

Compton, Ryan A.; Craig, Andrea N.; Heger, Dörte; Skogstad, Karl

Working Paper

Origin country conflict and immigrant physical health

Ruhr Economic Papers, No. 1068

Provided in Cooperation with:

RWI – Leibniz-Institut für Wirtschaftsforschung, Essen

Suggested Citation: Compton, Ryan A.; Craig, Andrea N.; Heger, Dörte; Skogstad, Karl (2024) : Origin country conflict and immigrant physical health, Ruhr Economic Papers, No. 1068, ISBN 978-3-96973-240-3, RWI - Leibniz-Institut für Wirtschaftsforschung, Essen, <https://doi.org/10.4419/96973240>

This Version is available at:

<https://hdl.handle.net/10419/287764>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



RUHR

ECONOMIC PAPERS

Ryan A. Compton
Andrea N. Craig
Dörte Heger
Karl Skogstad

Origin Country Conflict and Immigrant Physical Health

Imprint

Ruhr Economic Papers

Published by

RWI – Leibniz-Institut für Wirtschaftsforschung

Hohenzollernstr. 1-3, 45128 Essen, Germany

Ruhr-Universität Bochum (RUB), Department of Economics

Universitätsstr. 150, 44801 Bochum, Germany

Technische Universität Dortmund, Department of Economic and Social Sciences

Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics

Universitätsstr. 12, 45117 Essen, Germany

Editors

Prof. Dr. Thomas K. Bauer

RUB, Department of Economics, Empirical Economics

Phone: +49 (0) 234/3 22 83 41, e-mail: thomas.bauer@rub.de

Prof. Dr. Wolfgang Leininger

Technische Universität Dortmund, Department of Economic and Social Sciences

Economics – Microeconomics

Phone: +49 (0) 231/7 55-3297, e-mail: W.Leininger@tu-dortmund.de

Prof. Dr. Volker Clausen

University of Duisburg-Essen, Department of Economics

International Economics

Phone: +49 (0) 201/1 83-3655, e-mail: vclausen@vwl.uni-due.de

Prof. Dr. Ronald Bachmann, Prof. Dr. Almut Balleer, Prof. Dr. Manuel Frondel,

Prof. Dr. Ansgar Wübker

RWI, Phone: +49 (0) 201/81 49-213, e-mail: presse@rwi-essen.de

Editorial Office

Sabine Weiler

RWI, Phone: +49 (0) 201/81 49-213, e-mail: sabine.weiler@rwi-essen.de

Ruhr Economic Papers #1068

Responsible Editor: Ansgar Wübker

All rights reserved. Essen, Germany, 2024

ISSN 1864-4872 (online) – ISBN 978-3-96973-240-3

The working papers published in the series constitute work in progress circulated to stimulate discussion and critical comments. Views expressed represent exclusively the authors' own opinions and do not necessarily reflect those of the editors.

Ruhr Economic Papers #1068

Ryan A. Compton, Andrea N. Craig, Dörte Heger and Karl Skogstad

Origin Country Conflict and Immigrant Physical Health

Bibliografische Informationen der Deutschen Nationalbibliothek

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie;
detailed bibliographic data are available on the Internet at <http://dnb.dnb.de>

RWI is funded by the Federal Government and the federal state of North Rhine-Westphalia.

<http://dx.doi.org/10.4419/96973240>

ISSN 1864-4872 (online)

ISBN 978-3-96973-240-3

Ryan A. Compton, Andrea N. Craig, Dörte Heger and Karl Skogstad*

Origin Country Conflict and Immigrant Physical Health

Abstract

Using multiple waves of Statistics Canada's Canadian Community Health Survey (CCHS) linked with the Longitudinal Immigration Database (IMDB), as well as the Uppsala Conflict Data Program (UCDP)/International Peace Research Institute in Oslo (PRIO) Armed Conflict Dataset, we examine the effect of exposure to pre-migration conflict on the post-migration physical health outcomes of immigrants to Canada. Our results demonstrate that immigrants from conflict zones face unique physical health challenges that continue post-migration. Better understanding these challenges will help health policy makers and providers to better respond to the needs of people migrating from these regions of the world.

JEL-Codes: I10, J15, D74

Keywords: Conflict; health; refugees; immigrants; Canada

February 2024

* Ryan A. Compton, University of Manitoba; Andrea N. Craig, UBC Okanagan; Dörte Heger, RWI; Karl Skogstad, Lakehead University. – We would like to thank Matt Webb, as well as participants of the 2023 Defence and Security Economics Workshop, 2023 Canadian Research Data Centre Network Conference, and Lakehead University economics seminar for their helpful comments and suggestions. This research was conducted at the UBC Okanagan and University of Manitoba RDCs, a part of the Canadian Research Data Centre Network (CRDCN). This service is provided through the support of UBC Okanagan, the University of Manitoba, the Canada Foundation for Innovation, the Canadian Institutes of Health Research, and the Social Science and Humanity Research Council, and Statistics Canada. All views expressed in this work are our own. – All correspondence to: Andrea N. Craig, Assistant Professor of Economics, University of British Columbia, Okanagan Campus, Kelowna BC, Canada, e-mail: andrea.craig@ubc.ca

1. Introduction

Violent conflict within or between countries is, unfortunately, a rather widespread phenomenon, which leads to the displacement of many people within but also across national borders. Immigrants fleeing from conflict, having been exposed to violence either directly or indirectly, may have more physical health ailments than immigrants who have not been exposed to conflict, and these health ailments may persist long after migration. In this paper we estimate the impact on physical health that being exposed to conflict prior to migration has on immigrants, by combining detailed information on worldwide conflicts with rich health information of Canadian immigrants.

While the conflict literature has long concerned itself with the macroeconomic implications of conflict, researchers have increasingly highlighted the microeconomic consequences that conflict can have on individuals, both combatants and non-combatants.¹ Conflict is shown to have many potentially negative effects on those exposed to it, including adversely affecting the health of those experiencing it either directly or indirectly. Further, given that these microeconomic effects are internal to the person, while the individual may be removed from the area of conflict should they migrate, any negative effects may persist. Thus, those interested in understanding immigrant outcomes have increasingly factored in the effect that having experienced conflict may continue to have on those that have migrated to other countries.

While the link between conflict and migrant outcomes has generated increasing attention, there exists limited evidence on those who have migrated to Canada and limited work on the physical health outcomes of conflict migrants generally. For a country that is one of the most common destinations of immigrants, especially refugees, this is an issue that must be better understood, even more so as the country seeks to increase its immigration rate. Moreover, as knowledge on how the organization of health care systems influence health outcomes of immigrants having experienced conflict is sparse (Lokot et al., 2022), studying Canadian immigrants' health may provide important policy insights, i.e. on the potential benefits of universal health insurance coverage.

In this context we examine the impact of pre-migration conflict on the physical health outcomes of immigrants to Canada. We do so by using multiple waves of data from the Canadian Community Health Survey (CCHS) from 2007 to 2014 and the Longitudinal Immigration

¹ See Brakman, Garretsen, and Schramm (2004), Yamarik, Johnson, and Compton (2010), and Miguel and Roland (2011) as examples with a macroeconomic focus, and Akbulut-Yuksel (2013) and Justino, Leone, and Salardi (2014) as examples with a microeconomic focus.

Database (IMDB), along with conflict data from the Uppsala Conflict Data Program (UCDP)/International Peace Research Institute in Oslo (PRIO) Armed Conflict Dataset. As health is multidimensional, we consider three measures of physical health. First, we use self-assessed physical health, which is directly asked in the CCHS and which is commonly used to measure individuals' health (c.f. Halli and Anchan, 2005; Kwak, 2018; and Chai, 2022). Second, we construct an indicator variable based on whether the individual reports at least two chronic conditions, another standard measure to assess individuals' health status (Raina et al., 2020; Salive, 2013). Third, we create a more objective health index, based on principle component analysis using a wide range of self-assessed as well as diagnosed physical health variables included in the CCHS dataset.

Previewing our results, we find that immigrants from countries which have experienced conflict tend to have worse physical health across our three health measures than those from non-conflict countries. This result is primarily driven by the females in our sample. When taking into account when a person was exposed to conflict, the harmful physical effects are strongest in the case of females that experienced conflict as young children. These results prove particularly interesting in light of the literature that argues the effects of conflict can be gendered as well as particularly harmful to those exposed as children (c.f. Kadir et al., 2020).

