (Sociology), Associate Professor of Sociology, and Co-director, Centre for Family and Population Research, National University of Singapore, Singapore

Robert L. Tennyson, Ph.D (Anthropology), Postdoctoral fellow, **University of Utah and Columbia University**, USA

Trần Khánh Toàn, Ph.D., Associate Professor, **Family Medicine Department**, **Hanoi Medical University**, Việt Nam

Trần Thị Cẩm Nhung, Ph.D. Candidate, Department of Sociology, **University of Utah**, USA, and **Institute for Family and Gender Studies**, **Vietnam Academy of Social Sciences**, Việt Nam

Trần Quý Long, Ph.D., Senior Researcher, **Institute for Family and Gender Studies**, **Vietnam Academy of Social Sciences**, Việt Nam

Trần Thị Thanh Loan, M.A., Senior Researcher, **Institute for Family and Gender Studies**, **Vietnam Academy of Social Sciences**, Việt Nam

Trúc Ngọc Hoàng Dang, Ph.D., Lecturer, **Institute for Population and Social Research**, **Mahidol University**, Thailand

Yvette Young, Ph.D. (Sociology), Postdoctoral research fellow, **VHAS**, **University of Utah**, USA, and **Max Planck Institute for Demographic Research**, Germany

Zachary Zimmer, Ph.D. (Sociology), Professor, Director of Global Aging and Community Initiative, and Canada Research Chair, **Mount Saint Vincent University**, **Halifax**, Canada.

APPENDIX A

SUPPLEMENTARY MATERIALS

THE FOLLOWING SUPPLEMENTARY MATERIALS ARE
AVAILABLE ON THE VHAS WEBSITE
AT WWW.VHAS.UTAH.EDU.

1. Publication detailing study design and protocols
 - Design and measurement in a study of war exposure, health, and aging: protocol for the Vietnam health and aging study. <https://doi.org/10.1186/s12889-019-7680-6>
2. Data collection documentation
 - Wave 1 Questionnaire
 - English: https://vhas.utah.edu/_resources/documents/vhas-questionnaire-english.pdf
 - Vietnamese
 - Wave 1 Biomarker Collection Procedures Manual: https://vhas.utah.edu/_resources/documents/biomarkers-full-procedure-for-website.pdf
3. Information on data acquisition and use
 - Data Use Agreement
4. Library of VHAS publications
 - Publications: <https://vhas.utah.edu/publications.php>
 - If you need assistance accessing any of the publications, please contact Dr. Kim Korinek at kim.korinek@soc.utah.edu
5. Technical Appendix to this report
 - The Technical Appendix contains detailed descriptions of the statistical methods, unabridged statistical tables, supplemental tables, and supplemental figures.



**VIETNAM HEALTH
AND AGING STUDY**

VIETNAM HEALTH AND AGING STUDY
WAVE 1 REPORT, 2023