

Research Article

A Sketch of Nutritional Challenges, Awareness and Resources for Older Adults in Ontario

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Abstract

Canada is an ageing nation, with a greying demographic expected to comprise 25% or more of the population by 2025. Several aging associated chronic conditions are often associated with nutritional challenges that are often of a cumulative nature. In this review of literature, we have attempted to sketch a portrait of the aging demographic using the nutrition associated health challenges, the associated food and nutritional connections, food insecurity and foodbanks, the resources available for understanding nutrition with an urban snapshot, cumulative nutritional damage and finally what nutritional access might look like in a post-COVID scenario.

The Aging Landscape in Ontario and Canada

Over the decades, older adults in Canada are a rapidly growing segment of the population and are living longer and healthier lives than previous generations. In 2014, over 6 million Canadians were aged 65 or older, representing 15.6 percent of Canada's population. In less than a decade, by 2030, it is expected that older adults will

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number over 9.5 million and make up 23 percent of Canadians. Concurrently, by 2036, the average life expectancy at birth for women will rise to 86.2 years from the current 84.2 and to 82.9 years from the current 80 for men [1]. It has been projected that from 2015 to 2021, the number of older adults will exceed the number of children aged 14 and younger for the first time ever. By 2036, the number of older adults could reach between 9.9 and 10.9 million people. Apparently, by 2041, the number of older adults in all age groups is expected to continue to rise to comprise nearly a quarter (24.5%) of the Canadian population, as compared to the 14.8% in 2012. Those aged 85 and over are expected to nearly triple to 5.8% of the total population by 2041 [2].

Even though the improved medical technology and public health measures have provided Canadians with a longer life expectancy and quality of life than in the past, chronic health conditions are widespread among older adults, with four out of five older adults residing at home having a chronic health condition of some kind [3]. The most common of these conditions are hypertension, arthritis or rheumatism, back pain, heart disease and cataracts. Alzheimer's disease and other forms of dementia also affect significant numbers of older adults and are expected to present a major social and public health problem as the population ages. Most dementia sufferers are 75 years of age or older and the rate of 1.5% in 2008 is expected to rise to 2.8% of the Canadian population by 2038 [4]. Many older adults also have a disability or activity restriction that requires them to seek assistance with various activities. Limitations in performing activities of daily living increases sharply after 85, with mobility, sight, hearing and cognition becoming more restricted [5].

Despite the prevalence of these chronic conditions and activity limitations, older adults generally perceive themselves to be in good health. As of 2011, 46% of men and women over 65 rated their own health as very good or excellent. It has been observed that higher levels of educational attainment are strongly related to better self-reported health, as are greater independence, the absence of pain or barriers to communication, and the presence of strong social networks. Some community dwelling older adults with a diagnosis of hypertension continued to maintain their levels of activity and were mindful of their micronutrient uptake [6]. Even older adults residing in long-term care facilities generally rate their health fairly highly, suggesting that they adjust their expectations for health relative to their circumstances and those of their peers [7].

Nutrition, Food Access and Health

Good nutritional health is critically important for the prevention and management of nutrition related health conditions as well as the prevention of cognitive and physical functional decline. The achievement and maintenance of good nutritional health is particularly challenging for the burgeoning and diverse older population. Food insecurity is a complex, multidimensional phenomenon in older adults [8]. Many older adults experience nutritional health inequity as a result of gender, race or ethnicity, education or income, country of birth, disability, living arrangement, adequacy of social support,

or geographic location. Limited access to nutritionally adequate foods is found to increase the risk of poor nutritional and health status of the elderly [9]. Apparently, the salience of food insecurity has been underscored by its links to cardiovascular risk, diabetes body mass index or obesity risk of emergent and overnight care and non-adherence to pharmaceutical regimes [10-16]. In older adults specifically, food insecurity has been found to predict poor nutritional outcomes, including lower caloric intake, fewer meals per day, and foods lower in nutrients [17].