Several contributions come from this work. First, we add to the sparse research on conflict and Canadian immigrant health outcomes. While one notable exception is Joly and Wheaton (2015), which focuses on the mental health of immigrant and non-immigrant families in the Toronto metropolitan area, our paper differs from this study by examining a large nationally representative sample, by exploring physical health outcomes, and by extending the time horizon to encompass more modern conflicts. Second, our work is relevant to the general literature on conflict and immigration as we consider multiple physical health outcomes available in the CCHS as well as whether the sex of the immigrant may matter for the conflict–health link. Third, our research contributes to the large literature on the healthy immigrant effect and the health of immigrants in Canada generally as it highlights the importance of accounting for the possible conflict experience of immigrants when assessing their health. Fourth, a unique aspect of our paper is the use of principal component analysis to construct a physical health index that is largely based on diagnosed conditions and thereby reduces some of the subjectivity problems associated with the traditional use of only perceived health by many papers in this literature. Fifth, our results are particularly important from a policy

perspective in the Canadian context given the role of immigration as part of Canada's strategy to grow the population in coming years.

The rest of this paper proceeds as follows. The next section provides a review of the literature relevant to our work, while section 3 outlines the data and empirical approach used in the analysis. Section 4 details the results, and lastly, section 5 concludes.

2. Literature Review

Several research areas are important for situating our work, one being the health implications of conflict on a country's population. A recent literature review by Garry and Checchi (2020) points out that conflict has numerous health effects including trauma and injuries, mental health, non-communicable diseases, infectious diseases, child health, and sexual, reproductive, and maternal health, and that these health effects occur both through the fighting directly as well as through wider socioeconomic effects. Channels through which conflict impacts health include the destruction of communities and economic opportunities, food insecurity, population displacement, and damage to health and infrastructure related services. Further the authors point out that certain populations, including women and children are particularly vulnerable as targeting vulnerable people can be an explicit war strategy with practices such as rape and sexual violence, targeting of food and water supplies, attacks on health infrastructure, and the use of child soldiers. Also, the authors highlight that the effects on health are not simply immediate but can have long-lasting effects that continue over years and intergenerationally.

Kadir et al. (2020) provide a review of the literature over the past 60 years on conflict and child health and development and highlights the considerable number of children affected by conflict. The authors point out that increasingly schools, health care facilities, and health care workers have become a target, with negative consequences for children. Children are affected in war by being killed, maimed, sexually abused, and abducted, through their use as soldiers, by attacks against schools and hospitals, and through the restriction of humanitarian assistance. This includes direct effects such as death, physical injuries, illness, as well as indirect effects such as a range of diseases, environmental exposure leading to birth defects and cancer, reduced access to health care and school resulting in worse long-term health and educational outcomes, among others.

Further evidence on conflict and long-term health outcomes comes from papers studying exposure to World War II. Kesternich et al. (2011) use a number of war exposure measures, and test a number of possible channels, including dispossession, persecution, absence of a

father, missing childhood immunization, and hunger periods to consider the long-term health (and economic) outcomes of Western Europeans currently aged 50 and over that were exposed to war during World War II. They find war exposure increased the probability of suffering from diabetes, depression, heart disease (though this is more nuanced), and poor self-reported health. The authors also provide evidence of the importance of the possible channels.

Allais et al. (2021), who examine the physical health effects of World War II on French women, find that women who were exposed to more conflict during the first five years of their life were statistically more likely to suffer from a number of physical health ailments later in life. They also found that those who suffered from malnutrition during this period were also more likely to suffer from these ailments. The authors suggest that the cause of these negative outcomes is the stress induced from witnessing violence or having to escape the violence, or possibly from an increased likelihood of not having a father in the household, thus depriving the family of the resources he would have provided.

Along the same lines, Akbulut-Yuksel (2014) looks at Allied Armed Forces bombing in World War II Germany, and the subsequent labour market, health, and human capital development of those exposed to these bombings as children. For our purposes, the findings on height, mortality, and health satisfaction are most relevant, with the author finding those exposed to conflict experienced lower adult height, mixed evidence of increased mortality of those that survived the war, and lower satisfaction with their health for those that were from disadvantaged families as kids. The mechanism the author ties to these health findings centre around malnutrition as well as other possibilities of pollution, lack of clean water, and access to health care facilities also possibly playing a role. Similarly, Akbulut-Yuksel (2017) examines the long-term impact on the health of Germans who were exposed to allied air bombing during World War II while they were young or in utero. The author finds that an increased exposure to conflict at the early stages of life is associated with a higher BMI, increased probability of being obese, and a higher incidence of chronic disease later in life. The causal mechanism is suggested to be limited nutrition at a young age and limited access to medical facilities during the war.

Moving away from World War II, Li and Wen (2005) provide a cross-country study of the immediate and long-term effect of conflict on adult mortality over the 1961-1998 period. The authors highlight six channels through which conflict can affect mortality. These include immediate deaths during the fighting, the negative affect on the economy, health and

infrastructure destruction, reduced private and public spending on health, lower social cohesion, and finally the trauma and mental health effects of conflict. The authors find harmful negative effects on mortality at the immediate and long-run horizon. When considering gender differences, men are found to be more affected in terms of mortality in the immediate time horizon compared to women, while women tend to suffer in line with men over the long run in terms of mortality.

In a large cross-country study, Ghobarah et al. (2004) highlight four ways in which civil war can influence public health. This includes civil war increasing conditions such as poor food, water, malnutrition, sanitation, and violence (among others) that leads to increased risk of a worsened disease environment, injury and death. A second way is civil wars may reduce the amount of funds available for health care as well as the human and physical capital available for health provision due to things such as the destruction of hospitals and physical infrastructure as well as the loss of health care professionals. Additionally civil wars may reduce the amount dedicated to health following its completion as other areas become larger priorities for limited public budgets as the country rebuilds. Lastly, the authors argue that civil war can also negatively affect the efficiency with which those resources dedicated to health are used. All these the authors argue can link civil war to worsened health outcomes over the long run.

There are also examples of work on individual African countries. For example, Akresh et al. (2012) examine the impact that the Eritrean-Ethiopian War had on the physical health of children who experienced conflict during the period. They find that those children exposed to the war had significantly reduced heights compared to those not exposed. Some possible causal mechanisms are discussed, including lower nutritional intake due to reduced crop yields, increased exposure to diseases, and physical displacement which resulted in a loss of access to wealth and healthcare facilities. The authors find evidence of greater risk of death and disability due to a range of infectious diseases, as well as due to reduced social order leading to violence, and cervical cancer. The authors further show that over the long-run, women and children are most likely to be affected.

Related, Minoiu and Shemyakina (2014) examine the health impacts on children who were exposed to conflict in Cote D'Ivoire in the early 21st century and find that exposure to conflict led to a reduced height for children, with longer exposure leading to a larger reduction. The authors examine economic loss, health impairments, displacement, and whether they were themselves victims of violence as possible mechanisms for these outcomes. Children whose

families suffered from economic losses were more likely to experience the negative health impact of conflicts, as well as children who lived in a household where adults experienced direct violence or deaths during the conflict.

Moving to the literature on conflict and the health implications for immigrants rather than those remaining in the country of conflict, this is a large literature, with significant focus on the mental health implications for those migrating from war zones. Examples include Bogic et al. (2015), Joly and Wheaton (2015), Sangalang et al. (2019), Hou et al. (2020), Blackmore et al. (2020), Mesa-Viera et al. (2022), and Carpinello (2023). What we see emerging from these studies are general findings of current as well as life-time post-traumatic stress disorder, depression, and anxiety due to conflict exposure. Much less studied are the physical health effects of conflict for migrants. An exception is Green et al. (2018) who look at pre-migration conflict based on the Major Episodes of Political Violence database and post-migration self-reported health outcomes based on the Integrated Public Use Microdata Series for Central American immigrants to the United States. Using an ordered probit model they find that for females, after adjusting for age differences, pre-migration conflict is associated with an 8.6 percentage point decrease in excellent health, while for males it is associated with a 7.3 percentage point decrease. The authors further find that these health effects tend to decline over time for females while remaining constant for males.

Before moving to discussion of our data and empirical approach, we should point out that our work also informs a more general literature on Canadian immigrant health, of which there are many studies including Halli and Anchan (2005), Vang et al. (2017), Kwak (2018), Lacey et al. (2021), Morassaei et al. (2022), and Chai (2023). However, these studies do not account for whether there was a conflict in their home countries prior to immigrating, a variable we find is an important factor in determining their physical health.

