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Article

Examining Psychosocial Factors Influencing Nutrition Risk in Middle-Aged and Older Adults: Findings from the Canadian Longitudinal Study on Aging

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Abstract

Our objective was to identify the psychosocial factors correlated with the development of high nutrition risk, as assessed by SCREEN-8, among Canadian adults categorized by ten-year age groups (45-54, 55-64, 65-74, and 75+). We utilized data from 17,051 participants in the tracking cohort of the Canadian Longitudinal Study on Aging and employed multivariable binomial logistic regression to identify the social and demographic factors associated with the emergence of high nutrition risk at the follow-up, three years subsequent to the baseline. Baseline data were gathered between 2011 and 2015. At baseline, 34.4% of participants across all age groups were at high nutrition risk, and 40.0% were at high risk at follow-up. Factors consistently associated with the development of high nutrition risk across all age groups included lower levels of social support, lower self-rated social standing, infrequent participation in sports or physical activities, infrequent participation in cultural or educational activities, and lower household incomes. Programs and policies addressing these factors may reduce the prevalence of high nutrition risk and the development of high nutrition risk.

Keywords: nutrition risk; malnutrition; age; older adults; CLSA

1. Introduction

In Canada [1] and worldwide [2,3], older adults represent the fastest-growing demographic group. The majority of older adults prefer to age in place within their communities [4]. An older adult is able to age in place when their health, access to services, and social support interact in a manner that facilitates their ability to live safely and independently in their homes or communities for as long as they wish [5]. Aging in place, while desired by most older adults, is challenging for many. Healthy lifestyles, including an adequate diet, are essential for aging in place [6], and nutrition is one of the few risk factors for health that we can modify as we age [6,7].

Eating habits change as people age due to physiological, social, and psychological changes that affect eating habits and nutrient intake, such as new health conditions, loss of a driver's license or bereavement [8,9]. Inadequate dietary intake can lead to high nutrition risk. While there is no single definition of nutrition risk that is agreed upon, it "represents the determinants and risk factors that place an individual at risk for poor food intake and, if not interrupted, can lead to malnutrition [10]." Individuals who are at high nutrition risk have a higher chance of being admitted to the hospital and an increased risk of mortality, even when socioeconomic status, health status, and health behaviours are considered [11,12]. Nutrition risk is also associated with poor quality of life [6,13], early institutionalization [7], and frailty [14].

In the community, nutrition risk is typically measured by questionnaires that elicit information on dietary intake, food habits, and weight changes in older adults [15]. In Canada, nationally

representative studies have found that approximately one-third of community-living adults 45 years and older are at high nutrition risk [16–19]. Nutrition risk is also highly prevalent in other countries, with one study finding that 61.5% of older adults in the Netherlands, 68.2% of older adults in New Zealand, and 70.1% of older adults in Canada were at high risk [20]. Looking at malnutrition, a study that synthesized 24 data sets from 12 countries found that 13.8% of older adults who dwell in the community were malnourished [21]. A similar prevalence (1.5%) was found in 15 samples, based on data from 11 high-income European countries [22]. The differing percentages of nutrition risk are due to different tools, different cut-offs to identify at-risk individuals, and/or different subsets of the population being assessed [20]. Despite these differences, nutrition risk is prevalent and a growing concern with the aging population in Canada.

Research has uncovered numerous social factors associated with the prevalence of high nutrition risk in older adults [16,23]. These include social support, engagement, and participation [16,17,19,24]. It is widely recognized that dining with others enhances dietary intake leading to reduced nutrition risk [23], while eating alone is linked to high nutrition risk [23,25]. Some studies indicate that social isolation significantly contributes to increased nutrition risk [12,19]. Social relationships may mitigate nutrition risk by promoting adherence to dietary norms, while eating with others may provide “social cues for when and what to eat” [23] (p.15). An individual’s social support network may also encourage healthy behaviours, such as including a sufficient amount of nutrient-dense foods in the diet [26]. Studies have found that higher levels of social support help reduce the prevalence of nutrition risk [16], whereas lower levels of social support are associated with an increased prevalence of high nutrition risk [26]. Individuals possessing higher levels of social support may receive more help with food-related tasks, such as preparing and cooking meals and acquiring food [23], which helps to reduce nutrition risk [27].

Despite the recognized effect of social factors on nutrition risk, most studies in this area have not used a theoretical framework to examine how social factors and nutrition risk interrelate; therefore, the variables chosen in many previous studies have not had theoretical justification for their inclusion. Additionally, few studies have examined how the factors associated with nutrition risk differ between age groups, and due to changes related to aging, these factors may differ between younger and older age groups. Most research to date has also used cross-sectional data and small samples data, which limit our understanding of the social determinants that are most relevant to target for intervention [28]. It is essential to understand the social factors associated with nutrition risk in different age groups so that appropriate interventions, policies and programs can be designed and implemented to reduce nutrition risk and its negative consequences. Reducing the prevalence of high nutrition risk will therefore help older adults to age in place in their homes or communities.