The negative health outcomes of malnutrition often lead to inadequate food access and result in food insecurity [18]. Food security is defined as a condition where “all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” [19,20]. Food security requires the availability, accessibility and proper use of food. Food insecurity can affect the health and well-being of individuals [9]. Since nutrition is considered as one of the main determinants of healthy and active aging, consumption of adequate nutritious food is crucial for physiological well-being and better health and quality of life [21]. Proper nutrition and access to food is not a concern for many individuals living in Canada, however for individuals who fall below the poverty line it is a very tangible and stressful reality. Access to nutritious food is not a luxury that everyone has and many individuals often go with no nutritious food or no food at all [22,23]. With the increasing cost of living, even individuals with jobs are forced to choose between housing or purchasing enough food or a variety of food required for healthy living. Food security refers to the acquisition of all nutrients needed to have a healthy diet, someone can eat food everyday and still not have food security [24]. There are many individuals who live in highly populated low-income areas that face food deserts due to lack of nutritious food. Food desert areas are low income areas where the only food available does not have much nutritional value [25,26]. For instance, lower income areas with a large minority population often have very few grocery stores in the area and have significant difficulties finding fresh produce [27,28]. Areas in northern Canada have higher levels of food insecurity due to high cost of living, high cost of housing, fewer jobs and jobs with lower wages. The cost of living is so high in some areas that even working individuals can only cover the cost of their rent leaving them without money for food or other resources [29].

Food Insecurity in Canada

Food insecurity and access to proper nutrition is a large issue within rural and remote areas; these areas may not have a local food bank. Alternatively, transportation to these locations may be limited. These issues also greatly affect the indigenous population with many reserves being isolated and without food programs. Some rural areas traditionally have grown and made their own food and have not required assistance from food programs. However, due to changing demographics in rural areas, there is a significant increase in poverty and an absence of resources [30,31]. Areas with lower population with individuals living in poverty often require them to have to have their own vehicle for transportation because there isn't any public transportation comparable to larger cities like Toronto and Ottawa. Nunavut has the highest rate of food insecurity at 36.7% of the population, which is four times the Canadian average in 2011-2012 [29,32,33]. Weather conditions and long-distance travel make these services unreachable for a large percent of the population.

Individuals who have a physical disability would also have difficulties with transportation and accessing nutritious food. These individuals are often part of demographic that requires food bank services due to high cost of living and low financial government support [34-36]. There is also a great amount of food insecurity seen within food desert areas in Canada and the United States [32,37]. Affordable food is offered because residents of the community are not able to afford more nutritious items which results in residents consuming high carbohydrate and high fat diets. Residents who fall below the poverty line are 2.5 times more likely to consume fast food on a regular basis [38]. While residents may be consuming three proper meals a day the content of the meals does not provide the nutrients needed for a healthy diet.

Health Implications of Food Insecurity

There is a stigma surrounding individuals using food programs such as food banks and many individuals are reluctant to use these services due to societal views. Chronic dependence on food banks and financial stress can strain an individual's mental health. It has also been shown that food insecurity can put an individual at higher risk of being mentally ill [39-41]. Food insecurity puts individuals at risk of developing mental health issues and its impact is different for different age groups. Adolescents who face food insecurity are more likely to have suicidal thoughts and tendencies, adults with food insecurity were likely to suffer from stress, substance abuse and anxiety, and older adults with food insecurity were more likely to develop depression [42]. A possible reasoning for the mental health issues is constant worrying about if they will have enough resources to survive. Living in poor conditions, not having resources and being unsure if these aspects of an individual's life will ever change can cause significant damage to an individual's thought process and how they relate to their surroundings [43-45]. There needs to be greater amount of services put in place to ensure that food bank services are there for individuals in times of need but also to help individuals to not to have to rely on these services for prolonged periods of time.

In older adults, food insecurity is associated with numerous unfavorable nutrition and non-nutrition-related outcomes that may affect their health and well-being. Food insecurity is associated with low nutrient intakes [46] increased nutrition risk [47], and unhealthy weight and body size [48-50]. Food insecurity in older adults is also associated with poorer self-reported health status [46,51,52], anemia, poorer physical performance, anxiety and depression [53], multi-morbidity and disability [54,55], lower cognitive function, and decreased quality of life [56]. Food insecurity further contributes to the development or exacerbation of diet-related chronic illnesses. Food insecurity in older adults may lead to forced trade-offs between paying for basic needs including food, housing, heating, medication, social services, and medical care [15]. Because of the unique characteristics related to aging, diseases, and health status, the consequences of food insecurity are said to be potentially more severe for older adults than for the younger population.