3. Data and Empirical Approach

Our analysis requires measures of conflict and microdata on the physical health outcomes of immigrants. We use the 2007 to 2014 waves of Statistics Canada's Canadian Community Health Survey (CCHS) linked to the Longitudinal Immigration Database (IMDB). These datasets are widely used in the Canadian immigration literature (c.f. Warman et al. 2019; Ng and Zhang, 2020; and Woolley, 2021). The CCHS is a repeated cross-sectional survey that includes physical health measures, demographic and socioeconomic variables, and immigration year. The IMDB includes the census of immigrants to Canada from 1980 to 2020

based on administrative records from Immigration, Refugees and Citizenship Canada (IRCC) and tax files from the Canadian Revenue Agency. Our analysis focuses on immigrants who were aged 30 to 65 at the time of the CCHS.

Our conflict measures are based on the Uppsala Conflict Data Program/ International Peace Research Institute in Oslo Armed Conflict Dataset, which is the conflict literature's standard dataset for conflict measurement and is used in many of the papers we cite in this paper.² The UCDP/PRIO dataset includes the year and country of state armed conflicts, which are defined as "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in one calendar year" (Pettersson, 2023). This dataset spans 1946 to 2021 and categorizes conflicts as one of two intensity levels based on the number of battle-related deaths. Low intensity conflicts have between 25 and 999 battle deaths in a calendar year, while high intensity conflicts have deaths of 1,000 or more. For our analysis we only consider the latter of the two types of conflict. In the case of interstate conflict, we attribute the conflict to all states which saw battles occur within their borders.

We use these country-year measures of conflict, in conjunction with data from the IMDB and CCHS, to construct individual measures of conflict exposure. To construct our conflict variables, we use the country of birth and year of birth for each immigrant from the IMDB. From the CCHS, we require each individual's year of immigration to Canada to construct our conflict variable. For an individual immigrant, we define *conflict* as equal to one if there was conflict in the individual's country of birth between their year of birth and year of immigration to Canada (inclusive), and zero otherwise. We also calculate a more restrictive measure, *conflict at migration*, which is equal to one if there was conflict in the individual's country of birth the year of immigration to Canada or the year before, and zero otherwise. For sensitivity analysis, we expand the definition of conflict at immigration to equal one if there was conflict in the individual's country of birth the year of immigration to Canada or in the five years prior, and zero otherwise. Further, we create the variable *years of exposure to conflict*, which is the number of years the individuals' country of birth had been involved in conflict between their year of birth and year of immigration to Canada. We further create indicator variables for conflict in the individual's birth country (before immigration to Canada) in different age categories, which are not mutually exclusive. One age category is *in utero*, which is conflict in

² For more on this data please see Gleditsch et al (2002), Davies, Pettersson, and Öberg (2023), as well as <https://ucdp.uu.se/downloads/index.html#armedconflict>.

the individual's birth country in the year before they were born. We also create indicator variables for age at first exposure to conflict.

We estimate the following general model using a logit based on the following general regression³:

$$Y_i = \beta_0 + \beta_1 \text{Conflict}_i + \beta_2 X_i + \varepsilon_i \quad (1)$$

where Y is our health outcome measure for individual i , Conflict is our measure of conflict exposure, and X is a vector of demographic and socioeconomic controls. This allows us to compare immigrants who were exposed to those who were not. ε_i is an individual specific error term.

In terms of the dependent variable Y , we consider three measures of physical health. Our first is a self-assessed measure of *good physical health*, which is constructed using perceived health from the CCHS dataset. Respondents are asked to rate their health as poor, fair, good, very good or excellent. We construct our self-assessed good physical health measure as an indicator variable taking a value of 1 if the respondent rates his or her health as good, very good or excellent, and 0 otherwise. Second, we construct an indicator variable of *2+ chronic conditions* based on whether the individual reports at least two of the following chronic conditions: asthma, bronchitis, arthritis, back pain, high blood pressure, migraines, diabetes, heart disease, cancer, stomach ulcers, stroke, urinary incontinence, bowel disease, or dementia.⁴ Finally, we also construct a physical health index using principal component analysis (PCA). Health indices based on diagnosed health conditions have been commonly used in the health economics literature to obtain a more objective indicator for health (e. g. Hosseini et al., 2022). While the information on diagnosed conditions is still based on survey responses, such measures are sometimes referred to as quasi-objective and have been shown to be highly correlated with mortality (Poterba et al., 2017).

Yet, self-assessed health measures may include additional information on the severity of health problems and how they impact a person's life. Moreover, self-assessed health is not influenced by potential barriers to healthcare access. Hence, we include the five-point scale self-assessed physical health measure, three-point scale of the impact of health problems on life, three-point

³ Our results based on the principal component analysis health index is an exception, where we instead use traditional OLS for purposes of estimation.

⁴ Dementia is not collected in the CCHS for individuals less than 35 years old; for individuals less than 35 years old we assume dementia is zero. For 2008 and later, bronchitis includes chronic bronchitis, emphysema and chronic obstructive pulmonary disease (COPD). For 2007, the bronchitis indicator variable does not include chronic bronchitis.

Table 1: Principal Component Analysis Disability Weights (Full Sample and by Sex)

VARIABLES	(1) all	(2) male	(3) female
Asthma	-0.0442*** (0.000493)	-0.0446*** (0.000709)	-0.0441*** (0.000658)
Arthritis	-0.0845*** (0.000522)	-0.0846*** (0.000945)	-0.0845*** (0.000578)
Back pain	-0.0811*** (0.000354)	-0.0817*** (0.000535)	-0.0805*** (0.000454)
High blood pressure	-0.0624*** (0.000307)	-0.0620*** (0.000419)	-0.0625*** (0.000445)
Migraine	-0.0503*** (0.000365)	-0.0501*** (0.000620)	-0.0505*** (0.000443)
Diabetes	-0.0415*** (0.000473)	-0.0417*** (0.000630)	-0.0411*** (0.000721)
Heart disease	-0.0749*** (0.000685)	-0.0749*** (0.000767)	-0.0745*** (0.00113)
Cancer	-0.0493*** (0.00136)	-0.0493*** (0.00188)	-0.0496*** (0.00162)
Stomach ulcer	-0.0670*** (0.000622)	-0.0684*** (0.000733)	-0.0649*** (0.000854)
Stroke	-0.0653*** (0.00211)	-0.0655*** (0.00206)	-0.0661*** (0.00303)
Urinary incontinence	-0.0856*** (0.00101)	-0.0871*** (0.00146)	-0.0845*** (0.00109)
Bowel disease	-0.0592*** (0.000813)	-0.0586*** (0.00155)	-0.0597*** (0.000842)
Dementia	-0.0570*** (0.00338)	-0.0584*** (0.00451)	-0.0527*** (0.00148)
Bronchitis	-0.0567*** (0.00106)	-0.0540*** (0.00142)	-0.0589*** (0.00111)
Self-assessed health	0.0489*** (0.000135)	0.0489*** (0.000205)	0.0490*** (0.000174)
Impact of health problems	-0.0589*** (0.000556)	-0.0596*** (0.000967)	-0.0584*** (0.000627)
Limitations in participation/activities	-0.0613*** (0.000415)	-0.0610*** (0.000738)	-0.0616*** (0.000434)
Constant	0.799*** (0.000392)	0.799*** (0.000610)	0.798*** (0.000489)
Observations	10,315	4,990	5,325
R-squared	0.998	0.998	0.998

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

scale of participation/activity limitations, as well as indicator variables of whether the individual has been diagnosed with any of the chronic conditions listed above. We create the index using a polychoric PCA (Kolenikow and Angeles, 2009), which addresses the inclusion of indicator variables using polychoric and polyserial correlations. We use the first principal component to construct the health index, which we normalize to be between 0 and 1.

Table 1 shows the results of regressing the variables included in the PCA on the normalized physical health index. The results indicate the “disability weights”, i.e. how much each health condition impacts the health index. As expected, higher self-assessed physical health increases the physical health index, and each chronic condition decreases the physical health index.

Our model also includes several demographic and socioeconomic control variables. These include a female indicator, age as well as age-squared, education level indicators, language of interview indicators, indicator for mother tongue not English or French, adjusted income (measured in 10,000 CAD and inflation adjusted based on 2007 real values),⁵ married (or living common-law) indicator, unemployed indicator, indicator for at least twenty years since immigration, cultural/race background indicators, a rural indicator, province indicators, as well as survey year indicators. Additionally, we include indicator variables for region of birth based on World Bank classifications.⁶ In subsequent regressions, we add immigration categories as well. These variables were chosen based on those commonly seen in the determinants of health literature generally as well as the immigrant health literature (c.f. Sangalang et al., 2019; and Ng and Zhang, 2020). Summary statistics for our variables by sex are reported in Table 2.