Our research, therefore, aims to use a theoretical framework to examine the psychosocial factors associated with the development of high nutrition risk in community-living Canadians aged 45 and older, stratified by ten-year age group, using data from the Canadian Longitudinal Study on Aging.

2. Materials and Methods

Theoretical Framework

Our study employs social network theory, as articulated by Berkman and colleagues [29], as its theoretical framework. We chose this theory as our goal is to examine the psychosocial factors related to the development of high nutrition risk in Canadian adults. Social network theory provides a model for examining how social networks affect health [29]. Social networks are embedded in broader cultural and social contexts that influence how these social networks are structured [29]. Social networks, in turn, influence interpersonal and social behaviours [29]. They do so through the following pathways: 1) social support, 2) social influence, 3) social engagement, and 4) access to resources [29]. Our study focuses on the micro level of social network theory as described by Berkman and collaborators [29], as the psychosocial mechanisms at this level of their theory may be determinants of nutrition risk and the development of nutrition risk.

Data Source

Our study is a secondary data analysis using data from the Canadian Longitudinal Study on Aging (CLSA). The CLSA represents the most extensive and comprehensive prospective cohort study in Canada, focusing on the longitudinal examination of aging [30]. Participants in the CLSA were aged 45 to 85 years when recruited [31]. Participants are followed every three years for 20 years or until the participant's death [31]. Baseline data collection occurred between 2011 and 2015, and the first follow-up data (which we call follow-up) occurred during 2015–2018 [32]. Informed consent was obtained from all participants by the Canadian Longitudinal Study on Aging (CLSA) at the time of original data collection. The present study involved secondary analysis of de-identified data provided by the CLSA. No additional consent was required. Detailed information on CLSA's informed consent procedures can be found at: <https://www.clsa-elcv.ca/researchers>.

The CLSA has two cohorts, named tracking and comprehensive. The comprehensive cohort included 30,097 participants at baseline who were interviewed in person, underwent physical assessments, and provided urine and blood samples. The tracking cohort included 21,241 baseline participants, followed by telephone interviews. Our study used data from the tracking cohort, as this cohort reflects Canadian provincial populations [30].

CLSA cohorts share the same core set of questionnaires. These questionnaires cover demographics, social and psychological measures, health and functional status, lifestyle, and behaviour [32]. We used data from the baseline wave for the psychosocial variables and data from the baseline and follow-up waves for nutrition risk. We mapped variables from the CLSA onto the psychosocial mechanisms of Berkman and colleagues' social network theory (Table 1). We describe how the CLSA measured these variables below.

Table 1. Mapping CLSA¹ measures onto psychosocial mechanisms from Social Network Theory [29].

Psychosocial mechanisms	CLSA ¹ Measures
Social support	Medical Outcomes Study Social Support Survey
Social influence	
• Social comparison processes	• Self-rated social standing
Social engagement	• Frequency of participation in sports or physical activities with others • Frequency of participation in educational or cultural activities
• Physical/cognitive exercise	
Access to resources and material goods	• Total household income • Contact with a general practitioner or family physician • Satisfied with current housing
• Economic opportunity	
• Access to health care	
• Housing	

¹ Canadian Longitudinal Study on Aging.

Psychosocial Mechanisms

Social support: The 19-item Medical Outcomes Study Social Support Survey (MOS) [33] was used to measure social support. The MOS evaluates affection, emotional and informational support, tangible social support, and positive social interaction [33]. The MOS demonstrates excellent internal consistency, with Cronbach's alpha values ranging from .91 to .97 for the overall scale and its subscales [33]. Additionally, it demonstrates robust and test-retest reliability, as indicated by an ICC of .78 after one year [33].

Self-rated social standing: The CLSA asked participants to “think of a ladder with 10 steps as representing where people stand in their communities. At the top of the ladder (or step 10) are the people who have the highest standing in their community. At the bottom (or step 1) are the people

who have the lowest standing in their community. On which step would you place yourself on this ladder? [34]"

Social engagement: The CLSA asked participants how frequently they participated in sports or physical activities with other people and how frequently they participated in educational or cultural activities, in the past 12 months [35]. Responses were at least once a day, at least once a week, at least once a year, and never.

Jobs / economic opportunity: The CLSA asked participants to estimate their total household income using the following categories: less than \$20,000, \$20,000 or more but less than \$50,000, \$50,000 or more but less than \$100,000, \$100,000 or more but less than \$150,000, and \$150,000 or more [35].

