

THE CANADIAN AGING POPULATION



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EXECUTIVE SUMMARY: The Canadian population is aging. By 2021, it is predicted that 1 in every 3 Canadian individuals will be 55 or over (PHAC, 2007). As age increases so does the risk of acquiring chronic pathologies like cardiovascular disease (CVD). CVD alone tallied \$7.6 billion in health care costs and \$14.6 billion in lost economic productivity in 2000 (PHAC-CVD, 2009). Depression is also on the rise among the working-age population, contributing to an increase in health care costs, reduced work productivity and absenteeism (Cochrane, 2009). Together these chronic diseases put financial stress on the Canadian health care system and cost businesses billions of dollars in lost economic productivity.

Canada plans to spend \$757.5 million on health promotion programs geared toward tobacco cessation and physical activity initiatives (MHP, 2010). However, expanding these efforts around the World Health Organization's 12 determinants of health and the 7 dimensions of wellness can vastly impact the general health of the aging population. Designing health promotion efforts around these determinants of health and dimensions of wellness would engage stakeholders on many different levels and result in reduced health care costs incurred by businesses and the government of Canada (Morrison et al., 2008; PHAC, 2001). A possible solution to reducing the risk of CVD and depression among older adults could include health promotion / disease prevention efforts centered around current optimistic nutritional findings

on omega-3 (n-3) fatty acids and the alleviation of these aforementioned pathologies. This highlights the need for knowledge translation and transfer so that ethically-sound knowledge from research is distilled and disseminated among stakeholders to promote real-world applications of this knowledge into more effective healthcare systems, services and products.

This literature review will provide an overview of the Canadian aging population, health and wellness, health promotion, CVD and depression in the workplace and knowledge translation and transfer. It will also address current scientific findings in the literature on n-3 supplementation on the alleviation of CVD and depression in older adults 55 to 67.



INTRODUCTION: Globally, the proportion of individuals over the age of 60 is growing faster than ever before. The rise in the number of individuals 60 and up is multi-factorial and mainly the result of declining fertility rates and increases in life-expectancy since the 1960's (NRC, 2009). The aging population phenomenon has been reported as early as 1998 where the proportion of older individuals 60 plus exceeded young individuals 15 and under in some developed countries (UN, 2007). By the year 2050, the United Nations anticipates that the number of older persons over the age of 60 will supersede the number of young in many countries around the world (UN, 2007). This outcome will weigh heavily on many areas of life

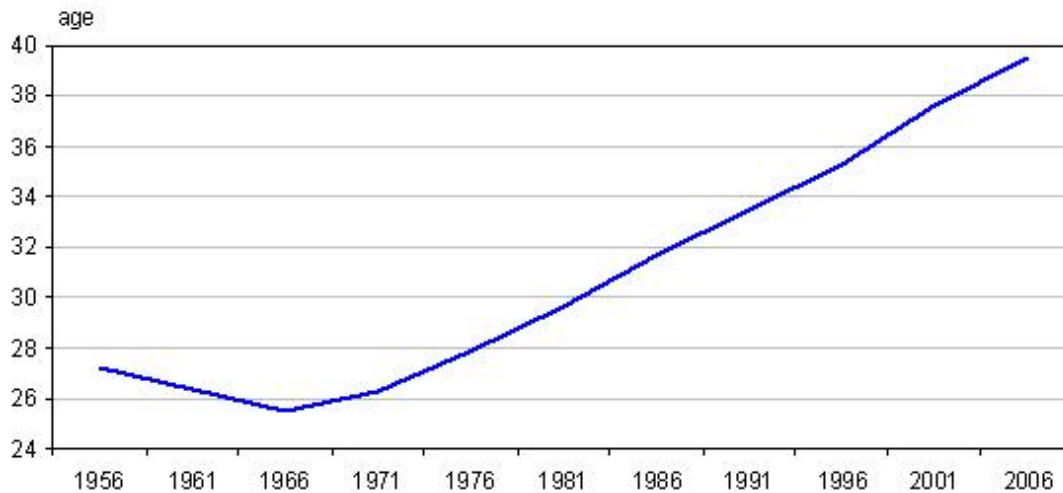
including economic, occupational, and medical domains involving economic growth, employee retention, and health care provision.