Table 2: Descriptive statistics

VARIABLES	Male	Female
Good physical health	0.91	0.89
2+ chronic conditions	0.16	0.21
Physical Health Index	0.86	0.84
Conflict	0.58	0.58
Conflict at migration		
(0 to 1 years)	0.16	0.19
(0 to 5 years)	0.27	0.31
Age at first exposure to conflict		
0 to 5	0.23	0.24
6 to 12	0.15	0.15
13 to 18	0.10	0.10

⁵ Note that adjusted income is real income (in 10,000s 2007 dollars) divided by the square root of household size.

⁶ The World Bank classifications are East Asia and Pacific, Europe and Central Asia, Latin America and Caribbean, Middle East and North Africa, North America, South Asia, and Sub-Saharan Africa.
<https://datatopics.worldbank.org/sdgatlas/archive/2017/the-world-by-region.html>

>= 19	0.10	0.09
Age exposed to conflict		
<i>in utero</i>	0.10	0.09
0 to 5	0.23	0.24
6 to 12	0.28	0.28
13 to 18	0.27	0.28
>=19	0.37	0.38
Years of exposure to conflict	3.74	3.92
Immigration Category		
<i>Economic</i>	0.56	0.53
<i>Family</i>	0.27	0.33
<i>Refugee</i>	0.16	0.12
<i>Other</i>	0.01	0.01
Age	44.28	43.62
Education		
<i>Less than secondary school graduation</i>	0.07	0.07
<i>Secondary school graduate or some post-secondary education</i>	0.17	0.17
<i>Post-secondary degree/diploma</i>	0.76	0.75
Adjusted income (\$)	41,489.23	38,747.61
Married (or Common Law)	0.84	0.78
Unemployed	0.14	0.31
20+ years since immigration	0.28	0.28
Rural	0.04	0.03
Region		
<i>East Asia and Pacific</i>	0.26	0.30
<i>Europe and Central Asia</i>	0.22	0.20
<i>Latin America and Caribbean</i>	0.15	0.15
<i>Middle East and North Africa</i>	0.12	0.09
<i>North America</i>	0.02	0.03
<i>South Asia</i>	0.17	0.18
<i>Sub-Saharan Africa</i>	0.06	0.05
Mother tongue not English or French	0.82	0.83
Language of interview		
<i>English</i>	0.79	0.79
<i>French</i>	0.13	0.13
<i>Other</i>	0.07	0.08
Province		
<i>Newfoundland and Labrador</i>	0.00	0.00
<i>Prince Edward Island</i>	0.00	0.00
<i>Nova Scotia</i>	0.01	0.00
<i>New Brunswick</i>	0.00	0.00
<i>Quebec</i>	0.19	0.16
<i>Ontario</i>	0.52	0.54
<i>Manitoba</i>	0.02	0.02
<i>Saskatchewan</i>	0.01	0.01
<i>Alberta</i>	0.10	0.10
<i>British Columbia</i>	0.14	0.16
<i>Yukon</i>	0.00	0.00
<i>Northwest Territories</i>	0.00	0.00
<i>Nunavut</i>	0.00	0.00
Cultural/racial background		
<i>White only</i>	0.28	0.25
<i>Black only</i>	0.09	0.09
<i>Korean only</i>	0.01	0.01

<i>Filipino only</i>	0.07	0.11
<i>Japanese only</i>	0.00	0.01
<i>Chinese only</i>	0.13	0.13
<i>South Asian only</i>	0.17	0.18
<i>Southeast Asian only</i>	0.04	0.04
<i>Arab only</i>	0.05	0.05
<i>West Asian only</i>	0.04	0.03
<i>Latin American only</i>	0.07	0.06
<i>Other racial or cultural origin (only)</i>	0.02	0.02
<i>Multiple racial or cultural origins</i>	0.02	0.02
<i>Aboriginal identity</i>	0.00	0.00

4. Results

Our first set of regression results are presented in Table 3. This table provides the results for logit estimation of our first two physical health measures expressed as odds ratios. Recall that our first dependent variable, *good physical health*, takes on a value of one in the case of good, very good, or excellent self-assessed physical health, and a zero otherwise, and that our second physical health measure, *2+ chronic conditions*, takes on a value of one if an individual reports having two or more chronic conditions, and zero otherwise.

Before discussing the results of our conflict variables, a brief discussion of the control variables in Table 3 is necessary.⁷ Our findings with regards to these control variables are largely in line with the literature (Public Health Agency of Canada, 2008). Beginning with females, we see they are almost 5% less likely to report having good physical health (though this result is not statistically significant) and are about 38% more likely than males to report having two or more chronic health conditions. Not surprisingly we also find that not having good physical health and having two or more chronic conditions increases with age, though at a decreasing rate. When accounting for education, we see that relative to secondary school graduates, those with higher levels of education are more likely to report good physical health levels and less likely to have two or more chronic conditions. Those with less than a high school education prove not to be statistically different than secondary school graduates. We also see higher income associated with a higher likelihood of reporting good physical health. When considering income, for every 10,000 increase in adjusted household income, the probability of reporting good physical health increases by 8 or 9 percent, while no relationship is found for income and the reporting of two or more chronic conditions. Married individuals tend to be in better health

⁷ Note that these control variable results are rather consistent across the various regression specifications that follow.

than single individuals, even though the effects are not always statistically significant, while unemployed individuals report worse health. We find no significant effect on health of time since immigration.

We now turn our focus to the relationship between conflict exposure and immigrant health outcomes. Looking across our four different measures of conflict and two different measures of health in Table 3, we generally find that exposure to conflict prior to immigrating to Canada leads to worse physical health outcomes. This is true for both the probability of reporting having good physical health, which is lower with conflict, and from reporting two or more chronic conditions, which is higher with conflict. Though statistical significance is not consistent across all specifications, taking the results as a whole, we see a clear negative impact of experiencing conflict on physical health. The even numbered regression specifications in this table add additional control variables that capture the immigration category. Here we observe that immigrants arriving as refugees or in the family category are more likely to report lower health outcomes as compared to economic immigrants. Though the inclusion of immigration categories reduces the statistical significance of our findings, the qualitative results remain. Our finding that the physical health of Canadian immigrants is negatively impacted by exposure to conflict is once again confirmed with our PCA results, which are presented in Table 4. Here again we see that across our four potential measures of conflict exposure, there is a measured negative impact of conflict exposure on health. While the disability weight for a chronic condition lies between -0.04 and -0.09 , conflict reduces the health index by approximately 0.01 , which is a meaningful reduction of health.

Much of the conflict literature finds that the effect of conflict differs across sex. To investigate this possibility, we divide our sample between males and females and re-run the regressions on these two subgroups, the results of which are shown in Table 5. The same control variables are used as in our previous regressions in Table 3. Females who are exposed to conflict are much less likely to report having good physical health compared to those who were not exposed. While the statistical significance of the results varies across measures, the qualitative result holds for all our health outcomes as well as all our conflict measures with only one exception. The negative effect of being exposed to conflict on physical health is larger for females than it is for males, when it comes to perceived health. Looking at the results for having two or more chronic conditions, we do not find a clear pattern across our conflict measures for the difference between the sexes. With one of the conflict variables, we find a large and statistically significant

