



Health Perspectives

Undergraduate Health Studies Journal
Volume X | March 2019
University of Toronto

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DIRECTOR'S FOREWORD

As the Director of the Health Studies Program at University College, it is my pleasure to introduce *Health Perspectives: Volume X*, of the Undergraduate Health Studies Journal at the University of Toronto. This year marks the tenth anniversary of Health Perspectives! Starting in 2009, Health Studies students have created a peer-reviewed journal each year that provides undergraduate students with the opportunity to have their academic work published.

This year's edition of *Health Perspectives* consists of nine papers: all written, edited, and published by student contributors. These papers focus on a wide range of health issues, both in Canadian and international contexts, and showcase our students' broad range of interests in approaching the study of health. The papers are united in their careful attention to cultural and structural factors in the production of health and wellness, and in the high quality of their scholarship. The Health Studies program focuses on developing a critical understanding of health: it is therefore exciting to me that all of the articles in this collection look beneath the surface for underlying, structural causes of ill health, with the ultimate goal of improving the health of individuals and populations around the world.

Since the inaugural edition of the journal, many Health Studies students have played important roles in keeping this student-run initiative alive and thriving. I want to thank Elizabeth Loftus and Jocelyn Catenacci, this year's Co-Editor-in-Chiefs; Maya Oakes, Kimberly Dias, and Charlotte Wong Labow (Senior Editors); Nammal Khan and Ashray Jani (Junior Editors); Iqra Mahmood (Layout Editor); and the Peer Review team. You have all been integral to the publication of this tenth anniversary edition!

I sincerely hope you enjoy reading this edition of Health Perspectives, Volume X.



SARAH WAKEFIELD
Director | Health Studies Program
University of Toronto

A NOTE FROM THE EDITORS

We are thrilled to bring you the latest edition of the Undergraduate Health Studies Journal, *Health Perspectives: Volume X*. Founded in 2009, Health Perspectives has provided opportunities for countless University of Toronto undergraduates to publish original work, and for Health Studies students to gain first-hand experience in editing and publishing as members of the Editorial Staff. The Health Studies program's commitment to understanding and analyzing health through a multidisciplinary lens is reflected in Health Perspectives' annual publications.

Health Perspectives: Volume X showcases the work of nine student authors. Each featured paper is presented from a unique vantage point and sheds light on significant health topics, ranging from Periodontal Health Promotion to the need for CPR and First Aid training across Canada. Thank you to this year's authors, as well as all who submitted papers, for sharing your work with us and contributing to a dialogue that fosters a holistic sense of health and well-being.

For her second consecutive year as Co-Editor-in-Chief, Elizabeth has greatly enjoyed co-managing this year's publication. In particular, Elizabeth loved focusing on the journal's outreach and marketing efforts, and contributing to the growth and impact of *Health Perspectives* at the University of Toronto; in particular, this included facilitating the staff hiring process, growing from 15 staff in 2018 to 20 staff in 2019, and drawing significantly more submissions this year. Joining Elizabeth in her first year as Editor-in-Chief, Jocelyn has been an integral part of *Health Perspectives* this year; in particular, Jocelyn aided in choosing the articles for publishing and helped coordinate the peer review process. In addition, she is developing a constitution to guide the future executives of *Health Perspectives*.

We are so grateful for the support of Dr. Sarah Wakefield, the Health Studies Director, as well as the Health Studies Students' Union, without whom this publication would not have been possible. To our diligent and thorough editorial staff: thank you for dedicating your time and energy to making Volume X our strongest publication to date!

And finally, to our readers: we hope that *Health Perspectives: Volume X* presents you with another collection of fresh ideas and creative approaches to examining today's health issues that help shape your own understanding of health and well-being.

Yours in health,



JOCELYN CATENACCI
Co-Editor-in-Chief | *Health Perspectives* 2019



ELIZABETH LOFTUS
Co-Editor-in-Chief | *Health Perspectives* 2019

Opioid Crisis in Ontario

EESHA CHAUDHRY

Opioids are drugs prescribed to relieve pain, however the prevalence of opioid abuse is a growing issue in Ontario, Canada. Thousands of deaths have resulted from the rise of opioid misuse, and these numbers will solely increase if no steps are taken to address this concern. There are various social determinants of health that largely impact opioid abuse, and many of these determinants are rooted within social disparities in Ontario. Education and Ontario's healthcare system are strong contributors for the increase in opioid use. Physicians are given too much leeway with regards to prescribing opioids, which has resulted in many avoidable deaths, which roots back to the lack of job security physicians have. Education also contributes to opioid misuse because individuals with lower socioeconomic statuses were found to be more susceptible to opioid abuse. Future policy implementations include community-based initiatives to provide support to susceptible individuals to appeal to their needs and offer assistance. Other implications include setting stricter policies to reduce prescription opioid analgesic dispensing to ensure opioids are only available to individuals who need the drug. Through collaboration with the Ontario government and healthcare system, the disparities regarding opioid abuse can be diminished.

Keywords: disparities, abuse, healthcare, Ontario, opioids

Opioids, a form of narcotics, are drugs that are commonly prescribed to relieve pain (Public Health Ontario, 2018). Opioid abuse has been a rising issue for decades in Ontario, originating in the mid-1990s (Government of Canada, 2017). This is a growing concern that has resulted in thousands of deaths in Ontario every year, and these rates are only expected to increase if no intervention occurs (Public Health Ontario, 2018). In 2016, there were over 2,500 opioid related deaths in Canada, a third of them occurring in Ontario alone (Government of Canada, 2017). Meanwhile, in 2017 over 1,250 Ontario residents died from opioids, resulting in a 246% increase in deaths since 2003 (Public Health Ontario, 2018). There are various factors that contribute to opioid related deaths in Ontario, the largest factors being the defects in the Ontario healthcare system, as well as social determinants of health such as education level. In order to understand the opioids crisis among Ontario residents, further investigation must be done within the healthcare system and disparities in education.

Opioids within Ontario's Healthcare

A social determinant of health that has contributed to the rise in opioid abuse is Ontario's healthcare system. Within the province's healthcare system, physicians are granted far too much freedom for prescribing opioids to patients, which has resulted in thousands of preventable deaths. Recent literature has assessed the issue of opioid addiction in Ontario, and several interesting results were found. In a population-based study that focused on opioid induced deaths in Ontario, nearly half of the patients received at least one prescription within the same year (Dhalla, Mamdani, Gomes, & Juurlink, 2011). Another study was conducted which observed all opioid related deaths in Ontario from 2013 to 2016, and it determined from the 2,833 compiled deaths, 997 of the deceased patients had active opioid prescriptions leading up to their deaths (Gomes et al., 2018). Similarly, this study discovered that of the one third of patients who died, 40% of them came into contact with additional opioids prior to their deaths (Gomes et al., 2018). This study then suggested that due to the high volumes of opioids these patients were prescribed by their physicians, they developed a dependency on opioids, and therefore, in order to obtain higher doses of the drug to fuel their addiction they resorted to illicit methods (Gomes et al., 2018). Ultimately, these studies use a biomedical approach to conduct research, attributing opioids as the principal cause for the deaths. They fail to take more social factors into account, such as living conditions, socioeconomic status, and even why physicians prescribe opioids to patients.

On the other hand, there is a deeper cause as to why doctors prescribe opioids frivolously. In North America specifically, physician ratings greatly impact their careers, including reimbursement, salary raises, and job security, which are completed at the hands of colleagues, directors, and, of course, patients (Lembke & Ballantyne, 2012). Ultimately, physicians are paid for treating pain, but the same does not apply for helping patients with addictions. Hence, they are more inclined to prescribe opioids to patients, whether or not they need it, just to reduce pain and attain positive ratings (Lembke & Ballantyne, 2012). Albeit this practice is immoral, there is a lack of job satisfaction among physicians, which can be associated with the stress and lack of job security due to the risk of losing their jobs from declining ratings (Williams, Skinner, & Cockrell, 2003).

Solutions have been implemented around the world to help minimize this crisis. To reduce opioid prescriptions in the United States, the American Medical Association (AMA) has encouraged physicians to reduce opioid

prescriptions, having since decreased prescriptions from 2013 to now by 55 million (AMA, 2018). The AMA employed an Opioid Task Force which not only encourages physicians to prescribe less opioids, but supports them, thus, offering job security to tentative physicians (AMA, 2018). In doing so, physicians are more likely to not prescribe opioids because they have support in their decisions to protect their patients. Although the opioid abuse rates in the United States are still quite high, the AMA's Opioid Task Force shows promise to continue reducing prescriptions for opioids.

Association Between Education and Opioids

Another social determinant of health that strongly impacts opioid abuse is education. Education is a root cause that greatly impacts one's life, and the various conditions and adversities they will experience. When it comes to education, the ultimate goal is to attain a degree, secure a well-paying job, and sustain stability; however, this is challenging to achieve without an education. According to various studies conducted, opioid abuse greatly affects individuals with low-income and lower socioeconomic statuses (SES) (Volkrow, 2017). In a more simplified manner, lower education results in a poor paying job, which leads to poor working and living conditions, and consequently more stress experienced by these individuals (Volkrow, 2017). Hence, these populations experience increased risk factors resulting in poor mental and physical health, such as addiction (Volkrow, 2017). In other studies, the relationship between SES and opioid and other drug abuse can even stem from parental education, and the effects that can lead to for the child (Patrick, Wightman, Schoeni, & Schulenberg, 2012). As a result of the parents' low education, low income and poor living conditions, the child experiences stress, which makes them more prone to drug abuse (Patrick et al., 2012).

The rise of opioid addiction can be associated with the cost of living in North America because a large number of individuals are moving into the lower income group, which increases stress and the likeliness to abuse opioids (Patrick et al., 2012). In the United States, people on Medicaid, which offers health insurance for low income populations, are at the highest risk of opioid abuse (Paulozzi, et al., 2012). Furthermore, race even plays a role in opioid misuse, as displayed in a research study that members of the black community in North America have a higher risk of opioid induced deaths due to racism rooted within society (Griffith, La France, Bacchus, & Ortega, 2018). Black people with lower income are not only more prone to opioid addictions, but

additionally death as they are unable to access the same resources for treatment, and face discrimination (Griffith et al., 2018). These studies adopt more of a social approach to view this issue by considering the living conditions of these individuals and how it contributes to increased opioid abuse risks. However, no solution has effectively been implemented to combat the racial and economic disparities that have been and continue to occur.

Policy Implications for Opioid Abuse

Various policies have been implemented to attempt to reduce opioid abuse, however none of them have proven to be sustainable. A suggestion of an effective policy is the implementation of community-based initiatives to target specific groups and offer support, so that these individuals feel more connected, and are given the means necessary to gain access to appropriate healthcare. In one study, the researchers observed common trends in opioid users such as mental health issues including history of addiction, and other health issues such as chronic diseases. These common patterns can be useful when implementing strategies to target these groups as it gives background to the lives of these individuals. (Madadi, Hildebrandt, Lauwers, & Koren, 2013). By executing this policy at the municipal level, it can be tailored to appeal to the needs of specific groups and assist them on a more intimate level. Another example of an initiative is the Global Opioid Policy Initiative (GOPI), which aims to monitor the availability and access of opioids around the world, while ensuring only individuals who direly need it have access to it (Cherny, Cleary, Scholten, Radbruch, & Torode, 2013). The Canadian government should implement a similar policy by monitoring who has access to opioids, such as through monitoring prescription opioid analgesic (POA) dispensing (Fischer, Jones, & Rehm, 2014). To decrease opioid abuse in Canada, the government should enact stricter enforcement to reduce POA dispensing, and solely give access to individuals who crucially need opioids (Fischer et al., 2014).

The Future of Opioids in Ontario

Opioid abuse in Ontario is an issue that will continue to grow if no action is taken to eradicate it now, but in order to do so, the social determinants that contribute to this concern need to be considered. Ontario's healthcare system and disparities in education are two determinants that greatly impact opioid misuse, and the Ontario government needs to implement effective strategies to improve these determinants. In turn, it will help minimize the cases of opioid

abuse. Health inequities play a massive role in opioid related mortalities, which is why effective solutions that target the social determinants of health should be enacted. Through the government collaborating with members of the community to improve the social determinants of health for the population, health equity can be achieved.

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Examining Systematic Reforms and the Paradox of Global Health

OMAR FARHAT

Global health activities seek to improve the health and well-being of marginalized populations through development, which has been shown to improve living standards of people in developing countries. However, increased development is promoting climate change that will have their greatest deleterious effects on these same marginalized communities. International organizations, that have promoted market-driven solutions and business-friendly arrangements, are weakening the welfare state and are leading to the withdrawal of the government from involvement in the distribution of resources in society. The implementation of neoliberal processes and policies by these international organizations have hindered the development of poor countries, and led to the privatization and commodification of resources like forests and water, while deregulation of markets and decreased government spending have negative effects on the environment. Therefore, a re-orientation in the economic model is necessary for the health and well-being of citizens in developing countries.

In 2015, the General Assembly of the United Nations adopted the 2030 Agenda for Sustainable Development to succeed the 2000 Millennium Development Goals (Struckmann, 2018). This new global agenda contains 17 universal Sustainable Development Goals (SDGs) that are necessary to address the global challenges humans face, and to achieve a sustainable future for all (Weber, 2017). They include eradicating poverty, promoting health and well-being, tackling climate change, and eliminating inequalities, among other goals. In fact, to achieve these economic, social and environmental goals, a healthy and thriving population is needed (“Health – United Nation”). Population health has a significant effect on per capita income and economic growth, so without a healthy population, sustainable development is unachievable (Sharma, 2018). Furthermore, lack of development negatively impacts population health since health is determined by social, environmental and economic factors (Tai, Chao, & Hu, 2015). However, developmental activities have devastating impacts on the environment, which in return affects human health (Tai et al., 2015). Hence, addressing and solving this paradox, with a particular focus on neoliberalism, is essential for effective global health initiatives.

The Sustainable Development Goal 1 is ending poverty in all its forms everywhere. In the past few decades, the number of people living in extreme poverty, which is defined by the International Community as earning below

\$1.25 a day, has declined significantly (Olinto, Beegle, Sobrado, & Uematsu, 2013). However, outside of China and India, this progress is much slower in other low-income countries where the number of poor people increased by 100 million from 1981 to 2010 (Olinto et al., 2013). Currently, half the world's population live on less than \$2.50 a day, while 1.3 billion of people live in extreme poverty ("11 Facts about Global Poverty"). Hence, lifting people above the poverty line and keeping them out of impoverishment is fundamental in ensuring their basic human rights. Poverty is a social phenomenon that nullifies several rights included in the Universal Declaration of Human Rights, such as the right to be equal in dignity, the right to a "standard of living adequate for the health and well-being of himself and his family, including food, clothing, housing, and medical care", the right to education, social protection, and "the highest attainable standards of physical and mental health" (Lister, 2013). In fact, poverty is linked to poor health in many ways; to reach the highest attainable standard of physical and mental health, individuals need to have access to food, clean water, sanitation, decent shelter, medical services and a clean environment (Choksi, 2018). The right to food ensures the freedom from starvation and continuous access to safe food, adequate nutrition and clean water, all at an affordable cost (Fismen et al., 2016). Those living in poverty often realize that adequate quality and sufficient quantity of food is not always physically and economically accessible, and must therefore consume cheap, processed food that contain high quantities of salt, sugar and fat, instead of fruits and vegetables (Fismen et al., 2016). Not to mention, poverty limits the access to quality education and childcare which only perpetuates the cycle of poverty as poor families do not have the resources necessary to lift them out of poverty (Ladd, 2012).

In the 1950s, industrialization was believed to improve the living standards of people worldwide, including those living in developing countries, by lowering poverty rates and income inequality (Haraguchi & Kitaoka, 2015). People living in the industrialized and wealthy societies, like in North America and Europe, enjoyed better health than citizens from poorer and undeveloped countries (Borowy, 2012). Economic growth is related to improvements in population health as life expectancy tends to rise with increasing gross domestic products (GDP), which indicates that citizens have access to their basic needs of life and that the living standards are getting better (Bezruchka, 2010). Moreover, it was accepted at that time that these undeveloped countries needed international cooperation, which led to the creation of international organizations whose central responsibility was the development of the world and poor

countries, such as the World Bank, the World Health Organization (WHO) and the United Nations (Borowy, 2012). In other words, developing countries needed development aid to reach the developed countries' state. However, with the rise of neoliberalism in the 1970s, the state was believed to be the cause of social problems and not the solution, whereas free markets and free trades were the most efficient in the production and distribution of resources in a society (Keskin, 2009). This market ideology led to the weakening of the welfare state, the withdrawal of the government from involvement in the distribution of resources in a society, and the increased interdependence between nations (Coburn, 2010).

International organizations, who are funded by conservative investors driven by profits and who need to comply with the member-states, played a significant role in the dissemination of neoliberal economic policies (Chorev, 2013). In fact, the WHO suffered from severe authority and financial crises in the 1980s before it began advocating for market-driven solutions and business-friendly arrangements (Chorev, 2013). The WHO began releasing reports stating that countries suffering from a high disease burden can only achieve the health status of "modern" countries once they complete the development stages (Borowy, 2012). Likewise, the World Bank began recommending national poverty reduction through open markets and economic growth, and argued that sustainable development required some natural resource extraction (Borowy, 2012). Reports released by international organization seldom show that neoliberal nations show greater social inequalities and poorer overall health than social democratic regimes, who reduce the gap between the rich and the poor through taxation and other payments (Coburn, 2010). In fact, in the 1970s, income inequality was low and declining in the United States and the United Kingdom prior to the Reagan and Thatcher regimes that influenced the rise of neoliberalism (Coburn, 2010). Furthermore, the United States, known for its neoliberal economic policies and for allowing the market to prevail in the health care delivery, has high health expenditures (17.6% of GDP) as well as high infant mortality rate compared to social democratic countries with a public system, like Sweden and Denmark (Bryant, 2016). One reason is because inequality is also correlated with a reduction in social cohesion and an increase in stress and anxiety, which are known to negatively impact health (Bryant, 2016).