In terms of economic strain, the global potential support ratio (PSR) can be used to illustrate the emerging trend linking aging population with a strained economy. The PSR signifies the number of working individuals to each individual over 65 (UN, 2007). By 2050, global PSR is expected to reach 4, down from 9 in 2000 and 12 in 1950. Therefore, it is evident by this descending trend that individuals of working-age will bear the weight of economic sustainability due to the aging population.

SNAP SHOT OF THE CANADIAN AGING POPULATION

In 2006, Census Canada provided a snapshot of the Canadian aging population according to each province and territory. It was noted that all of Canada had experienced an increase in persons 65 and older and a decrease in those 15 and younger compared to 2001 (Census 1, 2006). Individuals aged 65 and older reached 4.3 million, an all-time Canadian high (Census 1, 2006). If trends persist, the number of Canadian seniors will outnumber Canadian children in every province by 2022 (Census 2, 2006). The census also highlighted that Canada's 2006 median age was 39.5 years, up from 37.6 in 2001; up further still from values obtained over the past 50 years (Census 3, 2006). By 2031, the median age in Canada is expected to exceed 44 years (Census 3, 2006).

MEDIAN AGE IN CANADA, 1956 TO 2006



Sources: Statistics Canada, censuses of population, 1956 to 2006.

Figure 1

(STATS CAN, 2009)

Description

This figure depicts the rise in Canadian median age values from 1956 to 2006. After the slight dip in median age from 1956 to 1966 (27.2 years and 26.3 years, respectively), the Canadian median age rose steadily from 25.4 years in 1966 to 39.5 years in 2006.

With respect to the working-age population (which ranges from 15 to 64), the number of individuals 55 to 64 grew the fastest from 2001 to 2006 making up about 16.9% of the workforce (Census Canada, 2006). As such, it is predicted that 1 in 3 Canadians by 2021 will be 55 or older (PHAC, 2007). With fewer young people entering the workforce, it is important to note that individuals 55 and greater will soon reach retirement signifying a (double-edged) decrease in the Canadian labour force and a subsequent loss in knowledge retention for employers (UN, 2007). What's more, is the potential for the Canadian government to raise retirement-age from 65 to 67 increasing Canadian Pension Plan assets to \$982 billion by 2050 (UofT, 2010). Therefore, health of individuals 55 to **67** may be a key point of intervention by

which governments, private institutions and organizations wishing to retain human capital can prolong the inevitable transition into retirement.

**By 2021:
1 in every 3 Canadians
will be 55 or over**



As the population ages the incidence of chronic disease also increases. Among the diseases of the aging population (including cancer), cardiovascular disease (CVD) was the leading cause of death for Canadians in 2004 resulting in approximately 250,000 potential life years lost as a result of premature death before the age of 75 (PHAC-CVD, 2009). In 2000, direct costs of CVD on the health care system totalled \$7.6 billion whereas disability or death due to CVD resulted in a \$14.6 billion loss in economic productivity (PHAC-CVD, 2009). For men over 45 and women over 55 the rate of hospitalization increases sharply (PHAC-CVD, 2009). Although mortality by CVD has decreased dramatically over the past half century - due in part to improved health care provision - the aging population will soon put a strain on the

health care system as demand for health care provision will exceed supply (PHAC -CVD, 2009). Depression is another disorder affecting the Canadian population that not only impacts quality of life (QOL) but like CVD, impacts health care costs, absenteeism and lost work productivity (Cochrane, 2009; PHAC, 2009; PHAC, 2002).



2000: CVD tallied \$7.6 billion in health care costs and a \$14.6 billion loss in economic productivity

Aside from their individual outcomes on health it seems as though these two pathologies are not mutually exclusive. In 2002, Statistics Canada found that of the 10% men and 8% women aged 40 and above that were diagnosed with heart disease 3% men and 4% women met the criteria for a major depressive episode one year before they reported CVD (STATS CAN, 2008). Results as impactful as these affect stakeholders including patients, health care providers and policy makers in a variety of different ways. They allude to better health care and promotion efforts for major pathologies like CVD and depression such that individuals as well as communities can take part in navigating their own health and in turn alleviating the strain on health care costs and work place economics.

WHAT IS HEALTH AND WELLNESS?

Although there are many interpretations of health, the 1948 World Health Organization (WHO) defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. However, this preliminary definition implies a quantitative evaluation of ‘complete’ physical, mental and social health. While idealistic, health in its constant state of flux is not quantifiable (WHO, 2010).