Table 3: Odds ratios of the effect of conflict on physical health

VARIABLES	good physical health								2+ chronic conditions							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Conflict	0.976 (0.148)	1.039 (0.168)							1.207* (0.133)	1.192 (0.135)						
Conflict at migration (0 to 1 year)			0.718+ (0.115)	0.787 (0.119)							1.199 (0.166)	1.163 (0.159)				
Conflict at migration (0 to 5 years)					0.825 (0.109)	0.919 (0.124)							1.219+ (0.120)	1.180 (0.120)		
Years of exposure to conflict							0.977+ (0.011)	0.986 (0.012)							1.001 (0.010)	0.996 (0.011)
Immigration category																
<i>Economic (ref.)</i>		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)
<i>Family</i>		0.730° (0.080)		0.732° (0.080)		0.730° (0.080)		0.729° (0.079)		1.265+ (0.118)		1.258+ (0.117)		1.258+ (0.118)		1.260+ (0.117)
<i>Refugee</i>		0.466° (0.065)		0.485° (0.069)		0.477° (0.072)		0.484° (0.072)		1.363° (0.138)		1.362° (0.149)		1.342° (0.149)		1.404° (0.157)
<i>Other</i>		0.318+ (0.147)		0.324+ (0.145)		0.318+ (0.144)		0.317+ (0.143)		2.058* (0.830)		1.993* (0.788)		2.007* (0.797)		2.015* (0.813)
Female	0.962 (0.126)	0.947 (0.122)	0.976 (0.127)	0.958 (0.122)	0.970 (0.127)	0.951 (0.123)	0.963 (0.128)	0.950 (0.123)	1.380° (0.156)	1.385° (0.153)	1.373° (0.151)	1.380° (0.149)	1.373° (0.154)	1.379° (0.151)	1.385° (0.155)	1.391° (0.153)
Age	0.798° (0.053)	0.797° (0.054)	0.799° (0.053)	0.799° (0.054)	0.797° (0.052)	0.798° (0.054)	0.792° (0.052)	0.795° (0.053)	1.162° (0.059)	1.164° (0.059)	1.163° (0.058)	1.165° (0.058)	1.165° (0.058)	1.167° (0.058)	1.165° (0.058)	1.165° (0.058)
Age squared	1.002° (0.001)	1.002+ (0.001)	1.002° (0.001)	1.002+ (0.001)	1.002° (0.001)	1.002° (0.001)	1.002° (0.001)	1.002° (0.001)	0.999 (0.001)	0.999 (0.001)	0.999 (0.001)	0.999 (0.001)	0.999 (0.001)	0.999 (0.001)	0.999 (0.001)	0.999 (0.001)
Education																
<i>Less than secondary school graduation</i>	0.927 (0.205)	0.994 (0.224)	0.936 (0.210)	0.995 (0.227)	0.931 (0.205)	0.992 (0.224)	0.948 (0.211)	1.003 (0.228)	1.303 (0.326)	1.263 (0.307)	1.288 (0.322)	1.251 (0.304)	1.289 (0.320)	1.253 (0.303)	1.293 (0.323)	1.256 (0.307)
<i>Secondary school graduation (ref.)</i>	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)
<i>Post-secondary</i>	1.550° (0.207)	1.419+ (0.201)	1.549° (0.206)	1.421+ (0.200)	1.542° (0.205)	1.416+ (0.200)	1.535° (0.207)	1.412+ (0.200)	0.845* (0.080)	0.888 (0.084)	0.845* (0.079)	0.887 (0.083)	0.849* (0.078)	0.890 (0.083)	0.844* (0.079)	0.886 (0.083)

Income	1.092° (0.032)	1.080° (0.030)	1.092° (0.032)	1.080° (0.030)	1.092° (0.032)	1.080° (0.030)	1.090° (0.031)	1.080° (0.030)	0.996 (0.012)	0.999 (0.011)	0.996 (0.012)	0.999 (0.011)	0.996 (0.012)	0.999 (0.011)	0.996 (0.012)	0.999 (0.011)
Married	1.868° (0.241)	1.774° (0.242)	1.871° (0.241)	1.781° (0.242)	1.861° (0.240)	1.775° (0.243)	1.857° (0.244)	1.773° (0.244)	0.854 (0.102)	0.875 (0.105)	0.854 (0.102)	0.875 (0.105)	0.858 (0.103)	0.878 (0.106)	0.856 (0.102)	0.877 (0.105)
Unemployed	0.498° (0.067)	0.503° (0.067)	0.496° (0.066)	0.501° (0.066)	0.496° (0.066)	0.502° (0.066)	0.499° (0.067)	0.503° (0.067)	1.705° (0.179)	1.682° (0.176)	1.711° (0.179)	1.687° (0.176)	1.717° (0.179)	1.693° (0.177)	1.707° (0.180)	1.684° (0.177)
20+ years since immigration	1.119 (0.127)	1.187 (0.131)	1.146 (0.134)	1.197 (0.137)	1.128 (0.130)	1.183 (0.133)	1.081 (0.124)	1.154 (0.133)	1.123 (0.090)	1.087 (0.094)	1.089 (0.090)	1.058 (0.092)	1.099 (0.090)	1.066 (0.092)	1.102 (0.086)	1.059 (0.088)
Constant	2,268° (3,416)	3,273° (5,123)	2,137° (3,193)	3,089° (4,813)	2,335° (3,459)	3,266° (5,046)	2,585° (3,849)	3,468° (5,353)	0.001° (0.001)	0.001° (0.001)	0.001° (0.001)	0.001° (0.001)	0.001° (0.001)	0.001° (0.001)	0.001° (0.001)	0.001° (0.001)
Observations	13840	13840	13840	13840	13840	13840	13840	13840	11855	11855	11855	11855	11855	11855	11855	11855
Pseudo R squared	0.101	0.111	0.103	0.112	0.102	0.111	0.103	0.112	0.093	0.095	0.093	0.095	0.093	0.096	0.092	0.095

Note: ° p<0.01, + p<0.05, * p<0.1. Robust standard errors in parentheses. Further variables included but not reported: language of interview, mother tongue not English or French, rural, province of residence, CCHS wave dummies, region of birth country, cultural/racial background.

Table 4: OLS estimates of the effect of conflict on physical health

VARIABLES	PCA health index							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict	-0.008 (0.006)	-0.005 (0.006)						
Conflict at migration (0 to 1 year)			-0.008 (0.006)	-0.004 (0.005)				
Conflict at migration (0 to 5 years)					-0.014+ (0.006)	-0.009 (0.006)		
Years of exposure to conflict							-0.001+ (0.001)	-0.001 (0.001)
Immigration category								
<i>Economic (ref.)</i>		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)
<i>Family</i>		-0.009* (0.005)		-0.009* (0.005)		-0.009* (0.005)		-0.009* (0.005)
<i>Refugee</i>		-0.038° (0.006)		-0.038° (0.006)		-0.037° (0.006)		-0.037° (0.006)
<i>Other</i>		-0.025 (0.020)		-0.024 (0.020)		-0.024 (0.020)		-0.024 (0.020)
Female	-0.019° (0.006)	-0.019° (0.006)	-0.019° (0.006)	-0.019° (0.006)	-0.018° (0.006)	-0.019° (0.006)	-0.019° (0.006)	-0.019° (0.006)
Age	-0.009+ (0.004)	-0.009+ (0.003)	-0.009+ (0.004)	-0.009+ (0.003)	-0.009+ (0.004)	-0.009+ (0.003)	-0.009+ (0.004)	-0.009° (0.003)
Age squared	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Education								
<i>Less than secondary school graduation</i>	-0.027* (0.014)	-0.024* (0.014)	-0.027* (0.014)	-0.024* (0.014)	-0.026* (0.014)	-0.024* (0.014)	-0.025* (0.014)	-0.023* (0.014)
<i>Secondary school graduation (ref.)</i>	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)
<i>Post-secondary</i>	0.012* (0.007)	0.008 (0.007)	0.012* (0.007)	0.008 (0.007)	0.012* (0.007)	0.008 (0.007)	0.012* (0.007)	0.008 (0.007)

Income	0.002° (0.001)	0.002° (0.001)	0.002° (0.001)	0.002° (0.001)	0.002° (0.001)	0.002° (0.001)	0.002° (0.001)	0.002° (0.001)
Married	0.021° (0.006)	0.019° (0.006)	0.021° (0.006)	0.019° (0.006)	0.021° (0.006)	0.019° (0.006)	0.020° (0.006)	0.018° (0.006)
Unemployed	-0.046° (0.007)	-0.046° (0.006)	-0.046° (0.007)	-0.046° (0.006)	-0.047° (0.007)	-0.046° (0.006)	-0.046° (0.007)	-0.046° (0.006)
20+ years since immigration	0.000 (0.005)	0.004 (0.005)	0.001 (0.005)	0.004 (0.006)	0.001 (0.005)	0.004 (0.006)	-0.001 (0.005)	0.003 (0.005)
Constant	1.119° (0.077)	1.125° (0.073)	1.119° (0.077)	1.125° (0.073)	1.124° (0.076)	1.128° (0.073)	1.125° (0.075)	1.128° (0.072)
Observations	10315	10315	10315	10315	10315	10315	10315	10315
Pseudo R squared	0.119	0.126	0.119	0.126	0.120	0.126	0.120	0.126

Note: ° p<0.01, + p<0.05, * p<0.1. Robust standard errors in parentheses. Further variables included but not reported: language of interview, mother tongue not English or French, rural, province of residence, CCHS wave dummies, region of birth country, cultural/racial background.

increase in the probability of having two or more chronic conditions for females, and a smaller insignificant effect for males. In the case of the other three conflict variables, the impact is of a similar magnitude. Table 6 shows the results for our PCA index divided by sex. Again, we find some indication that the impact of conflict is larger on females than it is for males, as two of our conflict variables show a large magnitude for the former group. While the differences are not statistically different, taking all these results together suggests that being exposed to conflict as a female prior to immigrating to Canada may lead to a larger drop in physical health than a similar exposure does for males. Some point estimates, albeit statistically insignificant, are somewhat puzzling as they point to a positive effect of exposure to conflict on health.