The SDGs are also embedded in a neo-liberal politics of development. In fact, Goal 17, which seeks to strengthen global partnerships to achieve the

goals and targets set out in the 2030 Agenda, advocates for the promotion of “a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization” (“Goal 17”). The General Agreement of Trade in Services (GATS), a treaty of the World Trade Organization, expects states to open their markets to foreign competitors in order to attract foreign investments (Bakhouya, 2017). This framework is linked to the commercialization of public goods and services, such as water (Weber, 2017). The World Bank and the International Monetary Fund have created water markets in poor countries to generate the needed revenues to fund countries’ social and economic development plans (Weber, 2017). Water, which is recognized as having economic value, was privatized in Cochabamba, a city in Bolivia, in an attempt to improve the Bolivian economy (Helgegren, Rauch, Cossio, Landaeta, & Macconville, 2018). Neoliberalism argues that water should be fully private and a tradeable commodity that everyone would pay for, instead of being a basic need that must be provided to all at little or no cost. Thus, water became inaccessible to the citizens of that country, which was a clear violation of the Human Right to Water and Sanitation, which ensures obliges governments to guarantee clean, accessible and affordable water (Helgegren et al., 2018). Furthermore, Goal 10, which seeks to reduce inequality within and among countries, also focuses on economic growth and the reliance on the market to reduce inequality, instead of redistributive policies, which have been proven effective in social democratic countries (Weber, 2017). The key feature of social democratic regimes is the provision, through public taxation, of basic citizen entitlements such as access to a well-paying job, comprehensive health care, and safe working environments (Mackebach & Mckee, 2013). They improve their population’s health by reducing the gap between the rich and the poor; more egalitarian societies have better average health since the nature of sharing and caring in a society is correlated with the population’s health (Coburn, 2010). In fact, through taxes, transfers, and other payments, Sweden reduces its poverty rate based on income by over 80%, whereas in Canada, it is 40% and, in the US, only 20% (Mackebach & Mckee, 2013). Social democratic nations also show better infant mortality rate as Sweden, Finland and Norway ranked in the top three in 2005 (Coburn, 2010). In sum, neoliberal economics are imbedded in global development projects, which makes states more responsive to the market and big corporations instead of the citizens.

The extractive sector can make significant contributions to the realization of the SDGs (Pedro et al., 2017). Natural resource extraction can be a

driver for economic growth and can generate the bulk of government revenue, which can be used to develop the economy, improve health outcomes and living conditions, and reduce inequities (Schreker, Birn, & Aguilera, 2018). As a result, the World Bank has advocated for extractive sector investment to improve the welfare of all citizens in poor countries (Desai & Jarvis, 2012). However, the implementation of neoliberal processes and policies by these international organizations have led to the privatization and commodification of resources like forests and water, while the deregulation of markets and decreased government spending have negative effects on the environment (Liverman & Vilas, 2006). Neoliberal philosophy argues that owners have a greater incentive to protect the resources they own, so land and other resources are best managed by private owners rather than by the state (Liverman & Vilas, 2006). In Latin America, there is little evidence that the environment would be protected under neoliberal regulations (Liverman & Vilas, 2006).

In the 1990s, Peru decided to adopt a neoliberal political economy approach to improve their economy (Bury, 2004). The structural reform packages of the International Monetary Fund have resulted in the gold mining industry, largely located in Cajamarca, being dominated by the private sector, and land being forcibly taken away from the natives and privatized (Bury, 2004). Not only is this a clear violation of Article 17 of the Universal Declaration of Human Rights, which ensures that “everyone has the right to own property alone” and “no one shall be arbitrarily deprived of this property”, but this also affects their standard of living, which is a violation of Article 15, “everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services” (“Universal Declaration of Human Rights”). While Peru’s mining exports average approximately \$25 billion USD, mining activities in Peru have led to deforestation, destruction of agriculture fields and the contamination of water and the environment with the release of mercury and cyanide (Bury, 2004; Loayza & Rigolini, 2016). This lack of safe, clean and healthy environment undermines the enjoyment of other human rights, such as the right ensured in Article 15. In the city of Cajamarca, rapid growth in a 10-year period, from 1990 to 2000, have resulted in serious environmental effects (Liverman & Vilas, 2006). Moreover, decrease in poverty is only seen in communities surrounding the mining regions because profits from this industry is divided only in regions near the extractions (Loayza & Rigolini, 2016).

The International Monetary Fund and the World Bank require poor nations undergoing structural adjustments to also sell large tracts of land to foreign corporations, making it easier for businesses to operate in these countries, and reduce public spending. In Chile, the global market for agricultural products and timber resulted in rapid growth exports in the year 2000, which contributed 10% of the country's GDP (Liverman & Vilas, 2006). However, this growth resulted in less trees to remove carbon dioxide in the atmosphere and in local environmental problems like soil erosion and flooding (Shandra, Shircliff, & London, 2011). In fact, forest protection is not only essential for carbon dioxide sequestration, but also for the conservation of biodiversity, as animals are losing their natural habitat (Shandra et al., 2011). Moreover, when trees are cut during deforestation, carbon dioxide is also released during decomposition or burning. Not to mention, the mining industry in Chile is also a contributor to greenhouse emissions, and by burning fossil fuels such as oil and coal, a large concentration of carbon dioxide is released into the atmosphere (Odell, Bebbington, & Frey, 2018). Finally, the cuts in government expenditure demanded by international organization lead to cuts in budgets of conservation departments and hinder the enforcement of environmental regulations (Shandra et al., 2011).

Climate change has been receiving increased worldwide attention because it is a serious problem that requires urgent action (Shandra et al., 2011). Interestingly, while climate change will impact every country on earth, developing countries will suffer the most. Poor populations are more susceptible to floods, droughts, storms, and reduced agriculture yields, which will prevent these countries from achieving the SDGs (Bierbaum & Zoellick, 2009). In fact, poorer countries whose GDP is dependent on their agriculture sector will have their economic growth severely impacted due to the rising temperatures. While development and industrialization have provided humans with their basic needs and improved health outcomes, the significant increase of 34% in carbon dioxide concentrations in recent decades compared to pre-industrial levels raise concerns about the effectiveness of global health initiatives that promote development (Damtoft, Lukasik, Herfort, Sorrentino, & Gartner, 2008). In other words, while global health activities seek to improve the health and wellbeing of marginalized populations through development, development is promoting climate change that will have their greatest deleterious effects on these same marginalized communities. To solve this paradox, we need to challenge the structural and systemic features of the global political economy.

In 1987, the World Commission on Environment and Development released a report called “Our Common Future”, or also known as the Brundtland Report (Schubert & Lang, 2005). This report defined the term sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” and clarified that global development and environmental requirements are not opposite goals (“World Commission on Environment and Development”, 1987). The report suggested that a new form of growth, that is socially and environmentally sustainable, is needed (“World Commission on Environment and Development”, 1987). We can not just rely on the present economic system that relies on cheap, non-renewable as well as dangerous energy and chemicals. We need to facilitate the uptake of renewable energy sources, while removing fossil fuels grants. Moreover, changing our economic model when planning global health activities and developing environmental programs is essential. In Australia, the conservative Labour government, that advocated for neoliberal policies, ended the Energy Efficiency Opportunities program that has been proven effective at identifying, evaluating and implementing energy efficient strategies and have led to a reduction in emissions (Papas, 2017). Returning this program, which have been successfully implemented in the UK, is necessary in Australia, and a similar program is needed in developed countries.

Developing countries need to re-orient their economic models. It is recommended that African countries focus on adopting an agrarian economy that is not dependent on dangerous energy resources (Dike, 2015). In 2010, changes in agriculture lands, such as deforestation and land clearing, have contributed a quarter of total greenhouse gas emission (Whittman et al., 2015). Countries can still rely on extractive industries to generate the needed revenues to develop the economy, improve health outcomes, reduce inequities, and improve living conditions (Pedro et al., 2017). However, these resources can cause inequalities when wealth is concentrated in the top 1% of the population, or when profits are subjected to corruption by government officials (Pedro et al., 2017). Hence, good management and responsible extraction, coupled with redistributive policies and strong environmental regulations can help a country’s development while taking steps to protect the environment (Pedro et al., 2017). For instance, strong environmental regulations in Peru can prevent the release of mercury and cyanide into rivers by mining companies.

In conclusion, international organizations that promote neoliberal

philosophy have been shown to hinder the development of poor countries by promoting climate change, which have their greatest deleterious effects on the marginalized populations they are trying to help. The foreign aid and debt relief strategies, that are promoted by the international organizations, place restrictions on the recipient countries and undermines the capacity of civil actors and domestic governments to influence public policy outcomes and to be involved in health and social provision. Not to mention, the implementation of neoliberal processes and policies by these international organizations have led to the privatization and commodification of resources like forests and water, while deregulation of markets and decreased government spending have negative effects on the environment.

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Vaccine Hesitancy in Canadian Parents: A Community-Based Health Approach

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Immunization rates are subpar in Canada mainly due to the reluctance of parents to vaccinate their children. This hesitancy is due to social influence, misleading information, distrust in the drug regulatory authority as well as a lack of first-hand experience with the infectious diseases against which vaccines protect. Mandatory vaccination policy and vaccine promoting campaigns have been shown to have poor efficacy and to be a risk of having unwanted results by actually perpetuating vaccine hesitancy. Due to the social factors that contribute to vaccine-hesitancy, and the need for tailored case-by-case solution, a community-based health promotion model shows promise of being a well suited solution.

Vaccination has made a vital contribution to global health by preventing the spread of many infectious diseases. It is considered one of the greatest accomplishments of public health, currently preventing 2-3 million deaths from infectious diseases per year (World Health Organization [WHO], 2018b). Not only has vaccination contributed directly to global health, it has also contributed indirectly by providing relief from enormous burdens of disease. Vaccines have allowed many nations to direct their energy toward economic development, and the resulting resources towards improving elements of the social determinants of health, such as increased access to education (WHO, 2018). Looking at vaccination through this political-economic perspective shows how a new allocation of resources can lead to new social structures that improve health in broader ways (Bryant, Raphael, Rioux, & Teeple, 2010). However, while some undeveloped countries are still struggling with immunization availability and delivery, in many developed countries childhood vaccination rates are suboptimal solely due to parental choice (Brown et al., 2010). This deferral or rejection of vaccination is referred to as vaccine hesitancy, which the WHO has identified as an increasing global health concern (SAGE, 2014).

Vaccine hesitancy is a problem in Canada, with immunization rates of all vaccines falling below the national target coverage (Public Health Agency of Canada [PHAC], 2018b). UNICEF reported that Canada has the second lowest immunization rate of developed countries (Scheifele, Halperin, & Bettinger, 2014). Several steps have been taken to encourage the immunization (or timely

immunization) of children in Canada, through policy change for instance. In Ontario, children, unless exempted, must be vaccinated in order to enter the public school system (Government of Ontario, 2017). In April 2018, the Canadian government committed to launching a national awareness campaign on childhood vaccination (PHAC, 2018c). Additionally, the medical community has stepped in; the Canadian Paediatric Society (CPS) issued a statement for doctors regarding how to approach vaccine hesitancy with parents (2018).

While it is agreed that vaccine hesitancy and the resulting sub-par immunization rates in Canada are an issue, the best way to address this problem is disputed. The reasons for vaccine hesitancy in parents are complex, making for a unique and sensitive issue that cannot be solved with policy, education, or campaigns alone. The approaches of mandatory vaccine policy and educational campaigns were found to result in short-term results (Salmon, MacIntyre, & Omer, 2015), and if not administered carefully, can actually lead to an increase in anti-vaccination lobbying and unintended reinforcement of uncorroborated beliefs (MacDonald et al., 2018; Pluviano, Watt, & Della Sala, 2017). Interestingly, health education has also been found to be insufficient in changing the beliefs and actions of vaccine-hesitant parents (Cairns et al, 2015; Nyhan, Reifler, Richey, & Freed, 2014; Dubé et al., 2016). There is still concern regarding how to best decrease vaccine hesitancy in Canada and how to direct the \$5 million of annual governmental funding (Government of Canada, 2016) that is designated to increasing vaccination rates.

This paper will argue that vaccine hesitancy in Canadian parents should be addressed with a community-based health promotion approach. Many of the social cognitive and behavioural elements of vaccine hesitancy, and the findings of several studies support a health promotion approach as a solution. Vaccine hesitancy in parents is influenced by social norms and contexts (Brown et al., 2010). It is important to address specific concerns of individuals or groups, and for them to receive information about vaccines from credible sources rather than from social media or dubious web sources (Dubé et al., 2016). Social diffusion, such as in face-to-face communication, has been found to be effective in altering beliefs and encouraging parents to immunize their children (Cairns et al., 2015). Health promotion has many features and values that make it a holistic, inclusive approach that focuses on the social and environmental factors of health and builds on existing assets in order to assist people in gaining control over their own health (WHO, 1986). This paper will

explore factors leading to vaccine hesitancy, and the ways community-based health promotion can be effective in addressing them.

While it is hard to determine the exact vaccination rates in Canada due to the lack of a national vaccine registry, the 2015 Childhood National Immunization Coverage Survey found that vaccination rates are suboptimal, with all rates falling well below the national goal of 95% coverage (PHAC, 2018b). A certain percentage of a population (around 95%) must be vaccinated in order to prevent outbreaks of diseases. This threshold is sometimes called herd immunity, and varies from disease to disease depending on the efficacy of the vaccination (Bovan, Kretzschmar, O'Neill, Wichmann, & Hahné, 2010). For example, measles was eliminated in Canada as of 1997, but due to sub-par vaccination rates, there have been several outbreaks across the country since 2015 (Sherrard, Hiebert, Cunliffe, Mendoza, & Cutler, 2016). The unsatisfactory vaccination rates have already led to detrimental health outcomes and there is potential for more to arise if the problem is not addressed. Public Health Agency of Canada (PHAC) concluded their 2018 report with recommendations to improve vaccination coverage by addressing vaccine hesitancy (PHAC, 2018b). It is important to put the focus of this issue on prevention, and not wait until the vaccination rate is so low that further disease outbreaks occur resulting in the need for resources to be directed towards care. Disease outbreaks can result in unnecessary infection and death, even in those who are vaccinated, and lead to healthcare costs, both for treatment and containment of the disease. The underlying reasons for health issues such as this must be resolved with a preventative, upstream approach (Bryant et al., 2010).

The factors that contribute to vaccine hesitancy are complex and multifaceted. Due to the success of vaccinations, many individuals in Canada have no first-hand experience of the serious health dangers that vaccine-preventable diseases pose, which contributes to vaccine hesitancy; these individuals feel they are not at risk and do not see the implications of not vaccinating their children (Larson, Cooper, Eskola, Katz, & Ratzan, 2011).

A survey of vaccine providers and researchers in Canada found that distrust of pharmaceutical companies and belief that vaccines are unsafe were both in the top three most influential reasons for vaccine hesitancy (Dubè et al., 2016). The mistrust of the drug regulatory authority by the people of Canada can be explained by clientele pluralism (a theory that outlines the complex relationship between the government and private sectors) as it explains that Health

Canada gives some decision-making power about drug approval and regulation to the pharmaceutical industry (Lexchin, 2013; Bryant et al., 2010). This can cause people to doubt the motives and priorities behind the government's vaccination program, which can lead directly to vaccine-hesitancy as well as people's desire to look for information about vaccination from alternative, often false, sources (Dubé et al., 2016).

Often times, the safety concerns regarding the dangers of vaccines are from misleading information found on the Internet. In 1998 in the U.K., Dr. Andrew Wakefield claimed to find a causal connection between the measles-mumps-rubella vaccine and autism. Ten years later, it was discovered that his data were falsified. His study was retracted from *The New England Journal of Medicine* and he was charged for ethical, medical, and scientific misconduct. This false claim, and its proliferation, had a global negative effect on the public trust in vaccine safety and government vaccination programs and on the prevalence of vaccine hesitancy in North America today (Flaherty, 2011; Brown et al., 2010). False information sources are the top reason for vaccine hesitancy in Canada (Dubé et al., 2016).

One of the key features of health promotion that could be utilized in addressing vaccine hesitancy is that it uses participatory approaches to achieve health in cooperation with people rather than on behalf of them. This shifts the focus of health away from the biomedical model to a more socio-environmental understanding (Bryant et al., 2010; South, 2014). Health promotion goes beyond simple health education and has a strong community focus, emphasizing the increase in involvement and empowerment of individuals and the increase of overall social capital (Public Health Ontario, 2015). In this case, a health promotion project for decreasing vaccine hesitancy could be applied to any community (neighbourhood, social network, or otherwise) in which vaccine hesitancy is a problem. Communities usually have suboptimal vaccination coverage rather than zero coverage (PHAC, 2018b). This would allow the programs to be centred in communities where there were some vaccine-hesitant parents and some pro-vaccine parents. By doing so, this would permit health promotion to stem from those who believe in the protection of all with herd immunity.

The health promotion for vaccine hesitancy could be focused on such groups as expectant or new parents. In one study, mothers expressed discontentment at the lack of opportunity to discuss vaccination with peers, and

having limited time to conduct their own research (Brown et al., 2010). There are many opportunities, such as in prenatal classes, where a community-based health promotion program could be initiated.