Access to health care: The CLSA asked participants if they had contact with a family physician or general practitioner about their physical or mental health in the past 12 months [34].

Housing: The CLSA asked participants, "When thinking of your home, how strongly would you agree or disagree with the following statement? I am satisfied with my current housing [34]." Participants could respond strongly agree, agree, disagree, or strongly disagree.

Demographic Variables

Demographic variables collected by the CLSA included age, sex assigned at birth, educational attainment, and household composition (living alone or with others) [32].

Nutrition Risk

Nutrition risk was assessed in the CLSA using the abbreviated version of Seniors in the Community: Risk Evaluation for Eating and Nutrition II, now known as SCREEN-8 [36]. SCREEN-8 comprises eight questions related to typical daily eating habits and includes questions on weight change, meal skipping, swallowing, appetite, fruit and vegetable consumption, fluid intake, meal preparation, and eating with others [10]. The range of scores is 0 to 48, and scores lower than 38 indicate high nutrition risk [10]. Therefore, we used this cutoff of SCREEN-8 less than 38 to determine which individuals developed high nutrition risk between baseline and follow-up. Compared to registered dietitians' nutrition risk assessment, SCREEN-8 has good specificity and sensitivity; the test-retest and inter-rater reliability of SCREEN-8 are also good [37].

Data Analysis

Our main analytical approach was multivariable binomial regression, as the outcome variable in our analyses was the presence or absence of high nutrition risk at follow-up. Consequently, our outcome variable had two levels [38]. We set the significance level at $\alpha \leq .05$, and reported confidence intervals and effect sizes.

First, we completed univariate analyses to determine the descriptive statistics for each variable in our analyses. Using the ten-year age groups reported by the CLSA, we then compared the different age groups on all the variables of interest, using one-way analysis of variance (ANOVA) for continuous variables, while for categorical variables we used chi-square (χ^2) tests. We computed effect sizes, and used Cohen's d for continuous variables and Cramer's V for categorical variables [39].

Development of High Nutrition Risk at Follow-Up in Those Not at High Risk at Baseline

Next, we determined which participants were not at high nutrition risk at baseline. Then, using data from these participants, we completed multivariable binomial logistic regression analyses for both the entire sample and the sample stratified by ten-year age group. Our outcome variable was the presence or absence of high nutrition risk at follow-up, and the predictor variables were the psychosocial mechanisms. Subsequently, we conducted our regression analyses once more, incorporating demographic variables as potential covariates, given that previous studies have linked demographics with nutrition risk [16,19,40].

As the nutrition risk measure used in the CLSA has only been validated for those 50 years of age and older [18,36], we also conducted a sensitivity analysis for the 45 to 54 years old age group. We repeated our analyses for those aged 45-49 years old and those aged 50-54 years old and compared those to the results for the 45-54 years old age group.

3. Results

3.1. Sample Description

At baseline, there were 21,241 participants in the tracking cohort. At follow-up there was data for 17,051 individuals, and we used this sample of 17,051 for all analyses. Between baseline and follow-up, three years later, 6.0% (n = 1266) of participants withdrew from the CLSA, 12.0% (n = 2546) were lost to follow-up, 1.8% (n = 377) had their follow-up data still in preparation at the time we received the data, and there were confirmed deaths for 5.5% (n = 1165) of participants.

At baseline, participants had a mean age of 59.46 (SD = 9.94), and the majority of participants were married or partnered (70.4%). At baseline, the mean SCREEN-8 score of participants was 38.85 (SD = 6.30), and at follow-up, the mean SCREEN-8 score of participants was 38.02 (SD = 6.53). At baseline, 34.3% of participants were identified as being at high nutrition risk, which increased to 40.0% at follow-up (Table 2).

When we compared the different age groups, we found statistically significant differences for all variables, except for sex assigned at birth. However, the effect size for most variables was trivial, except for household income, contact with a family physician or general practitioner, and marital status, where the effect size was small, and household composition, where the effect size was medium (Table 2).

Table 2. Characteristics of the CLSA tracking cohort, overall and stratified by ten-year age group.