Mitigation of Food Insecurity; Food Banks

Food banks were first introduced in Canada in 1981 in order to compensate for the recession that the country was facing. Food banks in Canada continue to serve individuals in need. All major cities in Canada have food banks and food programs to help those who cannot afford food. However rural or sparsely populated areas

often do not have the same food banks or nutritional supplementation programs and services are often quite difficult for individuals to access [30,31,57]. Some areas in Canada have food banks which provide meals and non-perishable items free of cost to individuals who are not able to afford these items. Individuals that utilize food bank services on a regular basis are often homeless, while others use foodbanks because financial limitations do not allow them to budget for food. It was estimated that in March of 2016, 863,492 individuals accessed services from local food banks. A large percentage of these individuals were single older adults [58]. There is a very large number of Canadians that rely on these services and would not be able to survive without them. While food banks do receive some government funding a large portion of their resources come from donations. While some of these donations come from individual local donations the majority are donated by farms, food producers and retailers [20,59]. Food banks are often more accessible in highly populated areas, some smaller rural areas do not have a population great enough to offer food bank services. Reports indicated that rural areas and small populated centers were the least likely to be accessed, while largely populated areas such as Toronto, Hamilton and Ottawa were accessed more. Larger cities have more individuals attending food banks but that does not mean that there is not a need in less populated areas [57]. The following section is intended to provide a commentary on available and accessible nutritional education and information to the general public in the Greater Toronto Area (GTA).

Malnutrition & Lifestyle Diseases in Older Adults

Malnutrition, which diminishes the quality of life, is a strong predictor of short-term mortality, and is associated with higher health care costs [60,61]. Unhealthy eating is a major contributor to chronic disease, as malnutrition is considered one of the leading problems in public health in many countries [62]. The term malnutrition is used to describe a deficiency, excess or imbalance of a wide range of nutrients [63]. Malnutrition is not a simple problem with a simple solution, as it results from complex interplay of social and biomedical factors [64]. Chronic diseases such as obesity, cancer, chronic respiratory diseases, diabetes and cardiovascular disease are the leading causes of death and disability in Ontario [65]. For example; transition in current nutrition demographic is initiated by the effect of changing diet and physical activity patterns in higher socioeconomic groups, but the effect is even more noticeable in the lower socioeconomic groups [66]. Despite the sufficiency of energy in developed countries, diet quality is poor and micronutrient deficiencies are often still observed [67]. This transition creates the challenge of experiencing an obesity and diabetes epidemic, while still having to deal with malnutrition and micronutrient deficits [68]. The transition in current nutrition demographic requires us to address the sociocultural and biomedical influences of nutritional deficiencies, which contribute to the control of under nutrition and prevention of chronic diseases. Given the complex interplay of sociocultural and biomedical dimensions; accumulation of damage to these dimensions as a result of obesity attributed to chronic malnutrition can lead to development of other chronic conditions such as cancer and type II diabetes and hypertension. Obesity- which is now recognized as a chronic health condition- is the leading cause of serious conditions such as diabetes, high blood pressure, heart disease, stroke, arthritis [69]. Micronutrient malnutrition could be contributing to the increase in overweight/obesity and related disease [67].

The impact of social influences on obesity attributed to malnutrition can be observed through the relationship between lack of family resources and food insufficiency. When food insecurity exists in a community, excessive energy may be provided by the limited foods available; foods that most likely lack diversity. Lack of nutritional diversity diminishes nutritional quality due in part to inadequate micronutrients [70]. Compromising diet quality often leads to a higher intake of energy from foods that are higher in fat and carbohydrate, but lower in nutrient-density. These energy-dense foods are often less expensive than foods of lower energy density or higher nutrient density, such as fruits, vegetables and whole-grains. Despite the link between poverty, food insecurity, and malnutrition, households characterized as food insecure also have the highest body mass index [71].

People who are overweight or obese are at increased risk of developing several cancer types, including adenocarcinoma of the esophagus, colon cancer, breast cancer (in postmenopausal women), endometrial cancer and kidney cancer [72]. Research suggests that cancers of the liver, gallbladder and pancreas are obesity related, and that obesity might also increase risk for haematopoietic cancers and prostate cancer [73]. Obesity attributed to malnutrition is also associated with endothelial dysfunction and renal functional abnormalities that may play a role in the development of hypertension [74]. Increased leptin levels are observed in most obese individuals; leptin may represent a link between obesity and increased cardiovascular sympathetic activity as leptin acts in the hypothalamus to increase blood pressure (and activates the sympathetic nervous system). Mechanisms of obesity may also influence arterial pressure response, as obesity induces increases in arterial pressure and cardiovascular disease [75]. The pathophysiology of hypertension in obesity is complex and multifactorial, however, weight loss can clearly improve or even prevent the development of hypertension (which speaks to the adverse effect that weight gain promotes development of hypertension). High risk of chronic illnesses and disabilities and other vulnerabilities are often associated with the ever-increasing proportions of oldest population in developed countries.