A program recently initiated by the World Health Organization called “Tailored Immunization Programs” is utilizing an interpretivist approach (Bryant et al., 2010) to understand the reasons for vaccine hesitancy in specific communities with poor immunization rates just as would be necessary for the health promotion approach centred in Canadian communities. They have begun researching and designing pilot programs, some which use community-specific development campaigns in communities such as the vaccine-hesitant Anthroposophical groups in Europe (WHO, 2018c).

Through interpretivist research into the concerns about vaccination within a specific community, the health promotion approach could ensure that the concerns of the community were the ones directly addressed. It has been shown that it is critical to address and alleviate specific concerns of parents, because addressing concerns that people do not have can backfire and result in the creation of new concerns; the WHO’s recommendation for addressing vaccine hesitancy also suggests that these tailored mediations require dialogue (WHO, 2018b). Lack of addressing specific concerns and not using tailored mediations means national pro-vaccination campaigns often result in unwanted outcomes (Nyhan et al., 2014). The most successful campaigns directly involve communities in their design, and publicized social norms of acceptance (Strategic Advisory Group of Experts on Immunization [SAGE], 2014). A health promotion approach could go beyond health education and allow for more opportunities for communities to give input into local campaigns.

Influential opinion leaders or community members could utilize community-based, preferably face-to-face, communication approaches to ensure parents receive accurate educational information about the benefits of vaccination and the risk associated with remaining un- or under-vaccinated. This would compliment health education being done by pediatricians, and at the same time discourage the use of unreliable Internet sources. For those parents experiencing distrust in the medical system or pharmaceutical companies, this might provide confirmation of, and confidence in, the accuracy of scientific evidence.

The absence of peer support negatively affects vaccine acceptance (Brown et al., 2010). One American study in 2013 qualitatively gathered infor-

mation about how parents make decisions about vaccinations. They found that many parents accept vaccinations because the social norms of their communities or social networks are pro-vaccine (Brunson, 2013). These findings have important implications for dealing with vaccine hesitancy. In communities and social circles where anti-vaccination attitudes are prevalent, shifting the social norms could have good results in altering the vaccine beliefs and practices. In addition, the few individuals who are anti-vaccine in a community of pro-vaccine members, community-based health promotion through social diffusion, could be effective in altering their beliefs.

While community-based programs are not always successful, the health promotion programs for HIV/AIDS were extremely effective. These promoted risk-reducing behaviors because they were focused on changing the social norms surrounding risk-reduction in pockets of the population who displayed high-risk behaviors (Merzel & D’Afflitti, 2003, para. 80). These findings predict success for health promotion-based programs for vaccine hesitancy in high-risk pockets or communities. In both cases, social norms, acceptance and peer support have been shown to have a major influence over the health affecting behaviour and behaviour modifications (Brunson, 2013; Merzel & D’Afflitti, 2003). Change might be slightly more difficult to incite with vaccine hesitancy compared to HIV/AIDS as the risk of infection is often less immediate and rampant with vaccine-preventable diseases. Still, social context, norms and values play an equally important role in both cases.

Another value of health promotion is to mobilize people to take control of their own health outcomes by encouraging agenda setting and lobbying (PHAC, 2015). These community-based health promotion programs could provide a way for communities to encourage multi-sectoral collaboration between health departments, government and local people and suggest policy-changes that reflect their concerns with vaccination. Pro-vaccine groups could be mobilized by this approach, lobbying for specific changes to existing vaccine schedules or delivery modes. This change initiated from within communities is in alignment with the SAGE report’s recommendation to ensure “community input into vaccine hesitancy strategies for prevention, diagnosis, intervention and monitoring to ensure that they resonate with communities” (SAGE, 2014, pg. 61).

Vaccine hesitancy can be high in certain religious groups. In a religious community in British Columbia in 2014, there was a measles outbreak in

a school linked to a church (a protestant Reformed Church of North America). Of the 392 cases, 99% were members of the church and un-vaccinated. The fact that 1% of the population was vaccinated but still infected reminds us of the motivation for reaching vaccination rates that provide herd immunity, because even vaccinated subjects can be at risk of infection. Strategic Advisory Group of Experts on Immunization recommends the engagement of religious or other leaders to promote vaccine in such communities (SAGE, 2014; Van Buynder, 2014). Other members of this local community in BC, for example, could customize and utilize a health promotion approach in their community to recruit the religious leader to help alter the behaviours toward vaccines.

Other than the pockets of religious communities that tend to be un-vaccinated, we have very little information about other groups of people with tendencies toward high rates of vaccine hesitancy in Canada. In fact, studies have identified deficiencies of research into the role that broader social determinants and circumstantial factors can play in vaccine hesitancy among sub-groups of populations. The research has thus far focused on the social cognitive models, looking at individuals' behavioural reasons for vaccine hesitancy (SAGE, 2014). This is a major limitation in addressing the issue. In this case, specifically for instituting a community-based health promotion program, we need to know which groups have high rates of vaccine hesitancy before change can be promoted effectively. UNICEF identifies the establishment of a national vaccine registry as a top priority for Canada (Scheifele et al, 2014).

Data from other countries shows mixed results in terms of how the social determinants of health contribute to propensity for vaccine hesitancy; low-income level has shown a weak correlation with higher vaccine hesitancy, but education seems to be inconsistent, negatively affecting both the low- and high-education levels (SAGE, 2014). If improving inequality will not decrease vaccine hesitancy, then it is even more paramount that another strategy is employed – in this case through social ecology provided by community health promotion. However, in communities where access to vaccinations, inequity, and social determinants such as socioeconomic status, are factors for sub-par vaccination rates, the health promotion approach is designed to provide an avenue of empowerment for taking control of these social and economic factors of their health (WHO, 1986).

In 2016, Canada committed to allocating \$25 million on vaccine related surveillance and promotion over five years (Government of Canada ,

2016). The government needs to gather more epidemiological, population-based data on where vaccine hesitancy exists in order to make their vaccine promotion strategies more effective and at lower risk of backfiring (Scheifele et al, 2014). A possible suggestion is allocating a fraction of the vaccine promotion budget toward a community-based health promotion program. This program could be established in communities that have experienced recent outbreaks of vaccine-preventable diseases, like the aforementioned community in BC. Also, identifying communities of new parents across the country would be another logical place to start a vaccine-related health promotion program. Like all attempts at addressing vaccine hesitancy, this program would need to be carefully executed in order to not to worsen vaccine uptake (CPS, 2018); however, with its bottom-up approach focused on building trust among community members, health promotion shows more promise than top-down mandatory vaccine policies or even nation-wide campaigns.

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Type 1 Diabetes and Eating Disorders: A Discussion of Interventions

MARLEY GREENBERG

BACKGROUND: There is an alarmingly high prevalence of eating disorders (ED) in the type 1 diabetes mellitus (T1DM) population. The co-occurrence of T1DM and ED is associated with significantly poorer health outcomes and a mortality risk three times greater than that found in those with T1DM alone. Individuals with comorbid T1DM and ED are evidently a high-risk group in need of effective and tailored interventions.

FINDINGS: Current treatment approaches for co-occurring T1DM and ED vary but are often similar to traditional interventions for ED patients. When lacking diabetes-specific components, ED interventions such as psychoeducation and cognitive behavioural therapy are ineffective for those with both T1DM and ED due to the complexity of the comorbidity and the potential role of insulin omission. One existing intervention that has been successful in treating individuals with comorbid T1DM and ED is “Integrated Inpatient Therapy” (IIT), an intensive, individualized, and diabetes-specific treatment. Family-focused interventions have also shown promise in treating this cohort.

CONCLUSION: To properly address the needs of this high-risk population, health promoters must take an upstream approach and develop interventions that are intensive, individualized, family-based, and diabetes-specific.

Introduction to the Issue: Co-occurring Type 1 Diabetes and Eating Disorders

The prevalence of eating disorders (ED) in individuals with type 1 diabetes mellitus (T1DM) is alarmingly high, with comorbidity rates estimated at up to 40% of the T1DM population (Dickens, Haynos, Nunnemaker, Platka-Bird, & Dolores, 2014). The co-occurrence of T1DM and ED is associated with poorer blood glucose control, more frequent episodes of diabetic ketoacidosis, and the early onset of microvascular complications (Rodin et al., 2002). Furthermore, it is estimated that those with T1DM and ED have a mortality risk that is three times higher than their T1DM-only counterparts (Dickens et al., 2014). In addition to displaying common disordered eating behaviours, such as fasting, vomiting, and laxative and diuretic abuse, those with T1DM and ED may also manipulate their insulin dosages in order to encourage weight loss (Custal et al., 2014). In particular, those who partake in insulin omission are eight times more likely to have poorly

controlled diabetes and to experience the aforementioned negative health outcomes (Banting & Randle-Phillips, 2018). Individuals with co-occurring T1DM and ED are evidently a high-risk group in need of effective and tailored interventions (Dickens et al., 2014).

At present, there is a lack of consensus in the health care community as to what approaches are appropriate for those with comorbid T1DM and ED (Banting & Randle-Phillips, 2018). This cohort often receives relatively ineffective treatment as they tend to undergo the same interventions as non-T1DM ED patients despite the unique nature of co-occurring T1DM and ED (Custal et al., 2014). To properly address the needs of this high-risk population, health promoters must take an upstream approach and develop interventions that are intensive, individualized, family-based, and diabetes-specific.

The Relationship between Type 1 Diabetes, Eating Disorders, and Insulin Omission

T1DM is a chronic disease in which the body attacks and destroys its insulin-producing cells, leading to a lifetime of dependence on insulin therapy (Banting & Randle-Phillips, 2018). Insulin therapy, whether delivered via multiple daily injections or by insulin pump, provides those in the T1DM population with ongoing opportunities to control or lose weight through deliberate insulin omission (Rodin et al., 2002). Insulin omission, a dangerous practice, promotes weight loss as it prevents the body from utilizing glucose as an energy source, thereby forcing the body to break down fat and muscle in order to gain energy (Banting & Randle-Phillips, 2018). In the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders), insulin omission is subsumed under the criteria for bulimia nervosa and anorexia nervosa (Allan, 2014). Although the practice of insulin omission for weight loss purposes is colloquially referred to as diabulimia, the American Psychiatric Association does not recognize this term in the DSM-5, nor does it consider chronic insulin omission to be its own mental health condition (Allan, 2014). The relationship between T1DM and ED is obscured by ambiguity pertaining to the function of insulin omission (Custal et al., 2014). Insulin omission is commonly assumed to be related to weight control, however, insulin omission may be more strongly linked to emotional regulation and self-harm behaviours than to weight concerns (Custal et al., 2014).

Ineffective Approaches to Treating Comorbid T1DM and ED

Current treatment approaches for co-occurring T1DM and ED vary but are often similar to traditional interventions for ED patients (Banting & Randle-Phillips, 2018). When lacking diabetes-specific components, ED interventions such as psychoeducation and cognitive behavioural therapy are ineffective for those with both T1DM and ED due to the complexity of the comorbidity and the potential role of insulin omission (Banting & Randle-Phillips, 2018).

Psychoeducation

Alloway, Toth, and McCargar (2002) explored psychoeducation as an intervention for co-occurring T1DM and ED. Using a sample of women with comorbid T1DM and ED, they compared a treatment group to a waitlist control group, and examined the effects of a six-session group psychoeducation program on blood glucose control, adherence to diabetes treatment regimens, eating disorder symptoms, and overall mental health (Alloway et al., 2002). On all the outcome measures, the study found that there were no significant differences between these groups, demonstrating that group psychoeducation alone is not an effective treatment for individuals with co-occurring T1DM and ED (Alloway et al., 2002). This finding contrasts with studies conducted on ED patients without T1DM in which group psychoeducation was shown to be more effective in improving health than no intervention (Olmsted et al., 1991). The contrast between the effectiveness of psychoeducation in ED-only research and co-occurring T1DM and ED research emphasizes the need of those with this comorbidity to receive diabetes-specific care. Although treating individuals with co-occurring T1DM and ED solely with group psychoeducation was ineffective, psychoeducation may be useful as a component of an individualized and multi-pronged intervention.

Cognitive Behavioural Therapy (CBT)

Colton et al. (2015) investigated cognitive behavioural therapy (CBT) as an intervention for those with co-occurring T1DM and ED. They explored the effectiveness of day hospital CBT treatment on minimizing eating disorder symptoms for women with comorbid T1DM and ED (Colton et al., 2015). They then compared these results to the effectiveness of CBT on individuals with ED, but without T1DM (Colton et al., 2015). Although a small proportion of participants with co-occurring T1DM and ED experienced so-called ‘good outcomes’, over 80% of this population had either ‘intermediate outcomes’

or ‘poor outcomes’ (Colton et al., 2015). The outcomes of individuals with comorbid T1DM and ED were significantly worse than their ED-only counterparts (Colton et al., 2015). The difference in outcomes between those with both T1DM and ED and those solely with ED demonstrates the need of these populations to have different interventions, and indicates that individuals with this comorbidity may need more intensive and diabetes-specific treatment.

Proposal for More Effective Interventions

Health Promotion Approach

Improving the efficacy of treatment for co-occurring T1DM and ED requires an upstream health promotion approach that addresses the social determinants of health. An upstream health promotion approach is preventative in nature and aims to improve the health outcomes of marginalized and high-risk populations, such as those with co-occurring T1DM and ED, by addressing the roots of health inequities and working to better the social determinants of health (Williams, Costa, Odunlami, & Mohammed, 2008). The social determinants of health describe the social and economic factors that impact how people come to experience different degrees of health and illness (Raphael, Rioux & Bryant, 2010). The social determinants of health include education, employment, income, race, ethnicity, and gender, among many other factors.

For those with T1DM, gender is a significant social determinant of ED development. Neumark-Sztainer et al. (2002) found that females with T1DM were more than twice as likely as males to partake in unhealthy weight control practices. As such, the literature on co-occurring T1DM and ED focuses almost exclusively on females with these conditions. Although there is research pertaining to the relationship between EDs and social determinants such as race and culture, data regarding the effects of these social determinants on co-occurring T1DM and ED is missing or inconclusive (Rodin et al., 2002). Considering the unique nature of comorbid T1DM and ED, it is important not to overgeneralize and extrapolate findings from ED-specific research. Thus, future studies should address this gap in knowledge and analyze the effects of the social determinants on co-occurring T1DM and ED in order to provide health promoters with the knowledge necessary to address social health disparities.

The Ottawa Charter for Health Promotion discusses how health promotion is “the process of enabling people to increase control over, and to improve, their health” (Public Health Agency of Canada, 2017). The charter describes

modes of health promotion including: building healthy public policy, creating supportive environments, strengthening community action, developing personal skills, and reorienting health services (Public Health Agency of Canada, 2017). These methods of health promotion can be meaningfully applied in the context of co-occurring T1DM and ED and can guide the development of effective interventions.

The actions of creating supportive environments, developing personal skills, and reorienting health services are particularly relevant for improving health outcomes for individuals with T1DM and ED. Interventions that emphasize learning from failures and have family-based components can create supportive environments for those with T1DM and ED, and can help these individuals develop the personal skills they need to be resilient and to better their health. Additionally, reorienting health services will aid in providing this population with effective interventions that are intensive, individualized, and diabetes-specific.

Intensive, Individualized and Diabetes-Specific Interventions

To deliver effective interventions to individuals with co-occurring T1DM and ED, health promoters must reorient services and utilize available T1DM and ED resources. There are many ways in which the existing assets of the health care community can be built upon to allow for the pragmatic implementation of intensive, individualized, and diabetes-specific interventions.

Rodin et al. (2002) emphasize the importance of ED prevention within the diabetes clinic setting. They suggest that professionals who work in diabetes clinics should be especially cognizant of the likelihood for patients to develop EDs (Rodin et al. 2002). In order to proactively detect the development of an ED, health care professionals should pay particular attention to instances of insulin misuse, concerns about weight, signs of disordered eating, and episodes of diabetic ketoacidosis (Rodin et al. 2002). The proactive measures described by Rodin et al. (2002) embody the preventative nature of an upstream health promotion approach.

Dickens et al. (2014) demonstrate how ED services can be more effectively utilized to treat individuals with co-occurring T1DM and ED. They found that multidisciplinary residential treatment in an ED facility was effective for those with comorbid T1DM and ED – following the treatment, these individu-

als had significant improvements in blood glucose control and decreased eating disorder symptoms (Dickens et al., 2014). This study combined cognitive-behavioural, person-centered, family-oriented, and feminist approaches to therapy (Dickens et al., 2014). The care was individualized through personal meetings for each patient with the multidisciplinary team (Dickens et al., 2014). The care was also intensive as it occurred in an inpatient setting, allowing those with T1DM and ED to become fully immersed in the program and to participate in multiple therapeutic groups every day (Dickens et al., 2014). Additionally, they found that longer treatment duration was associated with greater improvements in patient health, further emphasizing the value of extended and intensive care (Dickens et al., 2014).

Takii et al. (2002) describe and demonstrate the effectiveness of an individualized, intensive, and diabetes-specific intervention for individuals with co-occurring T1DM and ED. Takii et al. (2002) found that patients who underwent an “Integrated Inpatient Therapy” (IIT) had remarkable improvements in blood glucose control, as well as significant decreases in psychological disturbances and ED behaviors (Takii et al., 2002). Following IIT, the majority of patients no longer had a clinical or subclinical ED (Takii et al., 2002). IIT has three main elements: (i) recovery period of the mind and body, (ii) modification of behaviours and cognition, and (iii) restoration of family relationships. The element of modification is the most important part of the treatment and can be broken down into three parts, with the first part of modification pertaining to the improvement of eating behaviours (Takii et al., 2002). This step includes the incremental transfer of control from therapist to patient – as the treatment progresses, the patient regains autonomy over their food decisions at a pace that is appropriate for their individual abilities (Takii et al., 2002). In the next part of modification, the patients receive coaching on how to properly dose their insulin, thereby enabling them to take more control over their T1DM management (Takii et al., 2002). In the third part of modification, the patient partakes in group therapy as well as in individualized counselling (Takii et al., 2002). By slowly returning control to the patients, IIT provides individuals with comorbid T1DM and ED a safe and supportive environment in which they can fail but learn how to be resilient and recover from these setbacks (Takii et al., 2002). The therapists guide patients in viewing problems as learning opportunities and coach them on how to overcome challenges (Takii et al., 2002).