Characteristic	Population Estimate ¹ (n=17051)	45-54 (38.9%, n=6633)	55-64 (32.4%, n=5525)	65-74 (18.8%, n=3206)	75+ (9.9%, n=1688)	Age group difference effect size ² (p-value)
SCREEN-8 score at baseline, mean (SD)	38.85 (6.30)	38.67 (6.34)	38.87 (6.51)	39.18 (6.06)	38.86 (5.86)	.002 (<.001)
SCREEN-8 score at follow-up, mean (SD)	38.02 (6.53)	38.09 (6.69)	37.97 (6.56)	38.19 (6.35)	37.56 (6.10)	.001 (.027)
At high nutrition risk at baseline, % (n)	34.3 (5705)	37.0 (1728)	34.7 (1854)	32.0 (1182)	32.4 (941)	.042 (<.001)
At high nutrition risk at follow-up, % (n)	40.0 (6618)	41.0 (2787)	40.2 (2157)	37.8 (1382)	40.7 (1144)	.025 (.018)
Developed high nutrition risk between baseline and follow-up, % (n)	27.4 (2913)	25.7 (749)	24.8 (853)	24.4 (597)	29.2 (540)	.038 (.002)
Social support, mean (SD)	83.75 (17.25)	84.33 (16.67)	83.46 (17.34)	83.77 (17.81)	82.26 (18.15)	.001 (<.001)
Tangible Social Support, mean (SD)	82.05 (20.84)	81.50 (20.30)	81.83 (21.18)	83.67 (21.18)	81.30 (21.74)	.002 (<.001)

Emotional and Informational Social Support, mean (SD)	82.10 (19.23)	82.90 (18.41)	82.16 (19.33)	82.41 (18.92)	80.24 (20.63)	.002 (<.001)
Positive Social Interaction, mean (SD)	83.45 (19.57)	83.38 (19.31)	83.65 (19.42)	84.44 (19.00)	81.92 (20.85)	.002 (<.001)
Affection, mean (SD)	86.85 (19.77)	87.99 (18.78)	86.37 (20.30)	86.62 (20.02)	86.16 (19.93)	.001 (<.001)
Self-rated social standing, mean (SD)	5.81 (2.07)	5.92 (2.03)	5.80 (2.05)	5.75 (2.09)	5.70 (2.16)	.001 (<.001)
Frequency of participation in sports or physical activities with others, % (n)		23.0 (1105)	27.8 (1525)	31.4 (1185)	41.9 (1248)	.090 (<.001)
Never	29.7 (5063)	7.9 (378)	6.7 (367)	5.2 (198)	5.0 (148)	
At least once a year	6.4 (1091)	17.3 (828)	15.2 (831)	12.0 (452)	8.7 (258)	
At least once a month	13.9 (2369)	44.8 (2149)	42.2 (2313)	42.3 (1599)	37.3 (1109)	
At least once a week	42.1 (7170)					
At least once a day	7.8 (1335)	7.0 (338)	8.0 (440)	9.1 (343)	7.2 (214)	
Frequency of participation in educational or cultural activities		15.5 (742)	18.7 (1026)	20.7 (780)		.069 (<.001)
Never	19.7 (3353)	35.3 (1696)	33.3 (1823)	31.0 (1168)	27.0 (805)	
At least once a year	32.7 (5571)	39.7 (1907)	38.5 (2108)	36.4 (1371)	29.6 (884)	
At least once a month	37.3 (6347)				32.2 (961)	
At least once a week	9.6 (1633)	8.1 (390)	9.0 (491)	11.5 (432)	10.7 (320)	
At least once a day	.8 (130)	1.3 (64)	.6 (33)	.5 (33)	.4 (13)	
Household income, %		3.9 (176)				.221* (<.001)
Less than \$20,000		12.6 (582)	4.7 (244)	6.7 (233)		
\$20,000 – 49,999		32.9 (1524)	23.7 (1233)	38.6 (1351)	8.7 (234)	
\$50,000 - 99,999	5.5 (887)				46.0 (1241)	
\$100,000 – 149,999	27.5 (4407)	27.8 (1285)	41.1 (2135)	40.7 (1424)	33.4 (900)	
\$150,000 or more	37.3 (5983)					
	17.3 (2770)	22.9 (1061)	18.2 (943)	9.1 (320)	8.2 (822)	
	12.3 (1972)		12.3 (637)	4.9 (173)	3.7 (101)	
Contact with a general practitioner or family physician, % (n)						.123* (<.001)
Yes	90.1 (15112)	84.9 (3978)	89.9 (4840)	93.5 (3497)	94.5 (2797)	
Satisfied with current housing, % (n)		64.4 (3013)	67.4 (3617)	69.3 (2585)	65.6 (1934)	.041 (<.001)
Strongly agree	66.7 (11149)	30.9 (1445)	29.1 (1558)	27.8 (1038)	32.8 (968)	
Agree	30.0 (5009)					
Disagree	2.7 (449)	3.6 (168)	2.8 (150)	2.4 (90)	1.4 (41)	
Strongly disagree	.7 (113)	1.1 (53)	.7 (38)	.4 (15)	.2 (7)	
Age, mean (SD)	59.46 (9.94)	49.77 (2.80)	59.67 (2.83)	68.88 (2.86)	78.90 (2.99)	