In addition to frailty and malnourishment, obesity is prevalent among the older adult population for various reasons. Obesity is a predisposing factor for hypertension and type two diabetes. According to Statistics Canada, adults over the age of 65 present with the highest instances of diabetes, with 1,055,100 persons in 2017 increasing to 1,094,600 in 2018. Additionally, this age group holds the highest instances of hypertension (in 2017 and 2018, over 1.6 million and 1.9 million persons respectively) [76]. This data shows that the older adult population is at high risk of both malnourishment, obesity and associated illnesses [77]. Obesity rates among older women aged 60 years and older have increased from 31.5% in 2003-2004 to 38.1% in 2011-2012. While instances of obesity and diabetes among men were highest in this age group, increases have not been established from 2004-2012 among men. However, an increase of life expectancy due to medical intervention, in combination with increases of obesity, rates of multimorbidity are expected to rise [76-79]. It is well understood that risk factors of obesity include caloric excess and improper diet, therefore, it is important to address obesity from these standpoints [80].

Determinants For Malnutrition In Older Adults; Individual And Societal

Several physical and mental health conditions predispose older adults for malnutrition as individual risk factors. These, in addition to multimorbidity, gender, race and other social determinants intersect to put several older adults at great risk. Dominant among mental health conditions are dementia and depression. Dementia, a broad term used to describe symptoms related to memory and other cognitive deficits, affects the ability to perform daily tasks, including food selection, food preparation, and eventually, self-feeding [81]. Eventually, people with dementia may be unable to express or recognize hunger and thirst, forget to eat or drink, or be unable to recognize food [82]. These adults may also have difficulties with feeding, chewing, and swallowing. Any of these factors may precipitate inadequate nutritional intake and malnutrition [83]. The connection between nutrition and depression in older adults is complex. Depression can compromise nutritional status, and poor nutrition can put people at risk for depression [84].

Older adults are at a higher risk of chronic diseases than younger individuals [85]. Although malnutrition is estimated at approximately 10% in community-dwelling older adults, nutritional risk, a precursor to malnutrition, is more common, ranging from 25%-65%. Nutritional risk in older adults is determined by nutritional screening through tools such as the Geriatric Nutritional Risk Index (GNRI) or questionnaire, which takes into account various independent factors, although several different models are also used [86]. Because the older adult population is rising substantially, both nutritional risk and malnutrition could become more complex [87]. Older adults may be at higher risk of malnutrition due to lower caloric intake. Low-calorie diets may not allow room for sufficient nutrient intake, resulting in malnourishment or nutritional deficiencies. The World Health Organization (WHO) has outlined several determinants of health. These determinants such as social and economic factors, environmental factors, and one's individual characteristics and behaviours can be predictors for older adulthood by providing insight into a person's future health status and quality of life. Nutritional intake is arguably one of the most important factors with regards to individual behaviour, as our body requires a specific balance of macro and micro nutrients to achieve or maintain its highest level of functioning. However, multiple health determinants may affect one's ability to make practical nutritional choices, which establishes a need to dissect possible risk factors and health determinants, as well as highlight their connections to individual nutritional choices and malnutrition amongst various populations [88].

Older adults, specifically older women, socially isolated older adults, and such individuals in low income households are at increased risk of poor nutritional status due to overlapping health determinants [88,89]. These instances may be attributed to life course experiences unique to women (less time spent in full-time work), or gender disparities in life expectancy, which is longer for women than men. Furthermore, gender disparities in wellbeing may be attributed to the nutritional and health status of women [90]. In addition to gender, age is an independent health determinant which often converges with nutritional status. Additional factors associated with aging are mobility and dexterity, lack of transportation, poor oral health, and social isolation, which may contribute to the influence of age on nutrition [91].