IIT is an intensive, individualized, and diabetes-specific intervention that is effective in treating individuals with comorbid T1DM and ED. IIT's success is likely due to its development and deployment in a Japanese hospital department that specializes in co-occurring T1DM and ED (Takii et al., 2002). Although specialized departments like this are rare, IIT has the potential to be widely applied as any residential ED facility should be able to hire diabetes professionals in order to assist in conducting an IIT-style intervention.

Family-Based Interventions

Effective interventions for individuals with co-occurring T1DM and ED require a family-based component. Salvador Minuchin developed structural family therapy, an approach that addresses issues between family members, and suggested that effective ED treatment must utilize this structural family therapy method (Minuchin, Rosman, & Baker, 1978). Family-based therapy is an important element of co-occurring T1DM and ED treatment as adolescent girls in this population tend to report higher levels of family dysfunction than their T1DM peers without ED (Rodin et al., 2002). In particular, Rodin et al. (2002) found that young girls with T1DM and ED identified lower levels of support, communication, and trust than their non-ED peers when describing their relationship with their parents.

Rodin et al. (2002) analyzed the mother-daughter dynamics of girls with comorbid T1DM and ED as well as for T1DM girls without ED. By systematically observing videotaped mother-daughter interactions, Rodin et al. (2002) found that the mother-daughter relationships of girls with co-occurring T1DM and ED were characterized by less engagement, less empathy, and less support for the daughter's age appropriate autonomy than those of the non-ED cohort. Mothers of daughters with comorbid T1DM and ED seemed to be less capable of balancing their daughters' needs for both autonomy and guidance (Rodin et al., 2002). Family-based interventions can provide these parents with the practical knowledge and skills they require to support their children and aid these parents in striking a balance between supervision and child-independence (Rodin et al., 2002). As the family plays a large role in the management of chronic illnesses such as T1DM, family-based interventions are an integral part of building supportive environments in which those with co-occurring T1DM and ED can develop the personal skills they require to manage, and recover from, their challenging comorbidity.

Conclusion

Current interventions for co-occurring T1DM and ED are inconsistent and are often ineffective (Banting & Randle-Phillips, 2018). When not treated effectively, T1DM and ED are both dangerous conditions in their own right, and this danger is exacerbated by their co-occurrence (Rodin et al., 2002). Those with comorbid T1DM and ED therefore comprise an especially high-risk population. Providing this vulnerable group with effective treatment requires an upstream health promotion approach and the development of intensive, individualized, diabetes-specific, and family-based interventions. Research should continue to investigate the efficacy of the aforementioned interventions as well as further explore the relationship between the social determinants of health and co-occurring T1DM and ED.

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The Role of the Social Determinants of Health on Depression in the Elderly in Québec

EVANGELINE KAPSALIS

Statistics indicate that the incidence of elderly depression in Québec is on the rise. The physical environment and social networks have been shown to be important factors that play a role in the onset of depression among seniors. Thus, there is a need to implement policies at the broader level of these structural social determinants to reduce the risk of seniors developing depression. Studies have shown that the environment, neighbourhood characteristics, and transportation methods influence the ability for seniors to interact and have social contact. Social relationships are paramount in reducing the incidence of depression. Studies have shown the benefits of volunteering as a means for social interaction, and the feeling of contributing to society. As social isolation is a major cause for depression among seniors, policies actions need to be aimed at creating methods that enable seniors to interact and socialize with others, such as accessible transportation methods and programs. Through a focus on the social determinants, there can be an improvement of the lived-in environment and social networks to improve the mental health of the elderly of Québec, and reduce the incidence of elderly depression.

The Role of the Social Determinants of Health on Depression in the Elderly in Québec

There is an increasing incidence of depression in the elderly aged 65 years and over in Québec, with the incidence increasing from 3.5% in 2016 to 5.5% in 2017 (Cairney, et al., 2005, p. 808; StatsCan, n.d.). Characterized as the most common mental illness, depression affects one's emotions, as well as one's ability to cope with them (American Psychiatric Association, 2017, para. 1; Brouwer et al, 2005, p. 93). The challenges and circumstances of aging caused by structures in society can predispose individuals over 65 to depression (Licoudis, 2016, para. 2). It is clear that social determinants, especially the physical environment and social networks, play a role in the onset of depression amongst seniors by influencing mental health through various pathways, indicating the importance of addressing elderly depression in Québec through a model focusing on the social determinants of health.

The Role of the Physical Environment

Even though there have not been many studies on elderly depression

in Canada, studies in Europe and the US use an ecological model to indicate that the environment influences the onset of depression (Brouwer et al., 2005, p. 93; Djernes, 2006, p. 378-381; Fitpatrick & La Gory, 1992, p. 475-476). A study in Alabama shows that the elderly are especially sensitive to their neighbourhood characteristics (Fitpatrick, La Gory, 1992, p. 459-479). The physical environment they live in influences the quality of social support, and the resources available to them as they become less mobile with age, and experience functional impairments (Fitpatrick, La Gory, 1992, p.460, 465, 476). Additionally, living in areas with inadequate, poor or inaccessible transportation methods, including not being able to drive, decreases the opportunities available for social contact, limits the access to resources and health care, and increases the likelihood of developing symptoms of depression (Fitpatrick, La Gory, 1992, p. 465-466). In Québec, the area of residence is a risk factor as depression is higher in rural areas, and lower in metropolitan areas (Dube, Mechakra-Tahiri, Preville, Zunzunegui, 2009, p. 1229). Although this is not seen in other regions in Canada, as seen in a Manitoba study, these rural-urban differences play a role in the incidence of depression in the elderly in Québec, indicating that design and structure of neighbourhoods play a key role in depression (Blandford, St John, & Strain 2006, p. 1178; Dube et al., 2009, p. 1229-1230).

Broader social policies, such as neighbourhood planning and transportation regulations, also play a significant role in Québec (Dube et al., 2009, p. 1229-1230; Fitpatrick, La Gory, 1992, p. 459-466, 475-476). Urban areas with accessible methods of transport, and close contact with neighbours and friends allow for increased social support networks that act as a buffer for depression, while those in rural areas or poorly planned neighbourhoods hinder such support networks (Dube et al., 2009, p. 1226-1227, 1229-1230; Fitpatrick, La Gory, 1992, p. 460-466). Structural determinants, such as socioeconomic status and income, and public policy, are also important since the type of job held before retirement, pension benefits, and government funding, influence the neighbourhood that an elderly person can live in, and the types of care they can access as they develop functional and/or cognitive impairments (Brouwer et al., 2005, p. 93-98). Studies in various countries show that the type of housing, and home environment are important as the elderly in long-term care are at a greater risk for depression compared to those in community retirement housing, due to decreased social interaction, the feeling of loss of independence, and loss of familiar surroundings (Brouwer et al., 2005, p. 93, 95-96; Djernes, 2006, p. 378-382).

In Canada, various initiatives of social intervention have been implemented across various provinces, including the Wainwright and District Handivan Society in rural Alberta (an alternate transportation service for those unable to drive), and the South Shore Helping Hands in rural Nova Scotia (provides assistance with small tasks and transportation) (Government of Canada, 2017, p. 26-28, 33-34). These services allow the elderly to access recreational and public places for social interaction, while still allowing them to stay in their home and community longer (Government of Canada, 2017, p. 13-19). However, since the Québec government does not take part in integrated federal or provincial approaches, and instead takes full responsibility for its own seniors, many national interventions have not been implemented (Government of Canada, 2017, p. C-D). Instead, Québec has various provincial services and programs available for its elderly, from assistance with housing costs to transportation and home care, so that its seniors can remain independent in their own home and community (Gouvernement du Québec, 2018, p. 7-18). However, due to better infrastructure, these services are more accessible to seniors in urban centres (Dube et al., 2009, p. 1229-1230). Moving forward, actions and interventions that have been shown to benefit the elderly in urban centres need to be implemented in all areas of Québec. Elderly depression in Québec can be prevented through a focus and understanding of the influence that the broader structural role of the environment plays on mental health.

The Importance of Social Networks

The lack of social support networks is associated with the risk of depression among all age groups, but has a significant effect amongst the elderly, indicating the importance of high quality social relationships in preventing elderly depression (Dube, Mechakra-Tahiri, Preville, Zunzunegui, 2010, p. 56). Specifically, social isolation is harmful to mental health as it decreases the opportunities for developing social contacts, and obtaining social support (Bruce et al., 2009, p. 694-700; Musick, Wilson, 2003, p. 260). Various global studies show that low emotional support, lack of visits from children and family, and the loss of close friends are risk factors for depression among seniors (Djernes, 2006, p. 379-380). Different studies show that being single is also a factor for elderly depression, as those who are widowed are at an increased risk since the death of a spouse represents a decrease in social support networks (Blazer & Hybels, 2005, p. 1246-1247; Bruce et al., 2009, p. 1229; Brouwer et al., 2005, p. 93; Djernes, 2006, p. 378; Dube et al., 2010, p. 59-60).

Various global studies show the benefits of volunteering in the community as a method of social interaction (Dube et al., 2010, p. 59-60; Lightfoot, Lum, 2005, p. 33-35; Musick, Wilson, 2003, p. 259-261). It not only increases the social networks and resources of older adults, but also provides a feeling of power and respect, which in turn has a positive influence on their health (Dube et al., 2010, p. 59-60; Lightfoot, Lum, 2005, p. 33; Musick, Wilson, 2003, p. 261). As found in a study in Toronto, increased levels of social support were associated with a decreased incidence of depression, which indicates that social networks are a resource for the elderly that buffers against depression (Green-glass, Fiksenbaum, & Eaton, 2006, p. 20, 23-25).

Broader cultural and societal values also play a role in depression when elderly feel that they are no longer contributing to society or valued (Dube et al., 2010, p. 60-61). A study in Québec showed that the amount of contribution to society is correlated with the onset of depression (Dube et al., 2010, p. 60-61). Another risk factor is lack of community involvement, especially among elderly men, who after retirement lose their role in society as workers and contributors to the economy (Dube et al., 2010, p. 60-61). Additionally, the study observed that the lack of emotional support and a confidant, especially among elderly women, influence depression symptoms, indicating the need for society to create opportunities for social relationships (Dube et al., 2010, p. 59-61).

The Canadian government has implemented a nation-wide Age-Friendly Communities initiative which encourages social participation by providing seniors with accessible community activities, and volunteer positions (Government of Canada, 2017, p. 20-22; Gouvernement du Québec, 2018, p. 37). However, although such interventions have been implemented, they are not present in every community, and therefore, are not available to all seniors (Government of Canada, 2017, p. 20-21). In the future, there is a need for increased opportunities for the elderly to become active members of their community, and to participate in social groups in all areas of Québec. By focusing and understanding the importance of broader social networks as a determinant for elderly depression, its incidence can be reduced.

Policy Solutions to Address the Issue of Elderly Depression in Québec

Policies on reducing elderly depression in Québec need to target the

broader social factors by creating methods that bring seniors together (Government of Canada, 2017, p. 1-3). At the provincial level, the government needs to design facilities in all residential areas that are accessible by various modes of transportation, have programs, activities and volunteer opportunities for seniors so that they can meet people, socially interact, and build social networks. At the municipal level, the government needs to reduce transportation barriers by providing affordable and accessible transportation services in areas that are poorly developed and planned. This will provide the elderly with the opportunity to participate in community programs and services, thus reducing social isolation (Government of Canada, 2017, p. 1-3). These policies would also increase the amount of social support available, and in turn, help reduce the incidence of depression in older adults.

Conclusion

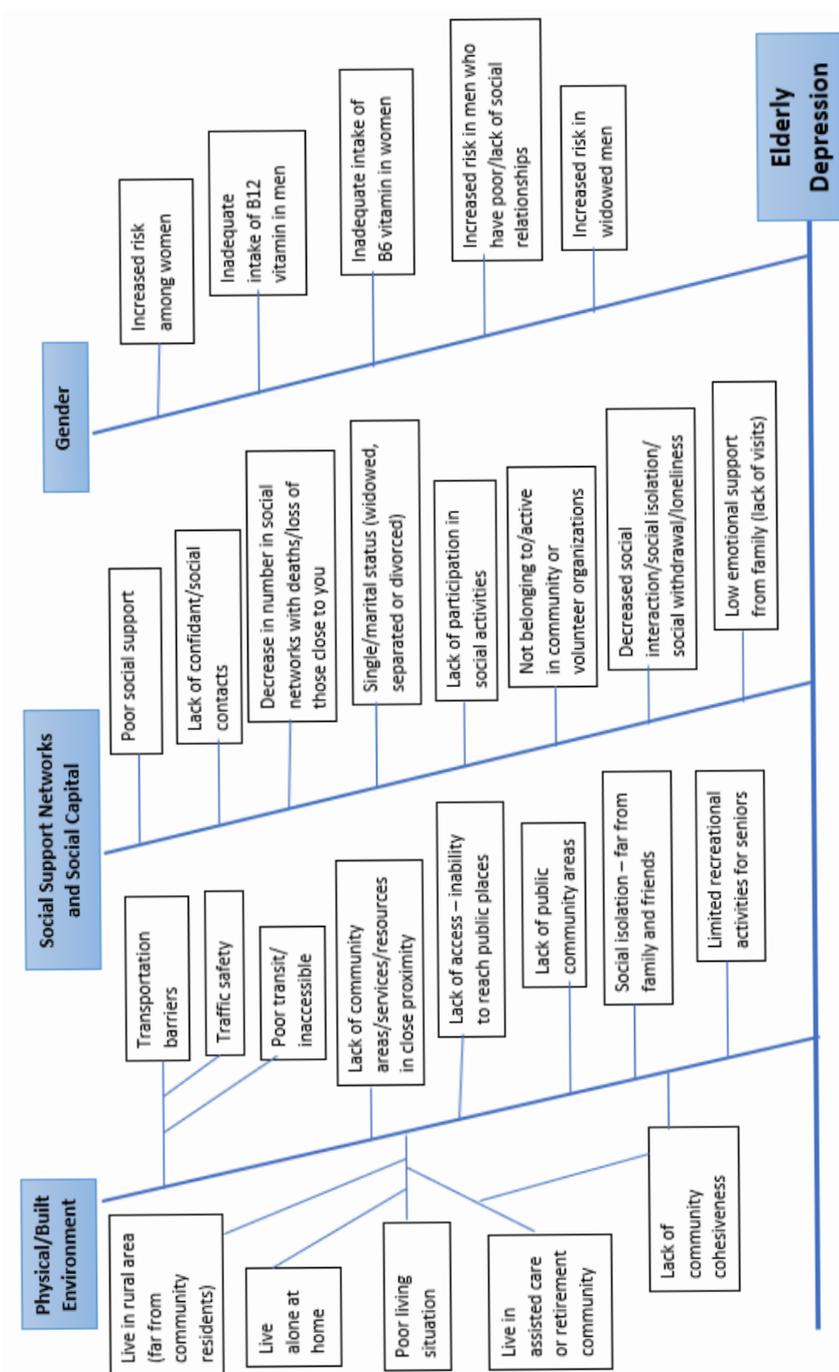
As the baby boomer generation ages, the number of older adults is increasing (Government of Canada, 2017, p. 1). Thus, the number of seniors that are at risk for suffering from depression in Québec is on the rise (Government of Canada, 2017, p. 1; StatsCan, n.d.). The role of the physical environment and social support networks as social determinants of health indicate the importance of addressing these determinants. Thus, effective policies should be directed at improving the environment lived in, and increasing the opportunities for social interaction between older adults. These policy actions decrease barriers that cause social isolation and feelings of loneliness, and can help to decrease the incidence of depression, and improve the mental health of the elderly in Québec.