Next we explore another result often found in the literature, the idea that the impact of conflict is felt more severely for those who are young, and that those exposed to conflict at a young age can experience sizeable long-run health implications as a result (see some of our previous discussion on this topic in section 2). To investigate this, we introduce variables which account for the ages at which immigrants were exposed to conflict. In the upper half of Tables 7 and 8 we include indicator variables which take on the value of one if the immigrant was exposed to conflict at any time while in these age brackets. The lower half of these tables use similar indicator variables, but they only take a value of one at the lowest age bracket in which an immigrant was exposed to conflict. We also continue to split our sample by sex when running these regressions.

Looking across the age brackets, we first notice that for the 0 to 5 age category for females, we see a particularly large negative impact of exposure to conflict on health. This is seen across all three of our health measures. Having been exposed to violence by age 5, females are much less likely to report having good health, much more likely to report having two or more chronic conditions, and more likely to score lower on our PCA health index. Interestingly, we find the opposite result for males. Exposure to conflict at this age is associated with having better health later in life. On the surface, this may seem like a perplexing result, but may be a result of families prioritizing the health and wellbeing of sons rather than daughters during periods of conflict. If a family's resources, e.g. with respect to investments in education, are directed away from girls and towards boys, especially during times of conflict, this may explain some of the results observed here (Buvinic et al. 2013, Sabarwal et al. 2010).

Table 5: Odds ratios of the effect of conflict on physical health by sex

VARIABLES	good physical health - male								2+ chronic conditions - male							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Conflict	1.159 (0.278)	1.238 (0.325)							1.083 (0.215)	1.067 (0.213)						
Conflict at migration (0 to 1 year)			0.851 (0.154)	0.976 (0.173)							1.292 (0.246)	1.230 (0.241)				
Conflict at migration (0 to 5 years)					0.858 (0.150)	0.975 (0.166)							1.241 (0.184)	1.189 (0.180)		
Years of exposure to conflict							0.989 (0.018)	0.996 (0.018)							0.990 (0.016)	0.988 (0.016)
Immigration category																
<i>Economic (ref.)</i>		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)
<i>Family</i>		0.726+ (0.110)		0.725+ (0.109)		0.725+ (0.109)		0.724+ (0.110)		1.457+ (0.252)		1.445+ (0.253)		1.447+ (0.252)		1.452+ (0.252)
<i>Refugee</i>		0.445° (0.087)		0.458° (0.091)		0.459° (0.089)		0.459° (0.090)		1.430° (0.198)		1.395+ (0.203)		1.389+ (0.199)		1.471° (0.208)
<i>Other</i>		0.163° (0.088)		0.160° (0.086)		0.160° (0.085)		0.160° (0.086)		2.398 (1.380)		2.306 (1.262)		2.349 (1.317)		2.381 (1.386)
Observations	6475	6475	6475	6475	6475	6475	6475	6475	5685	5685	5685	5685	5685	5685	5685	5685
Pseudo R squared	0.132	0.147	0.132	0.146	0.132	0.146	0.132	0.146	0.106	0.111	0.107	0.111	0.107	0.111	0.106	0.111

	good physical health - female								2+ chronic conditions - female							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Conflict	0.894 (0.150)	0.948 (0.159)							1.357+ (0.193)	1.320* (0.193)						
Conflict at migration (0 to 1 year)			0.630+ (0.120)	0.673+ (0.126)							1.126 (0.191)	1.090 (0.185)				
Conflict at migration (0 to 5 years)					0.814 (0.141)	0.889 (0.157)							1.234 (0.193)	1.185 (0.194)		
Years of exposure to conflict							0.968+ (0.014)	0.979 (0.014)							1.007 (0.012)	1.000 (0.013)
Immigration category																
<i>Economic (ref.)</i>		1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)	1.000 (-)
<i>Family</i>		0.720* (0.127)	0.724* (0.128)	0.721* (0.127)	0.723* (0.128)	0.721* (0.127)	0.723* (0.128)	0.723* (0.128)	1.069 (0.122)	1.069 (0.122)	1.065 (0.122)	1.065 (0.122)	1.065 (0.123)	1.065 (0.123)	1.065 (0.123)	1.065 (0.122)
<i>Refugee</i>		0.494° (0.128)	0.519+ (0.138)	0.503+ (0.137)	0.524+ (0.142)	0.503+ (0.137)	0.524+ (0.142)	0.524+ (0.142)	1.356+ (0.210)	1.356+ (0.210)	1.388+ (0.229)	1.388+ (0.229)	1.351* (0.231)	1.351* (0.231)	1.403+ (0.231)	1.403+ (0.237)
<i>Other</i>		0.593 (0.336)	0.609 (0.341)	0.598 (0.336)	0.598 (0.334)	0.598 (0.336)	0.598 (0.334)	0.598 (0.334)	1.601 (0.731)	1.601 (0.731)	1.546 (0.700)	1.546 (0.700)	1.551 (0.702)	1.551 (0.702)	1.551 (0.702)	1.551 (0.706)
Observations	7320	7320	7320	7320	7320	7320	7320	7320	6170	6170	6170	6170	6170	6170	6170	6170
Pseudo R squared	0.112	0.119	0.116	0.122	0.113	0.119	0.114	0.120	0.098	0.099	0.096	0.098	0.097	0.099	0.096	0.098

Note: ° p<0.01, + p<0.05, * p<0.1. Robust standard errors in parentheses. Further variables included but not reported: Full set of socio-demographic controls, language of interview, mother tongue not English or French, rural, province of residence, CCHS wave dummies, region of birth country, cultural/racial background.

Table 6: OLS estimates of the effect of conflict on physical health by sex

PCA health index - male								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict	-0.003 (0.010)	-0.001 (0.010)						
Conflict at migration (0 to 1 year)			-0.012* (0.007)	-0.009 (0.007)				
Conflict at migration (0 to 5 years)					-0.014* (0.008)	-0.010 (0.007)		
Years of exposure to conflict							-0.000 (0.001)	0.000 (0.001)
Immigration category								
<i>Economic (ref.)</i>		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)
<i>Family</i>		-0.012 (0.007)		-0.011* (0.007)		-0.0114* (0.007)		-0.0113 (0.007)
<i>Refugee</i>		-0.031° (0.008)		-0.030° (0.008)		-0.029° (0.008)		-0.032° (0.008)
<i>Other</i>		-0.046* (0.026)		-0.044* (0.025)		-0.045* (0.025)		-0.045* (0.026)
Observations	4990	4990	4990	4990	4990	4990	4990	4990
Pseudo R squared	0.131	0.137	0.132	0.138	0.133	0.138	0.131	0.137

PCA health index - female								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict	-0.013* (0.007)	-0.006 (0.007)						
Conflict at migration (0 to 1 year)			0.000 (0.009)	0.005 (0.008)				
Conflict at migration (0 to 5 years)					-0.013* (0.007)	-0.006 (0.007)		
Years of exposure to conflict							-0.003° (0.001)	-0.002+ (0.001)
Immigration category								
<i>Economic (ref.)</i>		1.000 (-)		1.000 (-)		1.000 (-)		1.000 (-)
<i>Family</i>		-0.005 (0.008)		-0.004 (0.008)		-0.004 (0.008)		-0.005 (0.007)
<i>Refugee</i>		-0.050° (0.010)		-0.051° (0.011)		-0.049° (0.011)		-0.045° (0.011)
<i>Other</i>		0.002 (0.028)		0.003 (0.028)		0.003 (0.028)		0.003 (0.028)
Observations	5325	5325	5325	5325	5325	5325	5325	5325
Pseudo R squared	0.128	0.137	0.127	0.137	0.128	0.137	0.131	0.138

Note: ° p<0.01, + p<0.05, * p<0.1. Robust standard errors in parentheses. Further variables included but not reported: Full set of socio-demographic controls, language of interview, mother tongue not English or French, rural, province of residence, CCHS wave dummies, region of birth country, cultural/racial background.