Furthermore, research suggests that older adults are at risk of excessive intakes of fat, saturated fat, cholesterol, and sodium [85]. Chronic health conditions and associated medications may also be a contributing factor to low-caloric intake among older adults affecting the individual's taste, enjoyment and retention of nutrients. Researchers have described the paradox of aging where one's caloric needs decrease, but the need for a micronutrient rich diet remains consistent. Consequently, it is important to establish who is at highest risk for poor nutrition and subsequent medical issues [91]. Instances of obesity and malnourishment may be hand in hand, and can be attributed to financial and food insecurity [79,88,92]. However, in some cases, it is an individual's multimorbidity that causes financial strain, and as a result, food insecurity [79]. The number of individuals with obesity per 1000 is highest among those severely food insecure (452 cases per 1000), compared with food secure individuals (324 cases per 1000) [93]. Disease and multimorbidity among the older adult population deeply affect an individual's quality of life. Such individuals are at increased risk of functional and cognitive decline, and increased hospital stays placing significant strain on the health care system [78,79,94]. Therefore, effective management of obesity and illness must be a lifelong process assessed in terms of minimizing individual risk factors [94,95].

Research suggests a negative correlation between income and food insecurity [35,89,90,96]. Low-income older adults encounter greater food insecurity, and, when combined with functional disability, depressive symptoms are common. In fact, 60% of older adults experiencing food insecurity are 10 times more likely to experience depressive symptoms than those who are food secure [96]. Low-income older adults in particular have a significantly greater risk of developing deficiencies in calcium, magnesium, zinc, and have inadequate protein, B-vitamin and caloric intakes in comparison to older adults with sufficient incomes [85,96]. A cross-sectional study found multimorbidity prevalence was highest among lower income groups [95]. A second study revealed a negative correlation to fruit and vegetable consumption and income. Others, however have revealed no significant correlation [97]. The 2017 census revealed the lowest incomes belonged to the youngest and oldest age groups. The median annual income per individual was \$11,500 for those aged 65 to 74 years and \$460 for those aged 75 years and older).

Societal determinants such as social support are crucial to individual health and can also be linked to nutritional habits. Social support systems include spouses, immediate or extended family, friends, religious or group associations and community support. Positive relationships have the potential to promote physical activity, healthier diets, and behaviours, while negative relationships permit adverse effects [98]. If an older adult is without social support, they are at higher risk if they have low self-care capacity. Self-care capacity should be taken into consideration to better understand older adult food insecurity because it may inhibit a person's ability to access, or prepare food [96]. Conversely, one study suggested a relationship between social support and diet quality among men, however no significant relationship was found among women. It was revealed that those with minimal social support may be at greater risk for diets that do not meet nutritional guidelines [98].

The Life Course as a Determinant

It is understood that nutritional intake patterns over the life span contribute greatly to the health status of persons in their

later years. While many life stages have been considered crucial times for nutritional focus (prenatal, early childhood), it has also been established that the day to day, consistent consumption of micronutrient rich, unprocessed foods is essential for future individual health status [99,100]. The Life Course Perspective (LCP) is the name given to the model that describes the sequence of life-long processes and their effects throughout the life span and can be applied to nutrition. The LCP suggests environmental, biological, physical, social, and behavioral determinants, as well as life experiences, influence health outcomes [99]. For example: a ten-year longitudinal study monitoring the implications on individual weight due to food choices suggested individuals who remained in the healthy trajectory of nutrient intake showed the least amount of weight gain. However, no trajectory was linked with weight loss. A key finding of this study revealed participants were more likely to change their diet habits than to eat consistently over the ten-year span. These changes typically occurred in later life stages [100].

The LCP allows researchers to take into consideration the magnitude of factors that affect an individual's food choices, beyond personal preference such as income level, accessibility, or health status. It is important, however, to recognize that food choices and diet changes will determine the health status of older adults in later years. These changes in consumption patterns may occur during transitional periods such as a child becoming financially independent, or as a result of unexpected life events such as loss of a spouse or job. It is crucial for individual quality of life, and health care management to establish screening and intervention programs targeted to individuals throughout the life span, which continue into older adulthood [88,99,101].