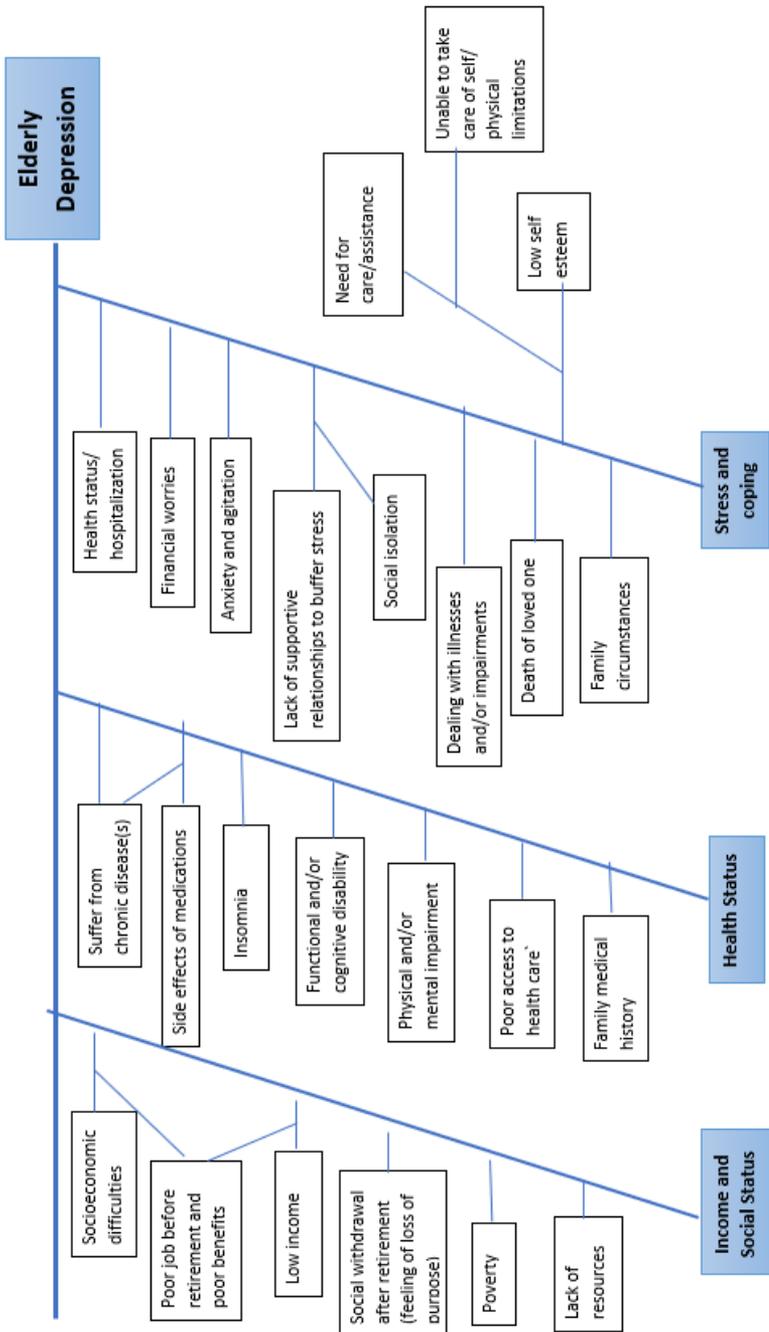
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Understanding Nutrition and Dementia: Changes in Eating and the Need for Training

YALDA MOUSAVI

Aims: The aim of this scoping review was to examine the available research on the association between nutrition and dementia for the elderly over the age of 65.

Background: Malnutrition and nutritional status have been associated with dementia, partly accounted for through difficulties eating and lack of nutritious foods, leading to weight loss or weight gain. With no treatment for dementia and a clear association with nutrition, it may become possible to improve the health of sufferers through alternative means.

Method: A scoping review of the available literature was done through PubMed, JSTOR, SCOPUS, Google Scholar and through reference lists, with search parameters inclusive of “dementia”, “eating”, “nutrition”, “Alzheimer’s” and “eating ability”.

Results: 10 articles were reviewed exploring the association between dementia and nutrition. 4 studies determined that eating ability, eating difficulty, and changes in eating patterns influenced the nutritional status of the elderly with dementia. 6 other studies contended that training programs and nutritional education are needed for caregivers.

Conclusion: The association between nutrition and dementia needs to be further researched and training/ educational programs need to be translated into new and existing programs and policies.

Keywords: Dementia, Alzheimer’s, nutrition, eating, elderly.

As the population of the world ages, dementia has become increasingly prevalent, with around 50 million cases thus far, growing by around 10 million new cases each year (WHO, 2018). Dementia is a disorder classified by the deterioration of cognitive functioning, memory, thinking, and the ability to perform daily activities (WHO, 2018). With the incidence rates of dementia exponentially rising, and without a proven cure, research ought to be done in areas which have not been thoroughly studied, one of which is nutrition. Evidence suggests that the brain can be directly modified by nutrient intake, specifically through micronutrient, macronutrient, and antioxidant consumption, which may influence cognitive function and dementia (Alzheimer’s Disease International, 2014). A healthy diet, and proper nutrition are essential for physical and mental well-being, but are often overlooked in research, specifically in relation to the effects on a person’s mental health.

Few randomized controlled trials (RCTs) have been done to assess the

impact of nutrition on dementia. Evidence from epidemiological cohort studies suggests that Alzheimer's disease is strongly associated with mid-life obesity, and that elderly with dementia suffer from malnutrition disproportionately, resulting from an imbalance between nutrient intake, and their nutrition needs (Alzheimer's Disease International, 2014). Thus far, the most consistent evidence in regards to dietary patterns improving health supports the Mediterranean diet, which is rich in fruits and vegetables, olive oil, wine and fish (Alzheimer's Disease International, 2014).

Beyond the actual food consumed, and its effects on the body, it is important to look at the many ways in which eating becomes a challenge, and contributes to the malnutrition of older adults. The literature within this scoping review suggests that dementia influences diverse factors, such as food availability and preparation, to appetite, taste and feeding problems, and thus, may impact dietary habits in different ways (Alzheimer's Disease International, 2014). This scoping review makes it evident that one of the biggest challenges faced by those with dementia is inadequate education and training caregivers receive, whether in the community or institutionalized/long-term care setting (Rullier et al., 2013; Saragat et al., 2012; Muurinen et al., 2014; Lauque et al., 2004; Min Lee & Song, 2014). By finding ways in which people with dementia show different characteristics, change their eating habits, or lack certain nutrients and minerals, it becomes possible to determine the mechanisms and nutrients which improve health, allowing for a more holistic view on the disease.

The goal of this scoping review was to examine the available research on the relationship between nutritional status and dementia, with the further aim of determining individual characteristics of people with dementia, which impacts their eating and nutritional status. Additional aims included determining the most important methods, interventions and needs for the elderly with dementia, in order to maintain and/or improve their physical and mental health.

Method

In November 2018, an electronic search was carried out using the following databases: PubMed, JSTOR and SCOPUS. Keywords used were "dementia", "nutrition", "eating", "Alzheimer's", and "eating ability". These keywords were combined in pairs, always including eating, nutrition or dementia in the search (Appendix B).

For inclusion criteria, the search was restricted to articles in English, after the year 2000, and included international studies since there are few recent studies that have been done in Canada. Observational, interventional and qualitative studies related to dementia and nutritional status were included, as well as RCTs. Sample characteristics of the studies had to include people over the age of 65, with dementia, living at home or living in an institutionalized setting, such as nursing homes and long-term care. Studies evaluating an intervention, assessing the eating habits of dementia sufferers, and identifying the relationship between dementia and nutrition were all evaluated for inclusion. For exclusion criteria, studies published in other languages and before the year 2000 were not included. Studies assessing the association between nutrition and mental health in general, were also excluded, if dementia or Alzheimer's were not directly mentioned.

The search strategy identified 3,292 relevant abstracts, with 50 being extracted for review. From these abstracts, 42 did not meet the inclusion criteria, and a representative eight were selected for inclusion (Appendix B). To identify additional studies for review, a web search was done on Google Scholar, and through references lists of the chosen studies. Two additional articles, included as supplementary information, alongside the eight articles, were chosen for this review (Appendix B). Keywords used to find grey literature also included combinations of the terms “dementia”, “nutrition”, “eating”, “Alzheimer's”, and “eating ability”. The literature had to include information about the relationship between nutrition and dementia, an evaluation of current programs, recommendations to caregivers, or discuss the lack of available research. One article, included as grey literature, was frequently mentioned in the reference lists of the previously chosen articles, and the other was found through Google Scholar. Each study was critically reviewed and analyzed, in order to extract data from the papers, and complete a summary and qualitative analysis (Appendix A).

Results

The findings of this scoping review reveal many themes that describe the association between nutrition and dementia in various ways. The following findings include a range of nutritional assessments, identifying individual characteristics impacting nutrition, interventions such as oral supplementation, and the need for training for caregivers caring for the elderly with dementia.

Relationship Between Nutrition And Dementia

As shown in Appendix A, a total of four studies examined the association between nutrition and dementia. Three of these four were cross-sectional studies (Rullier et al., 2013; Saragat et al., 2012; Muurinen et al., 2014), with one being a randomized controlled trial (Lauque et al., 2004). Outcome measures included the mini nutritional assessment (MNA), anthropometry, activities of daily living (ADL), instrumental activities of daily living (IADL), mental health assessments, and depression scales (Lauque et al., 2004; Muurinen et al., 2014; Rullier et al., 2013; Saragat et al., 2012). All studies found a significant association between nutritional status and psychological well-being in the elderly with dementia (Ibid.). Weight loss is a specific issue associated with dementia and Alzheimer's disease, which can be accounted for by the use of many medications, difficulties eating, lack of nutritious foods, and cognitive decline due to the disease (Alzheimer's Disease International, 2014). Alzheimer's Disease International highlights how in institutionalized settings, specifically, nutrient intake is inadequate, and 20-45% of those suffering from dementia experience significant weight loss, increasing morbidity, and increasing mortality (Alzheimer's Disease International, 2014). Saragat et al., (2012) also found a lower body cell mass in people with Alzheimer's, indicating a physical dimension measured through BIVA, which could serve as a biomarker of poor health.

Furthermore, in a community setting, it was determined that the nutritional status of the person with dementia was linked to the nutritional status of their caregiver who was a family member (Rullier et al., 2013). That is, the MNA score of the person with dementia was inversely associated with their ADL score, while being positively associated with the MNA score of their family caregiver (Rullier et al., 2013). The randomized controlled trial done by Lauque et al., (2004) also found that protein, and clean energy intake (nutritious foods and supplements) significantly increased fat-free weight gain, improving the nutritional status of those with Alzheimer's disease.

Individual Factors Influencing Nutrition For The Elderly With Dementia

As indicated in Appendix A, possible causes of different and low food intake for the elderly with dementia was the main study area for 3 of the 10 studies. Experimental designs varied, with two studies choosing cross-sectional studies (Lin et al., 2010; Min Lee & Song, 2014), and one study choosing a

prospective study (Ikeda et al., 2002). The common aim of all three studies was to assess the factors that influence the eating ability, and eating habits of the elderly with dementia, specifically in institutional settings. Outcome measures included MNA, activities of daily living scale, eating behaviour scales (Min Lee & Song, 2014), the Barthel index, Mini-Mental State Examination (MMSE), feeding evaluations (Lin, Watson & Wu 2010), and a questionnaire assessing swallowing problems, appetite change, food preference, eating habits, and other oral behaviours (Ikeda et al., 2012). Lin et al., (2010), and Min Lee and Song (2014), reported that differences in food intake for nursing home residents with dementia was associated with difficulty eating, and the eating location. Both studies contended that nurses need to be better equipped to assess the feeding ability of residents with dementia, in order to help them eat properly (Lin et al., 2010; Min Lee & Song, 2014). Fewer family visits also had an effect on the eating habits of residents with dementia, which highlights the social aspect of eating, and creates possible solutions to low food intake by simply having more social time at meals, and incorporating family more (Lin et al., 2010).

Ikeda et al., (2002) observed frontotemporal dementia and Alzheimer's disease, specifically, and found that changes in food preference, and eating patterns occurred for the elderly with dementia. No association emerged for Alzheimer's disease, although swallowing problems became an early warning sign for malnutrition (Ikeda et al., 2002).

The Social Care Institute for Excellence (2015) also noted individual characteristics that often change for the elderly with dementia. Suggestions included measuring body weight over time to track significant weight loss or weight gain (both associated with dementia), changes in food preferences, eating smaller meals more often, and analyzing how social circumstances around eating impact nutrition (Social Care Institute for Excellence, 2015). By tracking nutrition, weight, social changes and other individual characteristics, appropriate advice and support can be provided for the elderly with dementia (Social Care Institute for Excellence, 2015).

Interventions

A prospective randomized controlled trial done by Lauque et al., (2004) examined the effects of oral nutritional supplements (OS) on body weight, nutritional status, and cognition in patients with Alzheimer's disease. After 3 months of OS, 70% of patients in the intervention group, from care centres in

France, and 40% of control patients gained healthy, fat-free body mass (Lauque et al., 2004). With weight loss being a significant issue for the elderly with Alzheimer's disease, associated with mortality (Alzheimer's Disease International, 2014), OS showed significant body-weight increases, and the nutritional benefit was maintained over time (Lauque et al., 2004).

The Need For Staff Training

Murphy, Holmes, and Brooks (2017) studied 30 staff members from care organizations in the United Kingdom through focus groups and interviews, with the goal of developing a research model to understand nutritional problems for people with dementia. Seven domain areas were identified, including person-centered nutritional care, availability of food and drinks, tools, resources and environment, relationship to others when eating and drinking, participation in activities, consistency of care, and provision of Information (Murphy, Holmes, & Brooks, 2017). The study found that new educational models and training tools should be implemented to assess the nutritional status of those with dementia, and to help improve their eating (Murphy, Holmes, & Brooks, 2017).

Alzheimer's Disease International (2014) also contended that evidence showed an association between dementia and nutrition, which called for staff training programs and policies for the regular monitoring of nutritional status for the elderly with dementia. Staff training could address gaps in knowledge, and provide the skills necessary for caregivers to provide comprehensive care, involving eating assistance, managing aversive eating behaviours, and understanding the nutritional content of food (Alzheimer's Disease International, 2014).

Discussion

The main findings of this scoping review reveal that there is an association between nutrition and dementia, and that nutritional training becomes essential for caregivers to be able to assess, and promote nutritional status. The studies in this review acknowledge the need for further research to be done to assess the long-term success of interventions, educational programs, and to better understand nutrition's impacts on the brain and body.

Research Implications

There is a need for more research examining the association between dementia and nutrition, specifically to determine interventions that have proven to be successful, and to identify the various confounding factors that influence the eating habits of the elderly with dementia. Studies done by Murphy, Holmes, and Brooks (2017) and Min-Lee and Song (2014) express the need for further research to determine the effectiveness of nursing education and intervention programs, and whether these educational and training interventions prove to be successful over the long-term. Lin, Watson, and Wu (2010) also address the need for better research on how nursing staff members can successfully assess and aid in dementia patients eating and nutrition. Most studies done to date have been qualitative studies, including 7 of the 10 for review, lacking the ability to determine causality that an RCT could. Without RCTs, confounding variables can influence the existing complex pathways between nutrition and brain health, and thus, it becomes more difficult to design successful interventions.

As Canada's diverse population ages, context-specific research needs to be done to determine general nutritional trends of those with dementia, but also to be able to provide culturally appropriate nutritional care. Nutritional standards and eating traditions change across religions, making it necessary for caregivers to provide culturally appropriate care, and thus have the research available on different cultures. Further, as populations in Canada's provinces age differently, specific areas need to be studied to not only provide culturally appropriate care, but to also train enough caregivers to provide nutritional information and assessments, based on the province's needs. There is an overall lack of studies done in Canadian contexts and studies done in the United States or in Europe may not be generalizable to Canada.

Beyond the social and individual aspects of eating, nutrients direct effects on brain composition, cognitive functioning, and physical and mental well-being need to be further researched. While Lauque et al., (2004) found that oral nutritional supplementation helped the elderly with dementia attain a healthy body weight, the long-term effects of such supplementation have not been studied. Specifically, trials rarely include the population they are actually creating a drug or supplement for, which makes the side effects for that specific population virtually unknown. There is an overall need for RCTs studying the effects of supplementation on the elderly population with dementia. Specifically, there is a need for research on diabetes-related dementia, investigating

nutritional interventions, and long-term effects.

Practice Implications

The studies reviewed highlighted that caregivers, whether family members, friends, nurses or long-term care workers, did not have the proper training or tools to properly assess the nutritional status of the elderly with dementia, thus, being unable to successfully help them with their nutrition. The seven domain areas Murphy et al., (2017) identified, focused on person-centered nutritional care and the eating environment, revealed the need for new educational, and training tools to be added to existing programs in the institutional setting, equipping nursing staff to assess, aid, and facilitate eating for the elderly with dementia. Similar results were found by Min Lee and Song (2014) which suggested that nursing intervention programs could improve eating techniques, and quality of mealtime care, if appropriate training programs are created. This scoping review highlighted how nutritional status needs to be properly assessed, in order for caregivers to help the individual, which starts at the level of education and training the caregiver has on the problem. Saragat et al., (2012) proposed that bioelectrical impedance vector analysis (BIVA) is a successful tool for monitoring nutritional status of people with Alzheimer's disease, which could be integrated into institutional settings and doctors' offices, since nutritional status is associated with psychological functioning.

Beyond institutional settings, Rullier et al., (2013) found that the mini nutritional assessment (MNA) score was positively associated with the MNA score of the caregiver, usually being a family member. Their findings confirm the importance of determining nutritional deficiencies not just in the dementia sufferer, but also in their social network, specifically determining the nutritional status of their family caregivers (Rullier et al., 2013). As eating is often a social activity, and the food eaten by the individual with dementia is most probably prepared by the caregiver, if the caregiver has good nutritional status and habits, they are likely to prepare similar, healthy foods. Once again, in order for training tools and educational programs assessing nutritional status and aiding in eating to be developed, further evidence is needed from RCTs to be implemented into practice.

Policy Implications

There are few policies that account for the effects of nutrition on

mental and physical health. Thus, medical institutions, such as care facilities, are not required to regularly check the nutritional status of patients/residents. According to the Alzheimer's Society of Canada, "57% of seniors living in a long-term care home have a diagnosis of Alzheimer's disease or other dementia" (Alzheimer's Society of Canada, 2018). When residents with Alzheimer's disease have deteriorating psycho-functional abilities related to their nutritional status, policies must be implemented to regularly monitor their eating habits, nutritional status, and the overall food quality, including micronutrient and macronutrient levels (Saragat et al., 2012). Muurinen et al. (2014) found that 28% of residents in nursing homes in Helsinki were malnourished, and suffered with the worse psychological well-being. By creating policies to monitor nutritional status, and changing eating habits through the use of BIVA, MNA, anthropometry, and mental state examinations, it becomes possible to change or improve the eating habits of residents with dementia, thus improving their overall well-being (Saragat et al., 2012).