Sex, % (n)		48.0	47.7	49.1	49.1	
Male	48.3 (8240)	(2305)	(2614)	(1854)	(1467)	.012 (.451)
Marital status, % (n)		77.2	73.6			
Married or partnered		(3708)	(4036)	68.9	55.5	
Single	70.4 (12007)	21.5	21.7	(2604)	(1659)	
Widowed	19.7 (3356)	(1032)	(1191)	19.3 (728)	13.6 (405)	
	9.9 (1682)	1.3 (61)	4.6 (253)	11.8 (445)	30.9 (923)	.247* (<.001)
Education, % (n)						
Less than secondary		3.6 (174)	5.3 (289)	8.9 (334)	16.5 (491)	
Secondary	7.6 (1289)	11.2 (537)	14.0 (763)	13.7 (518)	12.7 (378)	
Some post-secondary	12.9 (2196)	6.7 (323)	8.1 (441)	7.4 (277)	8.4 (249)	
Post-secondary	7.6 (1290)	78.4	72.7	70.0	62.3	
degree/diploma	71.9 (12216)	(3760)	(3967)	(2639)	(1850)	.104 (<.001)
Household composition, % (n)			19.0		39.7	.236** (<.001)
Lives alone	21.8 (3724)	10.9 (523)	(1042)	25.8 (974)	(1185)	

¹Population estimates were calculated using trimmed inflation weights as recommended by the CLSA, ²Effect size for differences between age groups: eta-squared (η^2) for continuous variables and Cramér's V for categorical variables, * small effect size, ** medium effect size.

3.1.1. Development of High Nutrition Risk at Follow-Up, by Ten-Year Age Group, in Those Who Were Not at High Risk at Baseline

Among those who, initially, were not at high nutrition risk at baseline, 27.4% (n = 2913) had developed high nutrition risk by follow-up. The 75 and older age group had the highest percentage of individuals developing high nutrition risk (29.2%), and the 65–74-year age group had the lowest percentage of individuals developing high nutrition risk at follow-up (24.4%).

When we examined the psychosocial factors associated with developing high nutrition risk between baseline and follow-up, we noted similarities and differences between the age groups. In all age groups, factors associated with the development of high nutrition risk between baseline and follow-up included social support, self-rated social standing, frequency of participation in sports or physical activities, frequency of participation in educational or cultural activities, and household income (Table 3). Among all age groups, for every one-point increase in social support and self-rating social standing, the odds of having high nutrition risk develop by follow-up decreased. There was also a trend that as the frequency of participation in sports or physical activities increased, the odds of developing high nutrition risk between baseline and follow-up decreased. Similarly, participating in educational or cultural activities at least once a year or more frequently was correlated with lower odds of developing high nutrition risk. For all age groups, as household income increased, there was a trend for lower odds of developing high nutrition risk.

Factors that differed for the oldest age group (75 years and older) included contact with a family physician or general practitioner, and satisfaction with current housing (Table 3). For all but this oldest age group, having no contact with a family physician or general practitioner in the previous year was correlated with lower odds of developing high nutrition risk at follow-up. Also, for all but this oldest age group, there was a trend that as satisfaction with current housing decreased, the odds of developing high nutrition risk increased.

Table 1. Binomial logistic regression analyses exploring the development of high nutrition risk in CLSA tracking participants not at high nutrition risk at baseline, using variables measured at baseline, by ten-year age group.

Characteristic	95% OR ¹	p- CI ¹	p- value	95% OR ¹	p- CI ¹	p- value	95% OR ¹	p- CI ¹	p- value	95% OR ¹	p- CI ¹	p- value	95% OR ¹	p- CI ¹	p- value
	45-54			55-64			65-74			75+			Overall		
Age group	(38.9%, n=6633)			(32.4%, n=5525)			(18.8%, n=3206)			(9.9%, n=1688)					
Social support	.985	.981, .990	<.001	.985	.981, .989	<.001	.987	.982, .991	<.001	.985	.980, .990	<.001	.990	.987, .994	<.001
Self-rated social standing	.939	.908, .971	<.001	.948	.918, .979	.001	.953	.917, .991	.015	.935	.894, .977	.003	.973	.949, .998	.036
Frequency of participation in sports or physical activities															
Never	—	—		—	—		—	—		—	—		—	—	
At least once a year	.881	.678, 1.145	.345	.831	.640, 1.079	.166	.846	.593, 1.202	.354	1.099	.712, 1.687	.666	.856	.689, 1.059	.155
At least once a month	.813	.661, .999	.049	.825	.677, 1.004	.055	.843	.652, 1.089	.193	.981	.701, 1.366	.908	.946	.808, 1.106	.485
At least once a week	.611	.514, .726	<.001	.606	.518, .708	<.001	.797	.662, .960	.017	.841	.680, 1.040	.109	.763	.675, .862	<.001
At least once a day	.486	.360, .651	<.001	.487	.372, .633	<.001	.542	.395, .737	<.001	.657	.447, .953	.029	.541	.438, .664	<.001
Frequency of participation in educational or cultural activities															
Never	—	—		—	—		—	—		—	—		—	—	
At least once a year	.846	.688, 1.040	.112	.690	.574, .829	<.001	.982	.791, 1.221	.872	.779	.609, .998	.048	.912	.790, 1.054	.213
At least once a month	.809	.656, 1.000	.049	.615	.511, .741	<.001	.738	.592, .920	.007	.825	.640, 1.063	.136	.755	.652, .876	<.001
At least once a week	.850	.634, 1.137	.275	.542	.414, .709	<.001	.754	.563, 1.008	.058	.680	.480, .959	.029	.725	.593, .886	.002