Intersectionality of Geography, the Lived Environment and Nutrition

Although rates of malnutrition among independent, community-dwelling older adults are typically lower than for those living in health-care settings, evidence suggests about a third of community-dwelling Canadian older adults are at nutritional risk [91,102]. A study in 2004 indicated strong connection between nutritional risk and physical quality of life among community-dwelling older adults. Out of 367 participants, 31% were considered at low nutritional risk, 24.3% were moderate risk, and 44.4% were high risk [87]. These findings are consistent with others which found older adults with malnutrition, or risk of malnutrition combined with good appetite had lower life quality scores than well-nourished individuals. Additionally, the researchers reported that the health related quality of life scores of women were lower than men in all categories, including: physical functioning, bodily pain, and general health [103]. Besides, 34% of Canadians aged 65 or older who reside in private households are at nutritional risk, with women at 10% higher risk than men (38% versus 29%). Also, those individuals with depression, poor oral health, disabilities, and medication use were found associated with nutritional risk [89].

Comparatively, a study focusing on community-dwelling older men revealed 44% of the 522 respondents were at high nutritional risk, 24% were at a moderate risk, and 32% were at low risk. Therefore, it is notable that both older men and women are at risk for malnutrition, and interventions are important for both groups [102]. Geographic location may also be important to the health status of

older adults. Food security has been linked to urban-dwelling older adults regardless of income level [35,90]. Research suggests that rural older adults receive more social and community support, however, typically have lower household incomes and education. Moreover, rural residents have poorer health than urban-dwelling older adults. Geographic issues however, may be more amplified in the female population. Older women living in rural areas may have more limited formal health knowledge and more challenges in accessing health care services. This was addressed in a cross-sectional study which reported that individuals older than 65 living in urban areas with household incomes of less than 15,000 had higher instances of negative perceived health status than those with incomes of 80,000 and above. Lower income urban individuals also reported more chronic conditions than those with higher incomes. In contrast to previous literature, however, no connection was made to income level and chronic illness and poor health status in rural individuals. Additionally, food insecurity was not found significant to the health of older rural women, but did predict the health of urban dwellers. This study however, did not account for length of time spent in their rural setting, as it was not longitudinal [90].

Nutritional Awareness, Education and Resources

Nutrition literacy is defined as the capacity to obtain process and understand nutrition information and the materials needed to make appropriate decisions regarding one's health. Individuals who are able to access and understand nutrition information along with the necessary resources are better able to make healthy choices regarding their health. Nutritional education and access to nutritional information are valuable ways of addressing the nutritional divide in Canada and its role in the differential development of chronic diseases, however, the effectiveness of nutritional education is limited by the resources available to low income people to purchase and eat healthy food [104]. Government agencies such as Health Canada oversee the administration of initiatives that address nutritional education and access to nutritional information to the Canadian public. The topic of Food and nutrition includes food labeling, Canada's Food Guide, and A Consumer's guide to Dietary Reference Intakes serve to help prevent nutritional deficiencies and lower the risk of chronic diseases [105].

Canada's Food Guide is a publication of the Health Canada under the topic Food and Nutrition. It provides information to assist the public with making healthy food choices, recipes, resources, tips such as meal planning, and suggestions for healthy eating habits [106]. The information is available in multiple languages and reflects Canada's diversity. Health Canada supports and promotes initiatives like the Nutrition North Education program which helps to make frozen and fresh foods more accessible to inhabitants of isolated communities in the northern areas of Canada, a list of what Nutrition North Canada subsidizes is available under 'Eligible Food' on the Government of Canada website [107]. These communities are listed on the eligible communities' page of the Government of Canada website and include some Aboriginal peoples and First Nations Reserves such as 'old Crow' in Yukon, 'Paulatuk' in Northwest Territories and 'Naujaat' at Repulse Bay in Nunavut [108].

Nutritional Literacy and Education in the School System and Beyond; Ontario

Nutritional education is imparted in schools beginning from grade 1 through grade 12. The Ontario Ministry of Education developed and implemented a nutrition standard tool which assesses compliance with trans-fat standards, assesses food and beverage choices against nutrition standards and categorizes choices as 'sell most', 'sell less' and 'not permitted for sale' [109]. The Ontario Ministry of Education's curriculum classifies nutrition for grade 1-8 under Strand D, Healthy Living in the Health and Physical Education 2019. The design, layout includes the topic of healthy living followed by subheadings D1. Understanding Health Concepts, D2. Making Healthy Choices and D3. Making connections for Healthy Living. Grade 1 curriculum introduces foods for healthy bodies and minds incorporating Canada's Food Guide as well as awareness of hunger and thirst cues. Grade 2 curriculum promotes healthy eating patterns and food choices. Grade 3 are taught about food origins, nutritional value and environmental impact, they are taught to apply healthy food choices and oral health as well as making connections with local and cultural foods and eating choices. Grade 4 looks at nutrients, personal eating habits and healthier eating in various settings. Grade 5 introduces nutrition fact tables and food labels along with media influences on food choices. Grade 6 explores influences on healthy eating and eating cues and guidelines making connections to the benefits of healthy eating and active living. Grade 7 explores eating patterns and health problems and connects personal and external factors in food choices. Grade 8 examines personal eating behaviours and promotes healthy eating [110].