Since 1948, many amendments have been made to improve the definition of health. The 1986 Ottawa Charter for Health Promotion (WHO) and Achieving Health for All introduced the **determinants** of health which incorporate broader social, economic and environmental factors affecting health. Moreover, this charter also documents health as a resource for everyday life, and not the objective of living. In 1989, the Canadian Institute for Advanced Research introduced the population health concept which states that the determinants of health do not act in isolation; rather they interact in a complex fashion attributing to the dynamics of health. Amidst the evolution of the definition of health it is important to note that “health is a resource for everyday life and not the objective of living”. Therefore, by positively impacting the determinants of health, businesses, governments and health care professionals can improve the well-being of individuals one service, product or resource at a time (PHAC, 2001; WHO, 2010; WHO-OC, 2010).

The University of Iowa defines the 7 **dimensions** of wellness as: physical, emotional, intellectual, spiritual, social, occupational and environmental (UI, 2010). Although some overlap exists between dimensions of wellness and determinants of health, health status is

vastly multi-factorial and should be the combined influence of the aforementioned determinants of health and dimensions of wellness.

WHO Determinants of Health	
Social Economic Status	Personal Health Practices and Coping Skills
Social Support Networks	Healthy Child Development
Social Environments	Health Services
Physical Environments	Biology and Genetics
Education and Literacy	Gender
Employment/Working Conditions	Culture

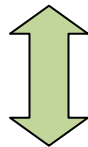


Table 1: WHO key determinants of health (PHAC, 2009).




Figure 2: University of Iowa Wellness Wheel (UI, 2010).

WHAT IS HEALTH PROMOTION?

As outlined by the 1986 Ottawa Charter for Health Promotion, **health promotion** is the “process of enabling individuals to increase control over and to improve their health” (WHO, 2010). Health promotion involves the fundamental health prerequisites; peace, shelter, education, food, income, stable eco-system, sustainable resources, social justice and equity (WHO-OC, 2010). Among advocating for good health, health promotion aims at enabling individuals to pursue their goals, acquire skills, learn and grow and mediates government, social and economic action (PHAC-PHA, 2001).

The 2010/2011 budget for the province of Ontario includes \$757.5 million dollars on health promotion programs like health and wellness, nutrition and healthy eating, preventing disease, injury and addiction, valuing sport and recreation, promoting partnerships that support healthy communities and creating a smoke free Ontario (MHP, 2010). These efforts focus on various demographics including children and youth, aboriginal First Nations, elderly and persons of low socio-economic status. By this, it is evident that the ministry is investing time and energy into continuously improving the health of vulnerable members of society and alleviating the health disparities between the vulnerable and more affluent members of the population (the socio-economic aspect of the determinants of health). However, the health of the aging population 55-67 in this health promotion program is not specifically addressed.



Canada will spend \$757.5 million on health promotion programs in 2010-2011

Health promotion and **disease prevention** strategies currently focus on secondary aging in individuals 65 and up. Secondary aging includes changes in tissue and biological functions due to disease, as opposed to primary aging which is the inevitable process of all living things (Keller, 2008). At risk older individuals 55 to 67 or those with subclinical disease are prime target demographics for secondary prevention efforts which evaluate and encourage behavioural and environmental changes that reduce risk of secondary aging (Keller, 2008). Fortunately, resources for sustaining health and prolonging secondary aging are on the rise boding well for older individuals ages 55 to 67 who wish to remain active members of society and continue working (Sask, 2003; US gov, 2010). However, the prevention of tertiary aging - the treatment of a health problem - through health promotion efforts might be an avenue worth investing in, which will be addressed in the latter half of this report.

OLDER ADULTS IN THE WORKPLACE

Employees are the most valuable asset to a business's strategic mission and achievements, especially *seasoned* employees with the know-how (Morrison and MacKinnon, 2008). They are present at work either part time (17.1 hours/week) or full-time (39.5 hours/week) providing an ideal setting for health promotion/disease prevention efforts (Cragg et al., 2008). With respect to general Canadian **workplace wellness programs** (WWP), the most common programs pertain to fitness (39.4%) and disability management (24.6%) with an employee preference for individualized program counselling (Morrison et al., 2008). With respect to the pathologies mentioned above, CVD and depression are major intervention points

for Canadian WWP. The **American Heart Association** (AHA) outlines a few recommendations for WWP targeted toward CVD disease prevention. Some components include tobacco cessation, regular physical activity, weight management, stress management/reduction, nutrition education, CVD education on resuscitation / defibrillator training, and changes in the work environment to encourage healthy behaviour (AHA, 2009).