Characteristic	95% OR ¹	p- CI ¹	p- value	95% OR ¹	p- CI ¹	p- value	95% OR ¹	p- CI ¹	p- value	95% OR ¹	p- CI ¹	p- value	95% OR ¹	p- CI ¹	p- value
	45-54			55-64			65-74			75+			Overall		
Age group	(38.9%, n=6633)			(32.4%, n=5525)			(18.8%, n=3206)			(9.9%, n=1688)					
At least once a day	.692	.363, 1.272	.247	.893	.376, 2.082	.793	1.674	.599, 4.615	.315	.201	.011, 1.126	.134	.896	.501, 1.536	.700
Total household income															
Less than \$20,000	—	—		—	—		—	—		—	—		—	—	
\$20,000 or more, but less than \$50,000	.549	.350, .844	.007	.681	.480, .961	.030	.658	.469, .919	.015	.771	.548, 1.084	.135	.823	.631, 1.079	.154
\$50,000 or more, but less than \$100,000	.403	.262, .608	<.001	.517	.366, .725	<.001	.476	.338, .669	<.001	.552	.386, .788	.001	.666	.512, .872	.003
\$100,000 or more, but less than \$150,000	.315	.203, .479	<.001	.586	.408, .838	.004	.429	.282, .648	<.001	.742	.473, 1.162	.193	.668	.505, .888	.005
\$150,000 or more	.311	.199, .477	<.001	.480	.328, .700	<.001	.466	.286, .753	.002	.315	.164, .582	<.001	.542	.404, .731	<.001
Contact with a family physician or general practitioner															
Yes	—	—		—	—		—	—		—	—		—	—	
No	.770	.640, .923	.005	.746	.603, .919	.006	.701	.505, .961	.030	.810	.522, 1.238	.336	.769	.651, .906	.002
Satisfied with current housing															
Strongly agree	—	—		—	—		—	—		—	—		—	—	
Agree	1.093	.949, 1.259	.218	1.213	1.056, 1.393	.006	1.116	.939, 1.325	.213	1.156	.950, 1.406	.147	.978	.877, 1.090	.690
Disagree	1.649	1.143, 2.387	.008	2.361	1.578, 3.569	<.001	1.582	.960, 2.620	.072	2.123	.874, 5.370	.100	1.841	1.333, 2.528	<.001

Characteristic	95% OR ¹	p- CI ¹	value	95% OR ¹	p- CI ¹	value	95% OR ¹	p- CI ¹	value	95% OR ¹	p- CI ¹	value	95% OR ¹	p- CI ¹	value
	45-54			55-64			65-74			75+			Overall		
Age group	(38.9%, n=6633)			(32.4%, n=5525)			(18.8%, n=3206)			(9.9%, n=1688)					
Strongly disagree	2.002	1.050,	.038	1.560	.707,	.273	15.79	2.904,	.009	.597	.072,	.588	.845	.305,	.722
		3.928			3.517			293.6			3.537			2.017	

¹OR = Odds Ratio, CI = Confidence Interval, *p*-values in **bold** are significant at *p* < .05.

After controlling for demographic variables, there were a few differences in the factors correlated with the having high nutrition risk emerge between baseline and follow-up (Supplemental Table 1). For the youngest age group (aged 45-54 years), the frequency of participation in educational or cultural activities was no longer associated with the development of high nutrition risk, and household income only remained significantly associated with the development of high nutrition risk in this youngest age group. The demographic variables associated with the development of high nutrition risk were marital status, household composition, and educational attainment. For the 45-54- and 65-74-year age groups, at baseline, being single, as compared to being married or partnered, was associated with increased odds of having high nutrition risk appear between baseline and follow-up. For the 55-64-year age group, living with others was associated with lower odds of developing high nutrition risk compared to living alone. For the two youngest age groups (45-54 and 55-64 years), having a post-secondary degree or diploma, compared to having a less than secondary was associated with lower odds of having high nutrition risk appear between baseline and follow-up.