The grade 9-12 nutrition curriculum is identified as Food and Nutrition in the Secondary Curriculum under Social Sciences and Humanities. Grade 9 and 10 covers Research and Inquiry Skills, Nutrition and Health, Food Choices, Local and Global Foods and Food Preparation Skills. Grade 11 covers Food and Culture across the streams of University/College Preparation and Workplace Preparation. Both streams teach Research and Inquiry Skills, Culture, Foods and Food Practices, Foods and Flavours as well as Food Preparation Skills. Grade 12 focuses on Nutrition and health across the streams of University Preparation and College Preparation. Both streams develop Research and Inquiry Skills, Nutrition and Health, Eating Patterns and Trends, Local and Global Issues along with Food Preparation Skills [111]. There are several education programs available, however, there is evidence in community settings and city websites that indicate a larger concentration on diabetes education than other chronic illnesses. Provincial nutrition education programs provide more practical support to the public while federal nutrition education programs focus on governance such as policies and guidelines.

An Urban Snapshot; The Greater Toronto Area

Nutrition education is available through community agencies, clinical practices, city websites, public libraries and government agencies. Community agencies such as Access Alliance Multicultural Health and Community Services in Toronto offer nutrition education programs ranging from gestation and postnatal nutrition to preventing and managing chronic diseases. Registered dietitians offer one-to-one counselling covering health concerns such as high blood pressure, high cholesterol, food allergies and intolerances, weight management,

vitamin and mineral deficiencies [112]. The agency does not directly see persons with pre-diabetes i.e., a condition where blood glucose levels are slightly higher than normal but not diagnosed as diabetes or persons diagnosed with the disease. It provides information for the West Toronto Diabetes Education Program where referrals from clinicians as well as self-referrals are accepted. The program is offered through the LAMP Community Health Center and its main goal is to aid in improving the quality of life for individuals living with pre-diabetes and diabetes [113].

Unison Health & Community Services is another community agency which offers a Healthy Eating & Fitness Program for the general public that is facilitated by a Registered Dietitian, Certified Fitness Instructor and Social Worker. The agency also offers a Diabetes Education Program geared to adults living with pre-diabetes and type 2 diabetes. The program educators are registered nurses and registered dietitians, entry to the program is by referral from a doctor or nurse practitioner and provide translators for multiple languages [114]. Clinical practices such as Dr. Poon's metabolic diet Clinic accepts clients through referrals and monitors their dietary intake over an eighteen (18) months period. Clients are supported with nutrition education for chronic diseases such as central obesity, arthritis, metabolic syndrome, high cholesterol and high blood pressure. Dr. Poon's clinic serves the communities of Brampton, Toronto, Thornhill, Pickering, Scarborough and Mississauga, the Ontario Health Insurance Plan gives access to the clinic's programs [115]. Similar or comparable programs are offered by Bernstein Diet and Health Clinics in over 50 locations across the provinces of Ontario, Alberta and British Columbia [116].

City websites such as those hosted by Diabetes Canada Toronto Region and Toronto Public Health provide nutritional education and access to nutritional information. Diabetes Canada Toronto Region provides basic information to the public on signs and symptoms of diabetes, risks and prevention, diabetes management which includes webinars, recipes, impact stories and tools & resources [117]. The City of Toronto's Public Health Unit provides nutritional information under Nutrition and Food Access such as 'Feeding your child' from infant to school age and the 'Student Nutrition Program' which provides nutritious meals for students throughout the day [118]. Public libraries such as the Toronto Public Library offer nutrition education workshops to the public under Health and Wellness in areas such as Exploring Canada's New Food Guide and celebrate the month of March as nutrition month with a program titled Nutrition month: More than Food which features discussions and activities that focuses on healthy eating [119]. The public library also shelves multiple rows of books and magazines on nutritional information and healthy eating that cover a variety of topics and food choices for public access.