5. Conclusion

In 2022, over 108 million people were forced to flee worldwide as a result of persecution, conflict, violence, human rights violations and events seriously disturbing public order (UNHCR 2024). While many are displaced internally, others migrate to other countries. For countries receiving these immigrants, it is key to understand their special situation and needs to achieve a successful integration. In this paper, we therefore use multiple waves of Statistics Canada's Canadian Community Health Survey linked with the Longitudinal Immigration Database, as well as conflict data from the Uppsala Conflict Data Program /International Peace Research Institute in Oslo Armed Conflict Dataset, to create a unique data set that allows us to examine the effect of pre-migration conflict on the post-migration physical health outcomes of immigrants to Canada. Our results demonstrate a robust impact of exposure to conflict on immigrants who later come to Canada. Across our three health measures and four conflict variables, we see a clear negative impact on having been exposed to conflict on one's physical health. While the statistical significance of the results is weakened by the inclusion of immigration classes, the size of the effects remains largely unchanged, which we interpret that exposure to conflict is indeed the source of the documented post-immigration health alignments. Breaking the data down into subcategories reveals that this exposure to conflict is particularly harmful for females, and particularly harmful to females exposed to conflict by the age of five, indicating that this group may require additional support.

Our literature review provided a number of potential mechanisms through which conflict could lead to the long-lasting negative health effects observed post migration. Though we are not able to comment on which of these is the most salient in the case of Canadian immigrants, our results do show that these mechanisms appear potentially important for females and especially those having experienced conflict at a very young age. This result aligns with the finding in numerous health studies that examine the long-term health impact of shocks experienced by females as well as at early ages (Garry and Checchi, 2020; Kadir et al., 2020). As we speculated above, the finding that exposure to conflict has more harmful health consequences for young girls may be a result of resources being diverted away from females and towards males during periods of scarcity (Buvinic et al. 2013; Sabarwal et al. 2010).

To contextualize the size of our estimated effect, one important data limitation regarding our measure of exposure to conflict needs to be highlighted. Since conflicts are often localized, a conflict may have occurred in a region that did not directly impact all immigrants from one

Table 7: Odds ratios of the effect of age of (first) exposure to conflict on physical health by sex

VARIABLES	good physical health - male				good physical health - female				2+ chronic conditions - male				2+ chronic conditions - female			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Age exposed to conflict																
In utero	1.475 (0.398)	1.488 (0.406)			0.961 (0.385)	1.006 (0.404)			0.897 (0.168)	0.917 (0.172)			1.098 (0.245)	1.069 (0.230)		
0 to 5	1.534+ (0.311)	1.561+ (0.303)			0.701* (0.130)	0.681+ (0.127)			0.652* (0.146)	0.642* (0.147)			1.533° (0.191)	1.550° (0.198)		
6 to 12	0.982 (0.164)	0.959 (0.163)			1.166 (0.238)	1.188 (0.247)			1.302 (0.212)	1.297 (0.220)			0.867 (0.117)	0.864 (0.117)		
13 to 18	1.161 (0.209)	1.180 (0.220)			0.845 (0.120)	0.871 (0.114)			0.760* (0.117)	0.760* (0.117)			1.306+ (0.153)	1.279+ (0.148)		
>=19	1.052 (0.236)	1.165 (0.249)			0.848 (0.127)	0.895 (0.136)			1.353* (0.247)	1.322 (0.241)			0.784 (0.147)	0.752 (0.147)		
Age at first exposure to conflict																
0 to 5			1.608* (0.439)	1.701* (0.499)			0.703* (0.148)	0.729 (0.153)			0.857 (0.200)	0.842 (0.195)		1.711° (0.293)	1.682° (0.295)	
6 to 12			1.011 (0.326)	1.040 (0.370)			0.943 (0.205)	0.995 (0.210)			1.350 (0.380)	1.347 (0.392)		1.325 (0.264)	1.295 (0.256)	
13 to 18			0.803 (0.246)	0.842 (0.272)			0.945 (0.215)	1.019 (0.234)			1.164 (0.242)	1.163 (0.240)		1.207 (0.225)	1.162 (0.227)	
>= 19			1.072 (0.313)	1.209 (0.368)			1.127 (0.244)	1.243 (0.282)			1.146 (0.283)	1.123 (0.285)		1.199 (0.218)	1.151 (0.215)	
Observations	6475	6475	6475	6475	7320	7320	7320	7320	5685	5685	5685	5685	6170	6170	6170	6170
Pseudo R squared	0.138	0.153	0.137	0.151	0.116	0.122	0.114	0.122	0.111	0.115	0.108	0.113	0.101	0.103	0.099	0.101

Note: ° p<0.01, + p<0.05, * p<0.1. Robust standard errors in parentheses. Further variables included but not reported: Full set of socio-demographic controls, language of interview, mother tongue not English or French, rural, province of residence, CCHS wave dummies, region of birth country, cultural/racial background. Even numbered columns also include immigration categories.

Table 8: OLS estimates of the effect of age of (first) exposure to conflict on physical health by sex

VARIABLES	PCA health index - male				PCA health index - female			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age exposed to conflict								
In utero	0.019 (0.018)	0.019 (0.018)			-0.001 (0.015)	0.002 (0.014)		
0 to 5	0.007 (0.010)	0.008 (0.010)			-0.011* (0.006)	-0.011* (0.006)		
6 to 12	-0.002 (0.007)	-0.001 (0.007)			0.005 (0.007)	0.005 (0.007)		
13 to 18	0.012 (0.012)	0.013 (0.012)			-0.020+ (0.009)	-0.018+ (0.009)		
>=19	-0.012 (0.008)	-0.009 (0.008)			-0.004 (0.010)	0.002 (0.010)		
Age at first exposure to conflict								
0 to 5			0.004 (0.012)	0.006 (0.013)			-0.016* (0.008)	-0.012 (0.008)
6 to 12			-0.010 (0.011)	-0.008 (0.012)			-0.014 (0.009)	-0.009 (0.009)
13 to 18			-0.006 (0.013)	-0.005 (0.013)			-0.011 (0.011)	-0.005 (0.011)
>= 19			-0.003 (0.017)	-0.001 (0.017)			-0.009 (0.010)	0.000 (0.011)
Observations	4990	4990	4990	4990	5325	5325	5325	5325
Pseudo R squared	0.134	0.141	0.132	0.138	0.130	0.139	0.128	0.137

Note: ° p<0.01, + p<0.05, * p<0.1. Robust standard errors in parentheses. Further variables included but not reported: Full set of socio-demographic controls, language of interview, mother tongue not English or French, rural, province of residence, CCHS wave dummies, region of birth country, cultural/racial background. Even numbered columns also include immigration categories.

country. While the possibility of violence spreading into one's region may still be a source of stress which could produce relevant changes in physical as well as mental health, we do not observe whether individuals were directly exposed to conflict or not. Rather, we calculate individual level measures of conflict based on available data, i.e. whether one was born in a country that has been involved in conflict prior to migration to Canada. This data limitation could lead us to underestimate the effect of conflict on our health outcome measures, and so our estimates should be seen as a lower bound of what is possibly a much larger effect. Future work should aim to better identify whether it was likely that an immigrant from a country was directly exposed to a conflict rather than just having lived in a country at the time of conflict.

Finally, from a policy perspective, a number of implications emerge from this work. As the number of conflicts in the world is expanding, it is likely that a sizable proportion of arriving immigrants will have been exposed to conflict at some point in their life. Our results suggest that the physical health of these immigrants is likely to be less robust than previous cohorts of immigrants who were less likely to be exposed to conflict, which receiving countries should take into consideration. Canada is currently in the process of increasing the number of immigrants that it accepts, with an ultimate goal of reaching 500,000 new immigrants per year by 2025. Provincial governments, who handle healthcare in Canada, must therefore be prepared for increased demand on healthcare services moving forward. Coupled with increased healthcare demand due to ongoing demographic shifts in Canada, without policy interventions the result will be further shortages and longer wait times in the future.