Within community and institutional settings, policies must be implemented requiring formal caregivers to receive adequate nutritional training, in order to be able to assess and aid in the eating habits of those whom they are providing care for (Murphy, Holmes, & Brooks, 2017). Services should also be available for family or informal caregivers within the home setting. These can include educating them on nutrition, and how to help dementia sufferers eat and maintain an adequate nutritional status (Murphy, Holmes, & Brooks, 2017). These services should be publicly funded, and be regularly provided in public places, such as community centres.

Beyond the contents of this scoping review, policy must be implemented for care facilities to provide healthier, more nutritious foods, which calls for the Canadian government to spend more than an average of \$9 a day on food per resident (Ontario Long Term Care Association, 2018). Proper nutrition, and vitamin and mineral supplementation can lead to proper molecular balance in the brain which in turn leads to good health, especially mental health, which is the basis of orthomolecular psychiatry (Mental Help, 2018). By having the Ministry of Health and Long-Term Care reallocate funds, and work towards improving food quality and nutritional value, the more nutritious food could lead to better health, and possibly cost the system less elsewhere.

Given the clear association between nutrition and dementia, and more generally, the effects of nutrition on mental and physical health, policies must

be implemented to include more holistic and preventative measures within the Western medical system. By recognizing the importance of nutrition, older adults with dementia may be able to demedicalize their symptoms, and avoid adding more drugs into their system. This calls for more research on how nutrition impacts other diseases, and how it can become a replacement for certain medications, or simply an aid in recovery.

Conclusion

With the absence of disease-modifying treatments for dementia, alternative therapeutic approaches, including nutrition have become an area of importance for research. In terms of the effects of nutrients on dementia, thus far, “antioxidants, phospholipids, omega-3 fatty acids, and polyphenols are known to be beneficial for brain function” (Lee et al., 2018). Besides the need for more research on micronutrient and macronutrient effects on the brain, body, dementia and mental health, it is also important to identify factors which influence the activity of eating, and to determine what intervention programs may better equip caregivers to assist in attaining healthy nutrition for elderly dementia sufferers. Overall, the findings of this scoping review suggest that the elderly with dementia, suffered the most from malnutrition (Lauque et al., 2004; Muurinen et al., 2014; Rullier et al., 2013; Saragat et al., 2012). Furthermore, it was found that poor nutritional status was associated with difficulty eating, eating location, social influences of eating, and lack of assistance (Lin et al., 2010; Min Lee & Song, 2014; Ikeda et al., 2002). All in all, studies called for educational programs and training tools for caregivers, in order to be able to understand, and assess the eating and nutritional status of the elderly with dementia, and assist them in attaining a healthy nutritional status.

This scoping review is limited in the sense that not all studies related to the topic were explored. Only a limited number of studies were assessed and chosen, therefore, important studies may have been overlooked. Also, few studies have been done in Canada, thus the scoping review took an international viewpoint, further highlighting the importance of geographically-specific research to be done. This review was also limited to a few public databases, where more information could have been collected if numerous databases were utilized. A general limitation mentioned in the review is the lack of clinical trials assessing the impact of nutrition on dementia, in order to determine specific interventions, and the long-term implications of these interventions. Since

dementia currently has no treatment, it becomes important to assess and implement non-traditional, or non-medicalized interventions and treatments, such as healthy eating. While researching and learning about the effects of nutrients on the brain is important, when assessing the nutritional status of the elderly with dementia, the social and personal aspects of eating must not be overlooked. Another important topic which future research should consider looking into is whether healthier eating, and better food choices in institutionalized settings save the healthcare system money, through fewer medications and healthier individuals. Overall, the impact of nutrition on health must be further researched, and initiatives and policies assessing and educating about nutrition need to be implemented in the healthcare system.

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Appendix A: Numerical Summary Data Extraction Table

Author, Country of Origin, Study Design	Study Character (purpose & sample)	Outcome Measures	Findings and Conclusions
Alzheimer's Disease	N/A	N/A	<ul style="list-style-type: none"> - Undernutrition is common for people with dementia - In care homes, attention to staff training and mealtime environment can lead to increased calorie intake - Need more research on nutrition and dementia, specifically undernutrition and weight loss - Staff training is needed
Ikeda et al., (2002) United Kingdom Prospective study	<p>Purpose: Investigate prevalence of eating behaviour changes in people with frontotemporal dementia and Alzheimer's disease.</p> <p>Sample: 91 older adults with dementia in UK.</p>	<ul style="list-style-type: none"> - Questionnaire with 5 categories: swallowing problems, appetite change, food preference, eating habits, and other oral behaviours. 	<ul style="list-style-type: none"> - Change in food preference and eating patterns in frontotemporal dementia. - Swallowing problems developed early in Alzheimer's, but no significant pattern emerged.
Lauque et al., (2004). France Prospective, randomized control trial	<p>Purpose: Examine the effect of oral nutritional supplements (OS) on body weight, nutritional status, and cognition in patients with Alzheimer's disease (AD).</p> <p>Sample: 46 patients from care centres in France who received OS, 45 control patients.</p>	<ul style="list-style-type: none"> - Weight - Body composition - Cognitive function, - Activities of daily living - Eating behavior and dietary intakes - Supplement compliance 	<ul style="list-style-type: none"> - Weight loss associated with AD - 40% of control group and 70% of patients from intervention group gained fat-free weight after 3 months. - Protein and energy intake improved for intervention group.

Author, Country of Origin, Study Design	Study Character (purpose & sample)	Outcome Measures	Findings and Conclusions
<p>Lin, Watson & Wu, (2010)</p> <p>Taiwan</p> <p>Cross-sectional study</p>	<p>Purpose: To investigate the risk factors of low food intake for elderly with dementia</p> <p>Sample: 477 dementia patients from Taiwan long-term care.</p>	<ul style="list-style-type: none"> - Barthel index - Mini-Mental State Examination (MMSE) - Edinburgh Feeding Evaluation in Dementia (EdFED) scale. 	<ul style="list-style-type: none"> - Low food intake of residents with dementia associated with no assistance with eating, eating difficulty and fewer family visits. - Nursing staff should assess residents' feeding ability and assist.
<p>Min Lee & Song, (2014)</p> <p>Korea</p> <p>Descriptive, cross-sectional study</p>	<p>Purpose: To identify factors that impact eating ability for people with dementia.</p> <p>Sample: 149 people in nursing homes in Korea.</p>	<ul style="list-style-type: none"> - Korean Mini-Mental State Examination - Korean Activities of Daily Living Scale - Eating Behaviour Scale 	<ul style="list-style-type: none"> - Significant eating ability differences according to cognitive and physical function, eating place and diet type. - It is important to assess eating ability of people with dementia and to develop training programs for caregivers.
<p>Murphy, Holmes & Brooks, (2017)</p> <p>United Kingdom</p> <p>Focus groups and semi-structured interviews</p>	<p>Purpose: To develop a research informed model for understanding the nutritional problems associated with eating and drinking for people with dementia.</p> <p>Sample: 27 care organisations. 30 staff members total</p>	<p>7 measures:</p> <ul style="list-style-type: none"> - Person-centered nutritional care - Availability of food and drinks - Tools, resources and environment - Relationship to others when eating and drinking - Participation in Activities - Consistency of care - Provision of Information 	<ul style="list-style-type: none"> - Seven identified domain areas (7 outcome measures) - Collaboratively developed, person-centred model can create new education model and training tools - Can train caregivers to help dementia patients attain proper and healthy nutritional status.

Author, Country of Origin, Study Design	Study Character (purpose & sample)	Outcome Measures	Findings and Conclusions
<p>Muurinen et al., (2014)</p> <p>Helsinki</p> <p>Cross-sectional study</p>	<p>Purpose: To examine the relationship between nutritional status of service housing and nursing home residents with dementia, and their psychological well-being (PWB).</p> <p>Sample: 2379 long term care residents</p>	<ul style="list-style-type: none"> - Mini Nutritional Assessment (MNA) questionnaire, including 6 measures of PWB. - Medical records 	<ul style="list-style-type: none"> - 28% of residents malnourished. - residents with worse nutrition suffered with worst PWB. - Nutritional status of residents with dementia was significantly associated with their psychological well-being.
<p>Rullier et al., (2013)</p> <p>France</p> <p>Cross-sectional study</p>	<p>Purpose: Examine impact of individual characteristics of dementia patients and family caregivers on their nutritional status.</p> <p>Sample: 56 community living elderly with dementia and 56 family caregivers.</p>	<ul style="list-style-type: none"> - Mini mental state examination - ADL and IADL - Neuro Psychiatric Inventory (NPI) - MNA <p>For family members:</p> <ul style="list-style-type: none"> - Burden Interview (Zarit scale) - State-Trait Anxiety Inventory - Center for Epidemiologic Studies Depression Scale 	<ul style="list-style-type: none"> - In people with dementia: 58.9% were at risk of malnutrition and 23.2% had poor nutritional status. - Family members had 32.1% risk and 5.4% poor status. - MNA score of older people with dementia was inversely associated with the ADL score and was strongly and positively associated with the MNA score of family caregiver. - Nutritional status should be fully assessed.

Author, Country of Origin, Study Design	Study Character (purpose & sample)	Outcome Measures	Findings and Conclusions
<p>Saragat et al., (2012)</p> <p>Italy</p> <p>Cross-sectional study</p>	<p>Purpose: To analyze nutritional status in relation to psycho-functional conditions in elderly patients with Alzheimer’s disease (AD) by bioelectrical impedance vector analysis (BIVA). Sample: 83 free-living patients with 91 age matched controls</p>	<ul style="list-style-type: none"> - Nutritional status was evaluated by anthropometry - Mini nutritional assessment - BIVA - Mini Mental State Examination (MMSE) - Geriatric Depression Scale (GDS) -Activities of daily living (ADL) - Instrumental Activities of Daily Living (IADL). 	<ul style="list-style-type: none"> - Patients with Alzheimer’s disease had a worse psycho-functional and nutritional status. - Lower body cell mass in Alzheimer’s patients -BIVA is a suitable tool for the screening and monitoring of nutritional status in AD.
<p>Social Care Institute for Excellence 2015</p>	<p>N/A</p>	<p>N/A</p>	<ul style="list-style-type: none"> - Measuring a person’s weight overtime is important to make sure weight is not lost - Food preferences changes - Healthier snack options can improve nutrition - Social circumstances around eating need to be considered - Dementia associated with malnutrition

Appendix B: Method of Study Selection

Database	Keywords Searched	Number of Results	Number of Studies Selected, Authors
JSTOR	“Dementia”, “nutrition”, “Alzheimer’s”, “eating”, “eating ability”	903	2 -Min Lee & Song, (2014) -Muurinen et al., (2014)
Google Scholar	“Dementia”, “nutrition”, “Alzheimer’s”, “eating”, “eating ability”	127,000	2 -Social Care Institute for Excellence -Alzheimer’s Disease International
PubMed	“Dementia”, “nutrition”, “Alzheimer’s”, “eating”, “eating ability”	2042	4 -Lin, Watson & Wu, (2010) -Murphy, Holmes & Brooks, (2017) -Rullier et al., (2013) -Saragat et al., (2012)
PsycINFO	“Dementia”, “nutrition”, “Alzheimer’s”, “eating”, “eating ability”	3	0
SAGE Journals	“Dementia”, “nutrition”, “Alzheimer’s”, “eating”, “eating ability”	4169	0
University of Toronto OneSearch	“Dementia”, “nutrition”, “Alzheimer’s”, “eating”, “eating ability”	19,242	0
SCOPUS	“Dementia”, “nutrition”, “Alzheimer’s”, “eating”, “eating ability”	347	2 -Ikeda et al., (2002) -Lauque et al., (2004)

Periodontal Health Promotion Through a Common Risk Approach

ANNA NESS

Periodontal disease affects 75% of adult Canadians to varying degrees, and yet one-in-six Canadians are not capable of addressing their dental health needs due to a lack of resources. Drawing on relevant academic literature and reports from various dental associations and organizations across Canada, this paper examines the state of access to periodontal health care in Canada and those factors that limit the effectiveness of current periodontal health care policies. This review indicates that current biomedical and behaviour approaches to Canadian periodontal health policy fall short of promoting overall health through the exclusion of the social determinants of health. This paper finds that an adoption of a common risk approach to periodontal health on the part of Canadian policy makers would increase access to dental care. This paper moves to approach treatment for periodontal disease through the mitigation of risk factors common with other chronic diseases.

Periodontal disease (gum disease) is caused by the inflammation of the gingival tissues (gums) and the supporting structures around the teeth due to the formation of bacterial colonies found in the sticky substance of plaque (Batchelor, 2014; Thomson, Sheiham, & Spencer, 2012). The accumulation of plaque creates an inflammatory process, which causes the gingival tissues to bleed and recede away from the teeth (Batchelor, 2014; Petersen & Ogawa, 2005; Thomson, Sheiham, & Spencer, 2012). Once the disease begins to spread into the bone, it may cause the teeth to become loose and fall out (Batchelor, 2014; Petersen & Ogawa, 2005; Thomson, Sheiham, & Spencer, 2012). Periodontal disease is the most prevalent chronic disease in humans and impacts not only the functional processes of eating and chewing, but can affect the self-esteem and social relationships of those who develop it (Batchelor, 2014; “Gum Disease and Overall Health,” 2018, para. 1; Peterson & Ogawa, 2012).

This paper will argue that current biomedical and behavioural models of treating periodontal disease are ineffective in reducing the burden of this disease in the Canadian context. It will highlight the need for further integration of the social determinants of health into policy and program making in Canada in order to promote better health outcomes of periodontal disease (Petersen & Bachni, 2012; Petersen & Ogawa, 2012; Raphael, Bryant, & Rioux, 2010). It

will do so by: (1) critically examining the current biomedical treatment modalities and behavioural approaches used to prevent periodontal disease, and (2) identify the risk factors that link periodontal disease to the social determinants of health. Periodontal disease shares many common risk factors with other major chronic diseases, yet policies and programs that target chronic diseases isolate the mouth from the body (Sheiham & Watt, 2000; Watt & Petersen, 2012). This is exemplified by the lack of access to dental care, as coverage for dental services are not included in the Ontario Health Insurance Plan or in the Canadian Medicare system (“Oral Health is Public Health,” 2018, para. 2). Ultimately, this paper proposes that Canadian federal and provincial policy and program makers should utilize a common risk factor approach as part of their health promotion strategies in which the inclusivity of periodontal health is integral to their design (Sheiham & Watt, 2000). This could be a step forward in achieving overall health and increasing access to dental care in Canada through the promotion of oral health.

Access to Dental Care in the Canadian Context

The Canadian Dental Association sites that in 2010 80% of Canadians had yearly access to a dentist (“A Snapshot of Oral Health,” 2017, para. 5), while the Ontario Dental Hygienists’ Association sites that up to 75% of adults will experience some degree of periodontal disease in their lifetime (“Gum Disease and Overall Health,” 2018, para. 1). Although the Canadian Dental Association states that access to dental care is widespread it acknowledges that 32% of Canadians do not have dental coverage and that one in six Canadians cannot address their dental needs due to the lack of finances (“A Snapshot of Oral Health,” 2017, para. 5, 7). Since dental care is not covered under the Ontario Health Insurance Plan, those who do not have coverage must be eligible for public programs or pay out of pocket (“Oral Health is Public Health,” 2018, para. 2). The high prevalence of periodontal disease in Canadian could suggest that even for those who have public or private access to dental care, the clinical treatments that are available are not only expensive, but also ineffective in their treatment of periodontal disease (Batchelor, 2014; Watt & Petersen, 2012).

Current Biomedical Approaches

Within the biomedical understanding of periodontal disease, plaque is determined to be the by-product of bacterial processes that occur in the mouth, and it is the accumulation of plaque that begins the inflammatory pro-

cess that breaks down gum and bone support over time (Batchelor, 2014; Watt & Petersen, 2012). This understanding suggests that the preventive course of action includes frequent removal of plaque via the oral home care regiment of flossing and brushing, and having the teeth professionally cleaned on a regular basis (Batchelor, 2014; Watt & Petersen, 2012). Further, although specialized surgical treatments may be available, they are not curative in active sites of periodontal disease; once the bone support around the teeth is gone, the prognosis becomes poor and teeth may be lost (Batchelor, 2014; Thomson, Sheiham & Spencer, 2012).

As mentioned above, the Canadian Dental Association states that 80% of Canadians rely on dental services, yet they give no statistics on how many sought preventative or surgical treatments of periodontal disease (“A Snapshot of Oral Health,” 2017, para. 5). Not every individual has access to a dental clinic, and even for those who do and are insured, they may not have enough coverage for frequent cleanings or for specialists’ fees incurred in the prevention or treatment of periodontal disease (Batchelor, 2014; Watt & Petersen, 2012). These traditional treatments are ineffective on a population level due to the lack of access to dental care in Canada. Further, they are ineffective on an individual level because they heavily rely on professional involvement— which is costly and time consuming (Batchelor, 2014; Watt & Peterson, 2012).

Current Behavioural Approaches

Behaviours explain a small amount of individual variation in health, thus a deeper explanation of health inequalities needs to be explored (Thomson, Sheiham, & Spencer, 2012). The behavioural approach to periodontal disease proves ineffective as it heavily relies on individual lifestyle and behavioural modifications that neglect the influence of the social determinants of health, particularly for those that are marginalized or disadvantaged due to their low socio-economic status (SES) (Watt & Petersen, 2012).