The City of Toronto has established a Student Nutrition Program under the administration of Toronto Public Health that promotes access to nutritional food for students throughout the school day. The city processes applications for grants to start the program, provides support to operate the program in schools, facilitate training and workshops for food safety and nutrition [120]. As a population, Canadians are provided with a great deal of nutritional information. Nutritional education is taught from grades 1-12 and is supported at local, provincial and federal levels of government. It would appear to be inefficient due to the prevalence of chronic diseases, however, there are limiting factors that create inequities in access to nutritious food.

Income, family dynamics, gender, geography and aboriginal communities were identified in the Heart & Stroke foundation brochure titled “Access to Affordable, Healthy and Nutritious Food” as elements that contribute to difficulties in procuring nutritious food [121]. Income is a significant deterrent for single income families and female headed households are reported by the foundation to earn insufficiently to cover their bills and shop nutritiously, Aboriginal and remote communities have limited access to fresh, nutritious food and transportation costs renders the products to me quite expensive in comparison to urban settings [122]. Though the population maybe sufficiently educated and has access to nutrition information, purchasing the necessary food to consume and maintain a healthy life is where the inequity is pronounced.

Nutrition Access in a Post-Covid Canada

The COVID-19 pandemic has further illuminated the precarious position many older adults are in regarding food security. As the economy shut down and stay at home orders went into place in March 2019, individuals lost their jobs and incomes, and rates of food insecurity rapidly climbed. Older adults were particularly susceptible, given that they had to navigate new ways of procuring food while they sheltered in place to avoid exposure to COVID-19. To cope with the crisis, University health Network Open Lab launched the Friendly Neighbourhood Hotline, a service involving over 1000 volunteers throughout Toronto to help seniors in low-income housing receive food and medicines [123]. The COVID-19 outbreak further exposed older adults and patients with chronic diseases to the risk to nutrition imbalance. Their susceptibility to malnutrition was elevated with the compromised health, social isolation and limited purchasing ability. It is therefore crucial to identify these vulnerable groups and extend assistance in food access and availability through a structured and reliable support system [124]. As the pandemic persists and the deleterious economic effects continue, it is vital that policymakers ensure that a robust suite of policies and programs are in place to provide food assistance to older adults who need it.

Moving Forward; Addressing the Nutritional Divide

National and international initiatives promote active and healthy aging, but there are still opportunities for the results of this approach to be reflected in increased quality of life and health of older adults. Rethinking aging implies a true transverse commitment and reconsideration of the entire set of associated factors. One of the main objectives of the Healthy People 2020 Report is to “improve the health, function, and quality of life”. So, understanding the associations between food insecurity, chronic diseases, and quality of life is fundamental for improvement of health policies, resulting in successful promotion of active and healthy aging populations. The purpose of this study was to estimate the prevalence of household food insecurity and its associations with chronic diseases and Health Related Quality of Life (HRQoL) factors in individuals ≥ 65 years of age living in the community [125].

Ensuring that older adults have enough food to meet their needs may be an important way to help them enjoy good health and remain active while aging. Food insecurity in older adults is an undesirable problem that requires additional attention. Food insecurity is associated with higher odds of chronic disease, poor self-management of chronic disease, and lower HRQoL. Because it is determined by economic factors, food insecurity is socially and ethically

unacceptable. Therefore, during a period marked by significant financial stress, implementation of strategies aimed at ensuring the food security of the aging population is needed. We suggest that other evaluation and monitoring studies should be performed and further investigation using longitudinal data are needed to determine the health consequences of food insecurity among older adults. These results would assist health professionals and policymakers to better understand the barriers to achieve improved health in this population.

Overall, nutritional intervention is important throughout the lifespan, and positive eating habits should be established in early life as preventative measures. Eating habits may change over the life span, due to various determinants, but will likely determine health outcomes in later years. Older adults, sixty-five and above are at highest risk of multi-morbidity and nutritional risk, and because this age group is beginning to make up a substantial part of the global population, they should be a focal point for future nutritional studies. Nutritional risk is amplified by factors such as lack of social support, advanced age and rural residency. Future research is needed to further investigate these health determinants, along with the nutritional risks of Indigenous persons and Canadians living in the territories. Several researchers listed these areas as limitations of study, and are thus under-researched and likely in need of support. Tackling nutritional risk by addressing roots of poverty, food insecurity, and social supports may improve individual quality of life, as well as functionality of the healthcare system [89,90,99].

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