3.1.1.1. Sensitivity Analysis

We noted some differences after conducting our sensitivity analysis for those aged 45-49 and 50-54. In the analysis that examined the psychosocial factors only, none of the variables were statistically associated with developing high nutrition risk among those aged 45-49 (Supplemental Table 2). Similarly, when looking at both the psychosocial and demographic variables, none of these were associated with the transition from low nutrition risk at baseline to high nutrition risk at follow-up, among those aged 45-49 (Supplemental Table 3). Looking at those aged 50-54, there were some differences in the results compared to the 45-54 age group. Social support, physical activity, household income, and satisfaction with housing were all associated with developing high nutrition risk among those aged 50-54 and in the age group 45-54. However, when examining the psychosocial variables for those aged 50-54, as opposed to those aged 45-54, self-rated social standing, participation in cultural activities, and contact with a family physician were not associated with the development of high nutrition risk. When adding in the demographic variables, while lower household incomes were associated with higher odds of developing high nutrition risk in those aged 50-54, this association was not statistically significant when looking at those aged 45-54.

4. Discussion

To our knowledge, this is the first study to examine the psychosocial factors associated with the development of high nutrition risk by ten-year age group using a nationally representative Canadian sample. Our study has contributed to the literature on nutrition risk in the community by expanding upon previous research examining nutrition risk using the Canadian Longitudinal Study on Aging. We found that the psychosocial factors described in Berkman and colleagues’ social network theory [29] were associated with the development of high nutrition risk, providing further support for this social network theory. We found that many psychosocial factors related to the development of high nutrition risk were common across all age groups, while there were a few differences.

Psychosocial mechanisms associated with the development of high nutrition risk in all age groups and in both models were social support, self-rated social standing, and frequency of participation in sports or physical activities. In the model that only included the psychosocial mechanisms, the psychosocial mechanisms that were associated with the development of high nutrition risk in all age groups, were frequency of participation in educational or cultural activities and household income.

Similar to previous work conducted using the CLSA [40], we found that social support was associated with the development of high nutrition risk, with higher levels of social support resulting in lower odds of developing high nutrition risk. Previous studies have identified an association between social support and nutrition risk in Canada [19,24] and the United States [26,41], where low levels of social support were associated with increased nutrition risk in adults aged 65 and older. There are several potential mechanisms through which social support may influence nutrition risk. Social support systems may encourage healthy eating behaviours [26], and compliance with social norms around eating, such as regular meal times [23]. Social support systems can also provide assistance with food-related tasks, such meal preparation, cooking, food provision, and grocery shopping, particularly when an individual needs assistance with these activities [27].

Similar to our results showing that lower self-rated social standing is associated with developing high nutrition risk, previous studies using the CLSA comprehensive [42] and tracking cohorts [40] found a relationship between self-rated social standing and nutrition risk. Individuals who rate their social standing as higher may find it easier to access healthy foods and so obtain adequate nutrition. Low social standing, in contrast, may indicate social disadvantage and social disadvantage has been shown to influence the ability to afford healthy foods as well as the ability to spend time on food preparation [43].

Household income was also associated with developing high nutrition risk in our study, with higher household incomes lowering the odds of developing high nutrition risk. This connection between household income and nutrition risk has been found in previous studies using the CLSA [16] and in many additional studies in a systematic review [44] and a scoping review [45]. Lower incomes are associated with food insecurity [46–48], which occurs when a household has “inadequate or insecure access to food due to financial constraints” [49] (p.6). Individuals with lower incomes may not be able to afford sufficient food to meet their needs, leading to nutrition risk.

Similar to previous research, we found that increased physical activity was associated with lower odds of having high nutrition risk develop in all age groups [50]. Individuals who are at high nutrition risk may not consume adequate amounts of foods and nutrients to support physical activity. In contrast, individuals who are physically active are more likely to meet their nutrient needs, as energy expenditure during physical activity allows an individual to consume greater amounts of food, which if nutrient-dense, can help them meet their nutrient requirements [51].

We also found that as the frequency of participation in educational or cultural activities increased the odds of having high nutrition risk develop decreased. To our knowledge, the association between educational or cultural activities and nutrition risk has not been previously explored in the literature. However, previous studies have examined the association between nutrition risk and participation in community activities. A Canadian study found that infrequent social participation (participating in community activities less than once per week) was associated with high nutrition risk [19]. Another study, conducted in Brazil, found that low social participation was associated with malnutrition risk [52]. Individuals who participate frequently in community activities may have higher levels of social support that enable them to engage in such activities. Additionally, individuals with more frequent participation in community activities may have more opportunities to eat with others. Consuming meals in the company of others has been demonstrated to enhance dietary intake and mitigate nutrition risk, whereas solitary eating is correlated with high nutrition risk [23,25].