The Ontario Association of Public Health Dentistry (whose aim is to provide oral health information to the general public) provide tips for good oral health on their website, which include: “eat a healthy diet, brush twice a day, floss daily, visit your dentist regularly, don’t smoke” (“Oral Health is Public Health,” 2018). These tips should equip the individual with the tools needed to prevent the accumulation of plaque from causing periodontal disease, yet the behavioural model fails to explain that individuals may continue to smoke due

to other factors in their lives, even though they may be aware of the risks associated with such behaviour (Thomson, Sheiham, & Spencer, 2012). This model isolates those who do not have access to oral hygiene aids, dental clinics, or to nutritional foods.

Periodontal Disease and the Social Determinants of Health

Social determinants of health are socio-political factors that govern who has the resources to access good health as determined by their income, education, social status, and environment (Raphael, Bryant, & Rioux, 2010; Thomson, Sheiham, & Spencer, 2012). These determinants produce social inequalities that directly affect health: people at the bottom of the social ladder tend to have the poorest health outcomes (Petersen & Baehni, 2012; Raphael, Bryant, & Rioux, 2010; Sheiham & Watt, 2000; Thomson, Sheiham, & Spencer, 2012). The social determinants of health should be utilized for a better understanding that those who get affected by periodontal disease may be living in poverty, have a lower level of education, a lower level of employment, may be racialized, or living in a physical environment that is hazardous to their health (Petersen & Baehni, 2012; Petersen & Ogawa, 2012; Raphael, Bryant, & Rioux, 2010).

Common Risk Factors for Periodontal Health and Other Conditions

There are numerous risk factors associated with periodontal disease, including smoking/tobacco use, poor nutrition/diet, excessive consumption of alcohol, stress and poor hygiene practices (Petersen & Ogawa, 2005). These risk factors are often believed to be a choice that is made by an individual on a daily basis, as exemplified above in the tips provided by the Ontario Association of Public Health Dentistry (“Oral Health is Public Health,” 2018). This hides the fact that those of lower SES will have a higher risk of periodontal disease and other major chronic diseases (Petersen & Baehni, 2012; Petersen & Ogawa, 2005; Petersen & Ogawa, 2012; Thomson, Sheiham & Spencer, 2012).

Periodontal disease shares many of its risk factors with other chronic diseases, such as diabetes, cancer, stroke, obesity and cardiovascular disease (Petersen & Baehni, 2012; Petersen & Ogawa, 2005; Petersen & Ogawa, 2012; Thomson, Sheiham & Spencer, 2012). As such, periodontal health should be understood as playing an important part in overall health (Petersen & Baehni,

2012; Petersen & Ogawa, 2005; Petersen & Ogawa, 2012; Thomson, Sheiham & Spencer, 2012). It has been shown that a bidirectional link exists between oral health and systemic health, meaning that the negative effects of periodontal disease will exacerbate the effects of any other present pathologies (Sheiham & Watt, 2000). For example, an individual who has both periodontal and cardiovascular disease will experience the negative effects of each disease while intensifying the symptoms of the other (Sheiham & Watt, 2000). As such, these other major chronic diseases can also be understood as by-products of the social determinants of health (Petersen & Ogawa, 2005; Petersen & Ogawa, 2012; Sheiham & Watt, 2000).

Common Risk Factor Approach: Beyond Current Approaches

The social determinants of health have been largely avoided in the dental community; however, the industry is beginning to be scrutinized for neglecting to acknowledge the social relationships that determine oral health (Watt & Petersen, 2012). It is imperative to connect periodontal disease to other systemic diseases in order to improve the overall health of an individual (Watt & Petersen, 2012). The mouth must be discussed in relation to the body, and not in isolation (Watt & Petersen, 2012). Shifting away from biomedical and behavioural models will not only highlight the role that the social determinants of health play in periodontal disease, but will focus the attentions of program and policy makers on periodontal health promotion via the development of policies and programs that target common risk factors of numerous chronic diseases (Petersen & Ogawa 2005; Sheiham & Watt, 2000; Watt & Petersen, 2012). Due to the commonalities of these risks, creating health policies in Canada that incorporate oral health as part of overall health will act as a health promotion strategy more in line with those suggested in the Ottawa Charter for Health Promotion (Watt & Petersen, 2012).

The Ottawa Charter for Health Promotion states that “health promotion is the process of enabling people to increase control over their health and its determinants, and thereby improve their health” (World Health Organization, 1986, para. 3). Health promotion focuses on enabling the individual or group to attain health through community empowerment, advocacy, the creation of safe environments and healthy policy development (World Health Organization, 1986). The Ottawa Charter highlights the health inequalities that individuals face, which work to impede personal choice, and creates a framework to tackle health inequalities through health promotion, all in the name of

achieving health for everyone (World Health Organization, 1986).

Theory of the Common Risk Factor Approach

Sheiham and Watt (2000) propose that a common risk factor approach would be more effective at tackling health disparities than biomedical and behavioural models alone, as they tend to isolate diseases not only from one another, but also from their social determinants. This strategy incorporates the tenants of the Ottawa Charter; it is directed at the health of populations versus individuals through the empowerment of communities and development of health policy (Sheiham & Watt, 2000). The common risk factor approach is a strategy through which periodontal health promotion could become part of public health for all (Petersen & Baehni, 2012; Sheiham & Watt, 2000; Watt & Petersen, 2012). Sheiham and Watt (2000) state that policies and programs that focus on the body in isolation from the mouth (or vice-versa) are a waste of resources. Rather, by linking risk commonalities the risk factor approach would avoid the duplication of messages that get featured in specialized programs or policies, in turn increasing the effectiveness and efficiency of each program (Sheiham & Watt, 2000).

Sheiham and Watt (2000) note that certain risk factors cluster around one another: for example, individuals who smoke may have a higher chance of having a poor diet and consuming excessive amounts of alcohol. These individuals are also more likely to have a lower level of education, a lower paying job, and may be marginalized or disadvantaged due to their low SES (Sheiham & Watt, 2000; Watt & Petersen, 2012). By targeting clusters of risks, the common risk approach links periodontal disease to other chronic diseases through the common risk factors that can overlap in individuals (Sheiham & Watt, 2000). This approach targets not only the populations that suffer from one particular disease, but links their disease(s) to the social determinants of health, and targets them within a cluster to promote overall health (Sheiham & Watt, 2000).

Application of the Common Risk Factor Approach: Case Example

The World Health Organization (WHO) Framework Convention on Tobacco Control is an international treaty that has been used in the development of public health policies in relation to tobacco and has trickled down to the national level (Watt & Petersen, 2012). The literature notes that tobacco

controlling policies affect the prevalence of smoking, which eventually filter down to the individual and have a mitigating effect on these various chronic diseases (Thomson, Sheiham & Spencer, 2012; Watt & Petersen, 2012).

The Smoke Free Ontario Act (2017) prohibits the use of tobacco and cannabis by minors, prohibits smoking in public spaces in Ontario, and was originally implemented in 2005 in the Canadian context after the WHO framework was released. This example is not a commentary on the effectiveness of prohibitive policies in combating chronic health risks. Rather, it works to highlight one way in which Ontario does utilize a facet of the common risk approach: decreased access to smoke permitted areas may reap health benefits, including decreasing the risk of lung cancer and cardiovascular disease through the control of second-hand smoke (“Dangers of second-hand smoke,” 2015, para. 14). Biomedical and behavioural models are often utilized by governments as a convenient way of conferring the responsibility of health on to the individual, and removes the responsibility from the government in regards to safeguarding health. Further, dentistry is a privatized billion dollar industry—Canadians spend \$12 billion per year on dental care (“High Cost of Dental Services,” 2018, para. 3). Universal dental care in Canada may not be a part of the nations healthcare system anytime soon, but if policy and program makers choose to connect all public health policy that focuses on the reduction of chronic health care disparities, then oral health can begin to be included as part of overall health (Thomson, Sheiham & Spencer, 2012; Watt & Petersen, 2012).

Conclusion

Periodontal health is part of oral health, and oral health is part of overall health (Sheiham & Watt, 2000; Watt & Petersen, 2012). If health equality for all is the goal in Canada, as stated by The Ottawa Charter, then provincial and federal policy makers should utilize a common risk factor approach when creating programs that tackle chronic health disparities, promoting oral health as a part of overall health (Watt & Petersen, 2012). Periodontal disease is caused by bacterial colonies found in plaque, a sticky substance that is found in every single individual regardless of their socio-economic status (Batchelor, 2014; Thomson, Sheiham, & Spencer, 2012). The social determinants of health affect who will have the resources to prevent plaque from causing periodontal disease (Sheiham & Watt, 2000; Watt & Petersen, 2012). By linking social inequity to periodontal health, policies and programs that integrate

a common risk approach can approach treatment for periodontal disease through the mitigation of risk factors common with other chronic diseases (Petersen & Baehni, 2012; Sheiham & Watt, 2000; Watt & Petersen, 2012). Further research can be done in the Ontario context to determine how to best cluster certain risk factors in the development of policy, both to increase their effectiveness and to be inclusive of Canada's most vulnerable populations.

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Cardiopulmonary Resuscitation and Life-Saving First Aid Training in Canada: A Proposal

FILIP POTEPSKI

An increase in cardiovascular disease in Canadians translates to an increased risk of sudden cardiac arrest events in the population. Out-of-hospital resuscitation and first aid correlate with positive outcomes in sudden cardiac arrest patients. Due to poorly implemented cardiopulmonary resuscitation and life-saving first aid training in Canada, Canadians are inadequately equipped to handle out-of-hospital cardiac arrests in their day-to-day life. Many national training programs fail due to poor funding and mismanaged resources. This lack of training translates into a greater burden on individuals as well as the healthcare system. The effects of bystander resuscitation and first aid, as well as the factors driving bystanders to intervene are explored through an analysis of previous literature on the topic in this paper. Various national training strategies regarding first aid training are examined and the factors affecting the success or failure of these programs is discussed in relation to Canadian implementation. This paper proposes a possible strategy based on successful health education programs as a solution to training Canadians on a national level and discusses possible structural obstacles.

Cardiopulmonary Resuscitation and Life-Saving First Aid in Canada: A Proposal

With over 7 million Canadians reported as obese and numbers rising annually, over 2 million suffering from diabetes, and over 5 million smoking, there is a significant risk of the development of cardiovascular disease (CVD) (Fryar, Chen, & Li, 1999; Statistics Canada, 2017) in the population. Many different forms of CVD are associated with heart failure, and heart failure has been found to significantly increase the risk of sudden cardiac arrest (Pazos-López et al., 2011; Uretsky & Sheahan, 1997). With this marked increase in the risk of sudden cardiac arrest due to increasing numbers of CVD in Canadian populations, as well as geographic isolation limiting Canadian access to emergency health services, training Canadians to provide cardiopulmonary resuscitation (CPR) and life-supporting first-aid (LSFA) in emergency situations is becoming increasingly necessary (Orkin et al., 2012). However, despite public health policies enacted requiring CPR and LSFA training in many secondary schools in Canada there is still a significant lack of training occurring due to numerous economic and logistical barriers (Act Foundation, 1999; Hart, Flores-Medrano, Brooks, Buick, & Morrison, 2013). This paper will argue that

through the regulation of guidelines regarding CPR/LSFA training and through community leadership programs, which have been found effective in other health education programs, effective CPR/LSFA training can be made accessible to Canadians regardless of socioeconomic status, education, or geographic location. These changes would increase patient survivability in cases of out-of-hospital cardiac arrest (OHCA) by means of bystander CPR/LSFA.

CPR Impact on OHCA Patients

Immediate bystander CPR performed in an out-of-hospital setting has been shown to significantly improve the chances of a patient's survival during a sudden cardiac event. It should be noted that in North America the rate of OHCA patient survivability without intervention is roughly 8% (Nichol et al., 2008; Sasson, Rogers, Dahl, & Kellermann, 2009; Weisfeldt et al., 2010). CPR performed on OHCA patients has been found to lead to increased rates of survival and improved neurological outcomes (Wang et al., 2014). This immediate action can prevent brain death and organ failure, increasing patient survivability rates as well as reducing the potential for further complications (Wang et al., 2014). Bystander CPR initiation varies between locale, but countries with higher bystander CPR rates generally have higher survivability rates for OHCA patients (Hansen et al., 2016). This information suggests a correlation between OHCA survival rates and bystander CPR/LSFA (Hansen et al., 2016).

Bystander CPR Rates Depend on Training

Numerous different factors affect bystanders' willingness to perform CPR/LSFA in an emergency situation. A lack of training and the fear of the possibility of causing further damage were reported as major factors (Eisenburger & Safar, 1999). A country with a significant bystander intervention rate is Norway (73%), with 25% of patients surviving OHCA (Hansen et al., 2016). It was also found that 90% of Norwegians reported having first aid training this suggests a correlation between higher bystander intervention rates and education (Kvåle Bakke, Steinvik, Angell, & Wisborg, 2017). First aid education makes lay persons more assertive in emergency situations, more confident in their CPR/LSFA skills, and more willing to help others in the similar scenarios (Kvåle Bakke et al., 2017). Many of the factors preventing lay bystanders from intervening in emergency situations could be negated with improved education.

CPR Education Viability

Improvements in technology have made CPR/LSFA training more accessible and efficient in recent years (Uray et al., 2003). Children as young as 6-7 years old have shown to be able to learn and retain basic LSFA techniques (Uray et al., 2003). Identifying the necessity for health education to younger populations and maintaining those values can lead to a healthier population in the future. Training with mannequins has been shown to improve retention of psychomotor skills associated with CPR and should be encouraged in training programs (Eisenburger & Safar, 1999). Allowing individuals to experience CPR/LSFA applicable situations in practise scenarios has also been shown to have a positive effect on CPR quality and an increase in survival rates (Bobrow et al., 2013). Improved CPR quality correlates with favourable outcomes for OHCA patients (Bobrow et al., 2013). Automated external defibrillators (AEDs) have been made more accessible in Canada with the roll out of the National AED Program (Government of Canada, 2016). Recent advancements in AEDs allow for several models to provide audiovisual feedback during LSFA, which is also associated with improved CPR quality (Bobrow et al., 2013).

Global CPR Policies and their Failures

With the increasing simplicity and effectiveness of CPR/LSFA training, as well as the increasing concerns of CVD and its effects on populations, several countries have passed legislation requiring first aid training in schools (Hansen et al., 2016; Kvåle Bakke et al., 2017; American Heart Association, 2018; Sorets & Mateen, 2015). Yet despite first aid being part of the national Norwegian school curriculum, very few Norwegians have listed school as the source for their first aid training (Kvåle Bakke et al., 2017). A similar issue has arisen in the United States, where 38 states currently require CPR training in high schools, but the rules and regulations for that training vary greatly between each state resulting in inconsistent CPR quality nationally (American Heart Association, 2018; Sorets & Mateen, 2015). In Denmark, school CPR training has not been successfully implemented despite legislation, due to lack of proper implementation and monitoring (Hansen et al., 2016). Policies in Ontario, Canada, have similarly failed due to lack of resources (Hart et al., 2013). Major issues cited in all these implementation failures often revolve around a lack of education materials, funding, and trained instructors (Hart et al., 2013).

Community Leadership Programs and their Effectiveness

In order to circumvent economic and resource issues involved in de-

veloping new training programs with certified instructors, developing community-based CPR/LSFA training programs with volunteer community leaders might prove to be more effective. Recent studies have shown that involving community leaders in health promotion has proven to be successful in improving health outcomes (Ali & Hiroshi Ushijima, 2018; Campbell et al., 2008; Tsutsumi et al., 2005). Community involvement and leadership have been major players in recent public health crises and using similar strategies can have promising outcomes on lay person health education and training (Kadomoto, Iwasa, Takahashi, Dulnuan, & Kai, 2011; Trapence et al., 2012). Volunteer instructors have shown to be capable of passing on knowledge as efficiently as public health professionals when provided with educational materials and training (Kadomoto et al., 2011). These approaches to community-based leadership training have been found to have sustained effects on improving health outcomes (Ceraso et al., 2011). Training only a few community leaders with nationally regulated guidelines for CPR/LSFA and providing the educational materials would not be fiscally taxing or very difficult. A novel strategy could be implemented in schooling systems, with one or two certified faculty members training older students, and older students training younger students with supervision, similar to health education systems promoted in the Philippines (Kadomoto et al., 2011). CPR/LSFA training should be kept as simple as possible to be most effective, and with significant retention levels in young children, training at a primary school level is entirely feasible (Eisenburger & Safar, 1999; Uray et al., 2003).

Discussion & Implications

Economic Disparities

In order to allow individuals of all socioeconomic levels to have access to the benefits of CPR/LSFA training, circumventing the economic burdens associated with CPR/LSFA training should be a priority. Cost is often referenced as a major deterrent to implementing training (Hart et al., 2013). The high disparities in OHCA survivability between counties in the US make the location of residence one of the most important factors in determining patient survival (Sorets & Mateen, 2015). If CPR training programs remain optional there is a high likelihood of areas of lower socioeconomic status having lower positive health outcomes in regards to OHCA (Sorets & Mateen, 2015). In Canada numerous populations suffer systemic disadvantages and lack of services, especially in northern territories, and with limited availability of affordable healthy

food options these populations are often at high risk of developing CVD (Orkin et al., 2012). While training these communities to be able to properly react in emergency situations will not solve systemic disadvantages, it may alleviate the emotional and physical burdens of patients suffering from OHCA and the associated complications.

Geographic Isolation

In northern Canadian territories, communities are sparsely located (Statistics Canada, 2016). This geographic isolation leads to a limited access of services (Orkin et al., 2012). The services required also vary based on the geographic features of the area (Orkin et al., 2012). Training in these areas should be molded to fit the lifestyles of individuals living there. Working with community leaders to implement sustainable programs would be a necessity. Urban and rural environments have varying health problems and those differences need to be acknowledged with the implementation of any programs (Orkin et al., 2012). Training individuals in isolated communities with community-focused programs has been shown to lead to improved health outcomes (Orkin et al., 2012). Individuals in these communities may also be more receptive to health professionals offering training if programs are developed with their communities specifically in mind (Bhanji et al., 2010).