As noted above, the prevalence of mental illness including anxiety and depression are on the rise among workers - increasing company costs due to absenteeism, presenteeism (poor productivity), and disability claims (Bland, 2009; Kirsh et al., 2010). Depression alone is a risk factor for new and recurrent CVD and stroke (AHA, 2009) putting the onus on employers to step in and make a difference. Typically, employers can achieve a \$3.50:\$1.00 savings-to-cost ratio from reduced absenteeism and health care costs by implementing WWP (Person, 2010). Stakeholders that are essential for the development and implementation of WWP include: employers, employees, unions, insurers, health professionals, provincial and federal government, the business community, and financial institutions (Morrison et al., 2008). Some potential barriers to the success of WWP tend to be insufficient incentives, inconvenient locations, poor marketing, low interest, and time conflicts (Person et al., 2010). It is important that these potential barriers be addressed so that efforts of the stakeholders involved are justified.

Workplace wellness programs can fetch businesses \$3.50 for every \$1.00 spent

The **Canadian Center for Occupational Health and Safety** is a not-for-profit federal corporation made up of Council representing government, employers and labour. It promotes the total wellbeing of the Canadian working population by providing information, training, education, management strategies and solutions that support physical, psychosocial and mental health (CCOHS, 2010). Private sectors have incorporated independent wellness programs such as LifeWorks® that claim to provide resources that target aspects of the dimensions of wellness, in turn helping reducing stress and creating a supportive work environment (LifeWorks, 2010). Health promotion outside of WWP is not limited to government and private sectors alone, but also involves community and individual action as well. Community members can enhance self-help and social support systems strengthening public participation and enhancing life skills at an individual level that can be facilitated at home, school, work or in the community (WHO, 2010). It is evident that health promotion is an intersectorial collaboration between federal, provincial, private sector, local, and individual contributors to the management of health issues (PHAC, 2001).

Health promotion *action* means building public policy around health in all sectors and at all health levels. It involves amending legislation, taxation and organizational change that improves health, income, and health equity in turn providing safe and healthier goods and services, clearer, and more enjoyable environments that allow all members of society to attain health (WHO–HPA, 2010). Population health plans, programs and policies can be implemented via health promotion, disease prevention, risk management, policy coordination, medical treatment, rehabilitation and palliative care efforts (PHAC-PHA2, 2001). Health interventions as grand as these confer accountability by all members involved in the implementation process to

develop transparent health plans, programs and policies that are easily understood by the population (PHAC-PHA2, 2001). Results and achievements of public spending should also be divulged to Canadian citizens. Typically, Health Canada/Public Health Agency of Canada (PHAC) can inform, consult or engage Canadian citizens in the development of health promotion, health service delivery and policy decisions (HC, 2006).

WHAT IS KNOWLEDGE TO ACTION?

An important question to ask is what steps do policy makers take when making decisions on health action plans, programs and policies? The PHAC has included a list of checkpoints required for the implementation of intervention, prevention and promotion strategies. This approach is not necessarily linear and can commence at any of the following checkpoints: identifying (1) the key health issue(s), (2) the hypothetical result of a potential solution(s), (3) health/evidence gaps, (4) key stakeholders that will assist in a solution, (5) evidence from research and the community, (6) developing an impactful and sustainable short or long term plan, and (7) identifying the impact of that plan (PHAC-HPA2, 2001). These checkpoints very much resemble the “Ottawa Model of Research Use” (OMRU) which focuses on moving research into practice (Tetroe et al., 2007). The rationale for this framework is to ensure that ethically-sound knowledge from research gets implemented into real-world applications resulting in more effective healthcare systems, services and products (Tetroe et al., 2007). Amended by Tetroe et al., are 15 key checkpoints with added examples that apply to CVD and depression efforts seen in [Table 2](#) (Tetroe et al., 2007).