Despite these similarities between age groups, there were some differences. Low levels of satisfaction with current housing were associated with the development of high nutrition risk in all

but the oldest age group. This could be because older adults may have been long established in their homes and comfortable with their housing situation. In contrast, younger individuals may be looking to buy their first home or to upsize or downsize their current home. Similarly, lack of contact with a primary care provider was only associated with high nutrition risk in the three youngest age groups and not the oldest age group. This observation likely indicates that a greater proportion of individuals within the oldest age cohort had interactions with their primary care provider in the past year compared to those in other age cohorts.

Limitations of the Study

As with all studies, this one is not without its limitations. While the CLSA tracking cohort is generalizable to the Canadian population, several groups are not included. The CLSA cohorts do not include full-time Canadian Armed Forces members, those living in the Canadian territories and some remote areas, and those living on First Nations reserves and settlements [32]. Additionally, only individuals who speak English or French and those who can answer the questions themselves are included [32]. The baseline CLSA data only includes individuals between the ages of 45 and 85 [32].

It is important to note that SCREEN-8 has only been validated for community-living adults aged 50 and older [53]. Therefore, SCREEN-8 may not measure nutrition risk accurately in younger individuals, and we included adults aged 45-49, as well as those 50 and older. This posed a risk of misclassification bias [54], and when we separated those aged 50-54 from those aged 45-49, we noted several differences in the results, indicating that misclassification likely occurred. When only looking at those aged 50-54 (as opposed to those 45-54), self-rated social standing, participation in cultural activities, and contact with a family physician were no longer associated with developing high nutrition risk.

Furthermore, the manifestation of nutrition risk may vary among individuals aged 45-54. This demographic may experience changes in household composition, such as having children residing at home or children transitioning out of the household. These dynamics can influence dietary choices [55,56]. These individuals may also be working adults, affecting their food choices during the workday [55,56]. However, we included this younger age group in our study so that, using future waves of CLSA data, we can examine how high nutrition risk develops as individuals in this age group enter older adulthood.

5. Conclusions

Nutrition risk is prevalent among Canadian adults aged 45 and older who reside in the community. Factors commonly associated with the development of high nutrition risk across all age groups include social support, self-rated social standing, frequency of participation in sports or physical activities, frequency of participation in cultural or educational activities, and household income. Individuals who have low levels of social support, low self-rated social standing, low incomes, and those who participate infrequently in physical, educational, or cultural activities should be assessed for high nutrition risk. As recommended by the Canadian Malnutrition Task Force, [57] adults aged 65 and older should also be screened annually for nutrition risk by their medical home [58]. Programs and policies that address these psychosocial mechanisms (social support, social standing, income, and participation in community activities) need to be designed, implemented, and evaluated to reduce the prevalence of high nutrition risk and the progression from low to high nutrition risk. Interventions that combine nutrition programming with social activities, such as congregate dining [59,60], community kitchens [61] and other forms of social nutrition programming, [62] may also help to strengthen social ties while reducing nutrition risk. Preventing the development of high nutrition risk can prevent the associated morbidity and mortality, thereby improving the health of adults at midlife and beyond. This, in turn, will support older adults to age in place in their communities safely and autonomously for as long as they desire.

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org, Table S1: *Binomial logistic regression analyses exploring the development of high nutrition risk, controlling for demographics*, Table S2: *Binomial logistic regression analyses exploring the development of high nutrition risk for those aged 45-49 and 50-54*, Table S3: *Binomial logistic regression analyses exploring the development of high nutrition risk for those aged 45-49 and 50-54, controlling for demographics*

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study by the Canadian Longitudinal Study on Aging. The present study is a secondary analysis of the first two waves of the CLSA.

Data Availability Statement: Data are available from the Canadian Longitudinal Study on Aging (www.clsa-elcv.ca) for researchers who meet the criteria for access to de-identified CLSA data.

Disclaimer: The opinions expressed in this manuscript are the authors’ own and do not reflect the views of the Canadian Longitudinal Study on Aging.

Conflicts of Interest: C.M.M. and C.D. declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

CLSA	Canadian Longitudinal Study on Aging
OR	Odds ratio
CI	Confidence interval
MOS	Medical Outcomes Study Social Support Survey
SD	Standard deviation
SCREEN-8	Seniors in the Community Risk Evaluation for Eating and Nutrition - 8

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