References

- Akbulut-Yuksel, M., 2014. Children of war: the long- run effects of large- scale physical destruction and warfare on children. *Journal of Human Resources* 49(3), 634-662.
- Akbulut-Yuksel, M., 2017. War During Childhood: The Long run effects of warfare on health. *Journal of Health Economics* 53, 117-130.
- Akresh, R., Lucchetti, L., Thirumurthy, H., 2012. Wars and child health: Evidence from the Eritrean–Ethiopian conflict. *Journal of Development Economics* 99(2), 330-340.
- Allais, O., Fagherazzi, G., Mink, J. 2021. The long-run effects of war on health: Evidence from World War II in France. *Social Science & medicine* 276, 113812.
- Blackmore, R., Boyle, J.A., Fazel, M., Ranasinha, S., Gray, K.M., Fitzgerald, G., Misso, M. Gibson-Helm, M., 2020. The prevalence of mental illness in refugees and asylum seekers: A systematic review and meta-analysis. *PLoS Medicine* 17(9), p.e1003337.
- Bogic, M., Njoku, A., Priebe, S., 2015. Long-term mental health of war-refugees: A systematic literature review. *BMC International Health and Human Rights* 15(1), 1-41.
- Brakman, S., Garretsen, H., Schramm, M., 2004. The strategic bombing of cities in Germany in World War II and its impact on city growth. *Journal of Economic Geography* 4(1),1–18.
- Buvinic, M., Das Gupta, M., Casabonne, U., Verwimp, P., 2013. Violent conflict and gender inequality: An overview. *The World Bank Research Observer* 28(1).
- Carpiniello, B., 2023. The mental health costs of armed conflicts—A review of systematic reviews conducted on refugees, asylum-seekers and people living in war zones. *International Journal of Environmental Research and Public Health* 20(4), 2840.
- Chai, L., 2023. Unpacking the association between length of residence and health among immigrants in Canada: A moderated mediation approach. *Journal of Immigrant and Minority Health* 25(1), 38-49.
- Davies, S., Pettersson, T., Öberg, M., 2023. Organized violence 1989–2022, and the return of conflict between states. *Journal of Peace Research*, p.00223433231185169.
- Garry, S., Checchi, F., 2020. Armed conflict and public health: into the 21st century. *Journal of Public Health*, 42(3), e287-e298.
- Ghobarah, H.A., Huth, P., Russett, B., 2004. The post-war public health effects of civil conflict. *Social Science & Medicine* 59(4), 869-884.
- Green, J.C., BeLue, R., Boakye, E.A., Choi, E., Vaughn, M.G., 2018. Armed conflict in central America and immigrant health in the United States. *Annals of Global Health* 84(4), 654-662.
- Gleditsch NP, Wallensteen P, Eriksson M, Sollenberg M, Strand H., 2002. Armed conflict 1946-2001: A new dataset. *Journal of Peace Research* 39(5), 615-37.
- Halli, S.S., Anchan, J.P., 2005. Structural and behavioural determinants of immigrant and non-immigrant health status: results from the Canadian Community Health Survey. *Journal of International Migration and Integration/Revue de l'integration et de la migration internationale* 6, 93-123.
- Hosseini, R., Kopecky, K. A., Zhao, K., 2022. The evolution of health over the life cycle. *Review of Economic Dynamics*, 45, 237-263.
- Joly, M.P., Wheaton, B., 2015. The impact of armed conflict in the country of origin on mental

health after migration to Canada. *Society and Mental Health* 5(2), 86–105.

Justino, P., Leone, M., Salardi, P., 2014. Short and long-term impact of violence on education: The case of Timor Leste. *World Bank Economic Review* 28(2), 320-353.

Kadir, A., Shenoda, S. Goldhagen, J., 2019. Effects of armed conflict on child health and development: a systematic review. *PloS One* 14(1), e0210071.

Kesternich, I., Siflinger, B., Smith, J.P. and Winter, J.K., 2014. The effects of World War II on economic and health outcomes across Europe. *Review of Economics and Statistics* 96(1), 103-118.

Kolenikov, S., Angeles, G., 2009. Socioeconomic status measurement with discrete proxy variables: Is principal component analysis a reliable answer?" *Review of Income and Wealth* 55 (1), 128–165

Kwak, K., 2018. Age and gender variations in healthy immigrant effect: A population study of immigrant well-being in Canada. *Journal of International Migration and Integration* 19(2), 413-437.

Lacey, K.K., Briggs, A.Q., Park, J. Jackson, J.S., 2021. Social and economic influences on disparities in the health of racial and ethnic group Canadian immigrants. *Canadian Journal of Public Health* 112, 482-492.

Li, Q., Wen, M., 2005. The immediate and lingering effects of armed conflict on adult mortality: a time-series cross-national analysis. *Journal of Peace Research* 42(4), pp.471-492.

Lokot, M., Bou-Orm, I., Zreik, T., Kik, N., Fuhr, D.C., El Masri, R., Meagher, K., Smith, J., Asmar, M.K., McKee, M., Roberts, B., 2022. Health system governance in settings with conflict-affected populations: a systematic review. *Health Policy and Planning* 37(5), 655-674.

Mesa-Vieira, C., Haas, A.D., Buitrago-Garcia, D., Roa-Diaz, Z.M., Minder, B., Gamba, M., Salvador, D., Gomez, D., Lewis, M., Gonzalez-Jaramillo, W.C., de Mortanges, A.P., 2022. Mental health of migrants with pre-migration exposure to armed conflict: a systematic review and meta-analysis. *The Lancet Public Health* 7(5), e469-e481.

Miguel, E., Roland, G., 2011. The long run impact of bombing Vietnam. *Journal of Development Economics* 96(1), 1–15.

Minoiu, C., & Shemyakina, O., 2012. Child health and conflict in Côte d'Ivoire. *American Economic Review* 102(3), 294-299.

Morassaei, S., Irvin, E., Smith, P.M., Wilson, K., Ghahari, S., 2022. The role of immigrant admission classes on the health and well-being of immigrants and refugees in Canada: A scoping review. *Journal of Immigrant and Minority Health* 24(4), 1045-1060.

Ng, E., Zhang, H., 2020. The mental health of immigrants and refugees: Canadian evidence from a nationally linked database. *Health Reports*, 3-12.

Pettersson, T. 2023. UCDP/PRIO Armed Conflict Dataset Codebook Version 23.1. Uppsala Conflict Data Program, 1-19.

Poterba, J. Venti, S., Wise, D., 2017. The asset cost of poor health. *The Journal of the Economics of Ageing* 9, 172-184.

Public Health Agency of Canada, 2008. The Chief Public Health Officer's Report on the State of Public Health. Chapter 4. Social and economic factors that influence our health and contribute to health inequalities report. Catalogue no. HP2-10/2008E. Available: <http://www.phac-aspc.gc.ca/cphorsphc-respcacsp/2008/fr-rc/cphorsphc-respcacsp07i-eng.php>.

Raina P, Gilsing, A., Mayhew, A.J., Sohel, N., van den Heuvel, E., Griffith, L.E., 2020. Individual and population level impact of chronic conditions on functional disability in older adults. *PLoS ONE* 15(2).

Ramirez, D., Haas, S.A., 2021. The long arm of conflict: How timing shapes the impact of childhood exposure to war. *Demography* 58(3), 951-974.

Sabarwal, S., Sinha, N., Buvinic, M. 2010. How do women weather economic shocks? A review of the evidence. World Bank Policy Research Working Paper, (5496).

Salive, M.E., 2013. Multimorbidity in Older Adults, *Epidemiologic Reviews*, Volume 35, Issue 1, 2013, Pages 75–83.

Sangalang, C.C., Becerra, D., Mitchell, F.M., Lechuga-Peña, S., Lopez, K. Kim, I., 2019. Trauma, post-migration stress, and mental health: A comparative analysis of refugees and immigrants in the United States. *Journal of Immigrant and Minority Health* 21, 909-919.

UNHCR. (2024). Data and Statistics Global Trends. UNHCR. <https://www.unhcr.org/global-trends>.

Vang, Z.M., Sigouin, J., Flenon, A., Gagnon, A., 2017. Are immigrants healthier than native-born Canadians? A systematic review of the healthy immigrant effect in Canada. *Ethnicity & Health* 22(3), 209-241.

Warman, C., Webb, M.D., Worswick, C., 2019. Immigrant category of admission and the earnings of adults and children: how far does the apple fall? *Journal of Population Economics* 32, 53-112.

Woolley. F. 2021. What Happened to the Immigrant Life Satisfaction Gap? *Canadian Public Policy* 47(4), 510-522.

Yamarik, S.J., Johnson, N.D., Compton, R.A., 2010. War! What is it good for? A deep determinants analysis of the cost of interstate conflict. *Peace Economics, Peace Science and Public Policy*, 16(1).