Lack of Records Regarding OHCA as a Knowledge Gap

A significant knowledge gap regarding OHCA was found during research for this paper and has been acknowledged by other researchers as well, which should be explored in further research (Vaillancourt, Charette, Stiell, Phillips, & Wells, 2010). Similarly, bystander-initiated CPR in the US lacks quantification due to a lack of records (Sorets & Mateen, 2015). Without well-maintained records regarding the effects of lay person CPR/LSFA, the benefits of bystander CPR/LSFA on OHCA patients in Canada cannot be quantified. Lacking information on bystander CPR/LSFA also reflects poorly on legislations requiring first aid training as the benefit or failure of these programs is determined by the increased survival of OHCA patients with bystander intervention. Any policy changes requiring CPR/LSFA training should be implemented alongside improved record keeping in regards to OHCA situations by Canadian health services.

Summary

Increasing rates of CVD might have a significant effect on sudden cardiac arrest events in the Canadian population. Bystander intervention and CPR/LSFA is a major determining factor in patient survivability during sudden cardiac arrest in out-of-hospital settings (Wang et al., 2014). While CPR/LSFA training will not improve the cardiovascular health of the population, it can relieve the fiscal and health burden of complications associated with cardiac arrest in the population.

Education and training are major factors in whether or not bystanders choose to initiate CPR/LSFA, but education and training policies have been poorly implemented globally, including in Canada (Hart et al., 2013). These poor implementations are mostly due to a lack of resources and regulations (Hart et al., 2013). With community-based leadership teaching programs, CPR/LSFA training can be made to be more efficient and available for all Canadians.

If CPR/LSFA training remains largely outside the scope of the public sector many Canadians will not be able to afford training and be at a higher risk of complications associated with OHCA (Sorets & Mateen, 2015). The geographic isolation of many Canadian communities also limits the resources and services available, but with community members trained to handle emergency situations we will see improved health outcomes. Alongside any policy changes made regarding CPR/LSFA training in communities, ways to improve OHCA data need to be explored and implemented in Canadian health services.

Conclusion

Moving forward, with the increasing rates of CVD in Canadians, changes regarding CPR/LSFA training in schools and communities need to be addressed as soon as possible as a short-term solution to sudden cardiac arrest events in the population. This paper proposed a method for improving survival rates among patients experiencing sudden cardiac arrest in an out-of-hospital setting that can be implemented in schools and communities. With an aging population and increasing obesity rates, an increase in cardiac arrest events in Canadians is expected in the future, and without intervention many may die or suffer unnecessarily (“Facts about Heart Disease | The Heart Research Institute - Heart Research Institute,” n.d.). Improvements to record-keeping in Canadian health services is also needed to evaluate further developing issues (Vaillancourt et al., 2010).

In the long-term there is a need for improved cardiovascular health education and access to healthy foods for Canadians. The increasing rates of obesity in Canadian children is especially concerning (Statistics Canada, 2017). Systemic disadvantages for Aboriginal Canadians and Canadians living in northern territories need to be addressed to improve health outcomes (Orkin et al., 2012). The lack of services in geographically isolated Canadian communities needs to be addressed as well (Orkin et al., 2012). CPR/LSFA training is not enough to improve the cardiovascular health of Canadians, and the government is urged to act and address this issue quickly and efficiently.

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Modelling the Biological and Social Determinants of Health Using COBWEB

VIVIAN TSENG

Health is a complex interaction of biological, environmental, social, and personal factors, which are known as the determinants of health. This study used an agent-based simulation software called Complexity and Organized Behaviour within Environmental Bounds (COBWEB) to model the population health outcomes of Canadians by modulating both social determinants of health (social support, income, and immigration) and biological determinants of health (cardiovascular disease and gender). Income was the strongest predictor of population health outcomes, making it the most important determinant of health, irregardless of high social support and absence of CVD.

Health is a multifaceted concept which must be defined and approached in an interdisciplinary way. Using a biomedical approach, health is defined as the absence of diseases, but with a behavioural approach it is the interaction of individual choices, such as exercise and diet (Svalastog, Donev, Kristoffersen, & Gajović, 2006). To fully understand the factors that contribute to health, the biological, environmental, social, and personal factors which interact within an individual's life must be considered. These factors are known as determinants of health and vary in prevalence and severity across populations (World Health Organization, 2005). Biological determinants of health include chronic diseases, age, and gender (Denton, Prus, & Walters, 2004). Social determinants include social cohesion, social support networks, income, and immigration which is of particular significance in Canada (WHO, 2005; Gee, Kobayashi & Prus, 2004). To consider the present and future health of Canadians, the interaction of both biological and social determinants must be analyzed together.

Social Support

Social support can be defined as the emotional, material, and informational support exchanged between family and friends (Cutler, Deaton, & Lleras-Muney, 2006). Support can be informal through friends or family or formal through health care workers. Viner et al. (2012) found strong social support networks are necessary for the healthy brain development of adolescents and for developing healthy behaviours regarding diet, exercise, and substance management. They also found social support networks facilitate the transition

of adolescents into adulthood and form a protective barrier against harmful healthy behaviours.

Income

Income and life expectancy have a consistent positive relationship in all countries, with the rich living significantly longer than the poor (Cutler et al., 2006). The underlying cause of this relationship is complex and has been linked to a lack of education, health literacy, stress, and use of technology (Cutler et al., 2006). Viner et al. (2012) also found that those with a lower socioeconomic status are more likely to engage in harmful health behaviours, such as drug and alcohol misuse. Those in the highest income bracket and between the ages of 40 to 64 are 4.65 times more likely to have higher self-reported health than those in the lowest (Bonner et al., 2017). There is also a significant relationship between low income status and the development of asthma, allergies, and infections in childhood (Victorino & Gauthier, 2009).

Low income is also associated with a greater prevalence of smoking, obesity, diabetes, hypertension, and poor working and living conditions (Kreatsoulas & Anand, 2010). The rates of mortality linked to CVD are interconnected with the effects of low income, which can be attributed to not having the financial resources to pay for services, medications, and not having the proper knowledge of diseases (Kreatsoulas & Anand, 2010). As for the Canadian population, CVD accounts for one third of all deaths in Canada making it the leading cause of death, with mortality rates on the rise in both genders and all age groups (Lee, Chin, & Manuel, 2009; Filate, Johansen, & Kennedy, 2003).

New Resident Status

Immigrants are faced with numerous challenges when they first move to Canada and are known to underutilize health care services compared to native born citizens (Tiwari & Wang, 2008). Certain ethnic communities such as Southeast Asian populations are much less likely to seek professional health for mental illness than Canadian born citizens (Tiwari & Wang, 2008). This is linked to barriers in accessing services, such as discrimination, transportation to services, perceived stigma, and feelings of dismissiveness from health care workers (Whitley, Kirmayer, & Groleau, 2006). Language barriers are another significant obstacle faced by immigrants which creates problems for understanding symptoms, treatments, and their prescriptions (Whitley, Kirmayer, & Groleau, 2006). The inability to communicate with health care providers

can create dissatisfaction and distrust towards the health care system (Derose, Escarce, & Lurie, 2007). These negative emotions prevent future visits to the doctor and can contribute to the underutilization of services, which both can lead to the delayed diagnosis of life-threatening conditions (Derose, Escarce, & Lurie, 2007). This contributes to the “healthy immigrant effect” which has been documented in numerous studies where immigrants have a higher level of health than Canadian-born citizens before coming to Canada and then see their health decline after settlement (Gee, Kobayashi, & Prus, 2004).

Gender

Gender is both a biological and social determinant of health as health outcomes vary between males and females in consistent ways. For example, women have higher rates of depression, distress, and psychiatric disorders (Patten et al., 2006). Men have double the chances of dying from their first acute myocardial infarction and are 20% more likely to die if diagnosed with ischemic heart disease (Public Health Agency of Canada, 2017).

Denton, Prus, & Walters (2004) found gender based differences in health by measuring self-reported health, level of distress, and overall health using the Health Utility Index. They found social determinants of health, such as life stressors, life events, and social support are more important for determining the health outcomes of women. In contrast, behavioural determinants of health, such as smoking, drinking, exercise, and diet are more important for men.

Method

The software Complexity and Organized Behaviour within Environmental Bounds (COBWEB), an agent-based simulation model was used to simulate the Canadian population. This software can be used to represent a large population using parameters to control the life history of individuals, called agents in the model, and their environment. The agents can gain energy and when they run out of energy, they die. Time is represented as ticks, which is an arbitrary measurement linked to the movement of each agent. The fluctuations in the parameters are outputted to an Excel spreadsheet. Using COBWEB, both biological factors and social factors (social networks, group dynamics) can be manipulated to see how they create changes in the population.

A 50 x 50 grid was used with 3 separate models run to distinguish between the effects of social support, chronic disease (CVD), and immigration on

health contrasted with the effect of income on health. In the first model, low versus high social support was modelled by differentiating the social support level between two sets of high, middle, and low income groups. The second model applies the effects of CVD by doubling the aging rate of a group of agents in order to simulate a lower life expectancy within the parameters of the model. The third model adds a group of immigrants to the 12 agent groups with varied income, social support, and CVD.

Social Support

COBWEB allows the agents to engage each other within the framework of the Prisoner’s Dilemma, a game that was formally described with mathematics (Mero, 1998). It allows the user to vary cooperation probability, which determines the likelihood agents will cooperate with each other, which can be used to represent social support. Agents with strong support networks had a higher cooperation probability and higher preference for genetically similar agents.

Income

The Organisation for Economic Co-operation and Development (2016) defines the middle class as those with 0.75-2 times the median income. The median income in 2016 was \$70,336 (2016 Census Highlights, 2017). Using information from Statistics Canada (2017), in 2015 33% of Canadians would be considered lower class with 3% as the upper class.

Income Bracket	Definition	Percentage	Initial Food Amount	Favourite Food Energy
High Income	Greater than double the median	47%	100	100
Middle Class	Between 0.75-2 times the median	50%	50	50
Low Income	Less than 0.75 the median	3%	20	20

100 agents were used in each model to represent the Canadian population of which 47 represent the high income group, 50 are in the middle, and 3 in the low income group. There are 3 types of food, one for each agent of which they can only eat. Since energy is the main resource which keeps agents alive, those in the high income group had higher favourite food energy, which gives them more energy from their type of food. They also began with a higher initial food amount.

Immigration

A large immigrant population of 400 agents begins on a separate island than the non-migrants. After this population is allowed to run for 250 ticks, it was sampled and inserted into the model with the non-migrant agents. When they were added with the 12 other agents, their settings were changed to lower social support and the amount of food decreased. This represents the decline in health that immigrants face after settlement (Gee, Kobayashi, & Prus, 2004). The island stimulates movement between the home country to a new one. The immigrant agents also had a strong preference factor for staying in the island due to increased favourite food energy, meaning they would get more energy from eating food in their native island than if they were moved off the island.

Gender

Women have poorer health outcomes as men, especially immigrant women who have much lower levels of social support and untreated health issues compared to Canadian born women (Sword, Watt, & Krueger et al., 2006). Immigrant women are also more likely to have low family incomes which have also been linked to poor well-being (Sword, Watt, & Krueger et al., 2006). These two factors are modelled in the agent group with low social support and low income.

Gender based differences for men were modelled with the agent groups which had lower life expectancy and higher rates of CVD (Mosca, Barrett-Connor, & Wenger, 2012; Greenberg & Normandin, 2015). As CVD is a non-communicable disease, the disease parameters on COBWEB could not be used as it would make it transferable from agent to agent. Instead, the aging rate of the agents who had CVD was doubled to represent a lower life expectancy and greater chance of dying compared to their counterparts.

Results

Low Versus High Social Support

When looking at the graphs, the trajectory of the lines need to be considered rather than the number of surviving agents as the initial amount of agents varied depending on the income group. As Figure 1 shows there is not that much of a difference between low and high social support between the low and high income groups. For the middle class there seems to be steadier growth for the high social support group compared to the low social support group.

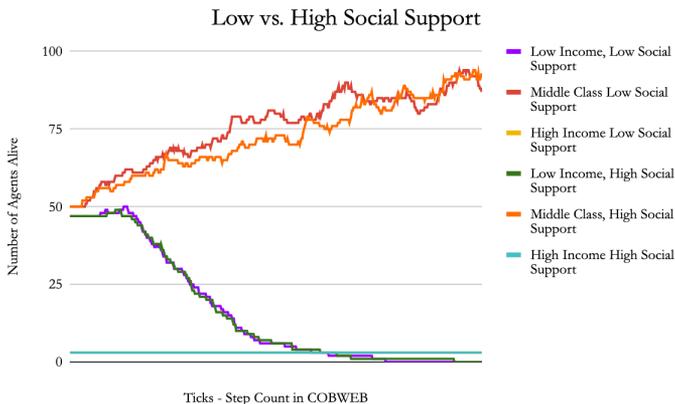


Figure 1 - Comparing low and high support groups amongst agents with varying income levels.

CVD

When modelled in both low and high social support settings, the patterns for CVD prevalence and no CVD prevalence were the same. There is considerable difference between the growth rates of the population if CVD is prevalent for low and middle income groups. There is no difference between the growth rates of the high income group if CVD is prevalent, as the population remained consistent at 3 agents for the entire 500 ticks.

Immigration

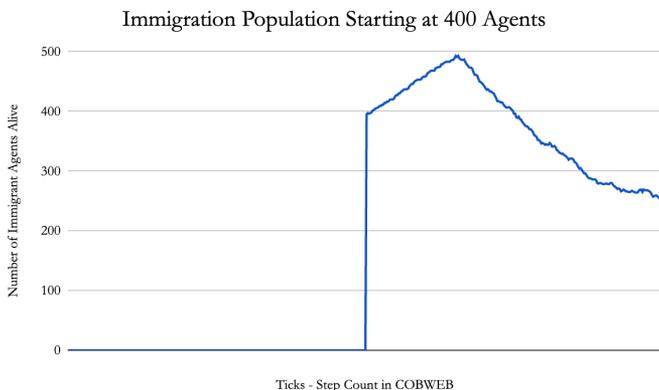


Figure 2 - A population of 400 immigrant agents are added into the population with Immigration was simulated by creating a separate immigrant population and inserting it into

the model with the 12 agents. The immigrant agents were added to the model with the 6 other agent groups at 250 ticks. As shown in Figure 2, for the first 70 ticks, their population grew and then saw a rapid decline at 330 ticks. The immigrant sample population began with 400 agents and 200 initial energy which is the same as the high income group and high social support.

Discussion

Low Versus High Social Support

The model uses 100 agents to represent the Canadian population, of which only 3 represent the high income group. Regardless of having low or high social support, the beginning population of 3 in the high income group was able to thrive the whole 500 ticks. This suggests having social support networks did not have an effect on the low income group, as their population declined in a similar pattern whether or not they had strong social support. Income which is represented by amount of food energy is more important than social support networks in determining the trajectory of a population. This might be due to energy being the main resource which keeps agents alive, which is analogous to income earned and its contributions to quality of life.

CVD

Despite the high income group having much fewer agents, the whole initial population of 3 agents with no CVD remain. 2 of the agents from the richest with CVD remain after 500 ticks. High income agents are able to sustain themselves throughout the 500 ticks, but not reproduce. This suggests high income in the form of energy from food in this model is more vital to the survival of the agents, regardless of having a lower life expectancy.

Immigration

When the agents were added to the simulation at 250 ticks, their population increased for 80 ticks, but then it decreased from 400 initially to 255 at 500 ticks. When they were added to the model with the 6 other agent groups, they were not forced to compete against them for food or other resources since each agent has their own separate food and energy derived from it. Instead, due to their loss of energy, social support, and favourite food energy after immigration, their population decreased. This is analogous to the healthy immigrant effect where immigrants have better health outcomes before they move (when the agents were by themselves in the island) compared to when they were put

with the other agents and allowed to move out of the island (Gee, Kobayashi, & Prus, 2004).

Gender

Immigrant women are more likely to have lower levels of social support and lower incomes (Sword, Watt, & Krueger et al., 2006). In all 3 models, this was linked to higher rates of mortality. This could mean that a combination of those two variables leads to worse health outcomes as discussed in the literature (Sword, Watt, & Krueger et al., 2006).

Conclusion

This model suggests that income is the most important determinant of health which is also supported by the literature (Bonner et al., 2017). Future modelling can be used to determine the significance of each determinant as well as also how determinants interact in a population. More research is needed to explore the complex interconnected nature of the determinants of health in the population of Canada. There are studies that focus on the biological determinants and on the social determinants but more studies must explore their interactions (Denton, Prus, & Walters, 2004). Health must further be conceptualized and analyzed using an interdisciplinary approach. By using COBWEB, the health of a large population, such as Canada, can be modelled using gender and cardiovascular disease as biological determinants and income, social cohesion, and immigration as social determinants. More insight can be given to how these determinants interact and affect rates of mortality using this program. COBWEB can be used to develop a multidisciplinary approach in modelling population health.

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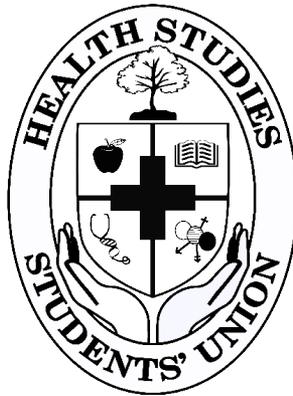
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