ACTION CATEGORIES THAT BRING KNOWLEDGE-TO-ACTION IN THE CONTEXT OF CVD AND DEPRESSION

Identify the problem (i.e. CVD/Depression)
Identify the need for change (i.e. Health care and CPP costs, and lost productivity)
Identify change agents (i.e. WWP, health promotion/disease prevention efforts)
Identify target audience (i.e. Active older working age individuals 55-67)
Assess barriers (i.e. Effective marketing, sufficient incentives)
Review evidence or develop innovation (i.e. Find existing science or initiate new research)
Taylor/Develop intervention (i.e. Omega-3 supplementation for depression and CVD)
Link(age) (i.e. Link evidence to create a WWP/health promotion/disease prevention program structure)
Implement (i.e. Implement into work place or hospitals)
Evaluate Develop evaluation plan, Pilot test, Evaluate the process, Evaluate outcomes
Maintain change (i.e. If the outcome is positive maintain intervention momentum)
Disseminate (i.e. Share results with other stakeholders and individuals who could benefit)

Table 2: Key points in bringing Knowledge-to-action

Tetroe et al., 2007.

This checkpoint system incorporates evidence or develops new evidence that brings knowledge-to-action (policy etc). But what is knowledge? **Knowledge** is defined by Oxford dictionary as: “(1) facts, information, and skills acquired through experience or education; theoretical or practical understanding of a subject; (2) awareness or familiarity gained by experience of a fact or situation” (Oxford, 2010). The creation of effective health promotion/disease prevention and WWP initiatives hinges on translating relevant and credible information (theoretical or empirical) into useable knowledge such that results of their

implementation are meaningful and impactful (Tetroe et al., 2007). It highlights the need for knowledge creation/synthesis, distillation and dissemination such that only high quality research is harvested or created, translated, used and shared – **knowledge translation (KT) and transfer (KTT)** (Straus, 2009). This paradigm also lends itself to that of evidence based medicine (EBM) whereby medical clinicians use high quality research on which to base clinical decisions (Kranke, 2010). However, the difference between the two paradigms is that KTT is not always medicinally motivated (Tetroe et al., 2007).

The **Canadian Institutes of Health Research (CIHR)** is a major federal agency that funds health research and is made up of 13 institutes integrating researchers, health professionals, policy makers, voluntary health organizations, and industry and patient groups. These stakeholders are brought together for the purpose of improving national biomedical, clinical, health systems and services, and population public health (Tetroe et al., 2007). Inevitably, these researchers and decision makers collaborate on knowledge exchange or KT to solve health problems by planning, producing, disseminating, and applying existing or new research in their decision-making process (CHSRF-SA, 2010; Straus et al., 2009). To make sure that the best possible information is harvested and used, a few particular models have been published including the OMRU mentioned previously. Another model that attempts to bring knowledge into use is by Graham and colleagues (Graham et al., 2006) who incorporate a **knowledge creation funnel** along with an **action cycle**. The knowledge creation funnel (**Figure 3**) is made up of 3 stages (1) knowledge inquiry, (2) synthesis and (3) creation of knowledge (Straus et al., 2009). Stage (1) of the knowledge creation funnel, knowledge inquiry, pertains to researching literature with an evidence-based approach. It requires the attainment of highly ranked

systematic reviews and meta-analyses with a narrow clinical scope and is heavily dependent on the totality and quality of evidence (Straus et al., 2009). Systematic reviews tend to synthesize high-quality literature that pertains to a single question whereas meta-analyses go one step further and quantify the results into a pooled analysis (Kranke, 2010). These are generally accepted research methods that amalgamate the best available research for the basis of clinical decision making. However, some flaws exist that should be mentioned. The potential for research bias is possible and could therefore, affect the integrity of the review, heterogeneity among available research can also skew the interpretation of the results, and intersubject-variability can over-generalize results in such a way that a pooled outcome may not yield a significant effect. Of note, is the concept of **knowledge management** and the misconception of knowledge. Researcher John Biggam cautions that knowledge that appears on the web may be lacking proper management throwing a wrench into the field of KTT. Therefore, despite flaws in the literature, emphasis should still be placed on up-to-date systematic reviews and meta-analysis mentioned above as they are rigorously reviewed and distilled as they move further down the knowledge funnel (steps 2 and 3) yielding high-quality knowledge for synthesis into decision making tools.

KNOWLEDGE-TO-ACTION STRUCTURE

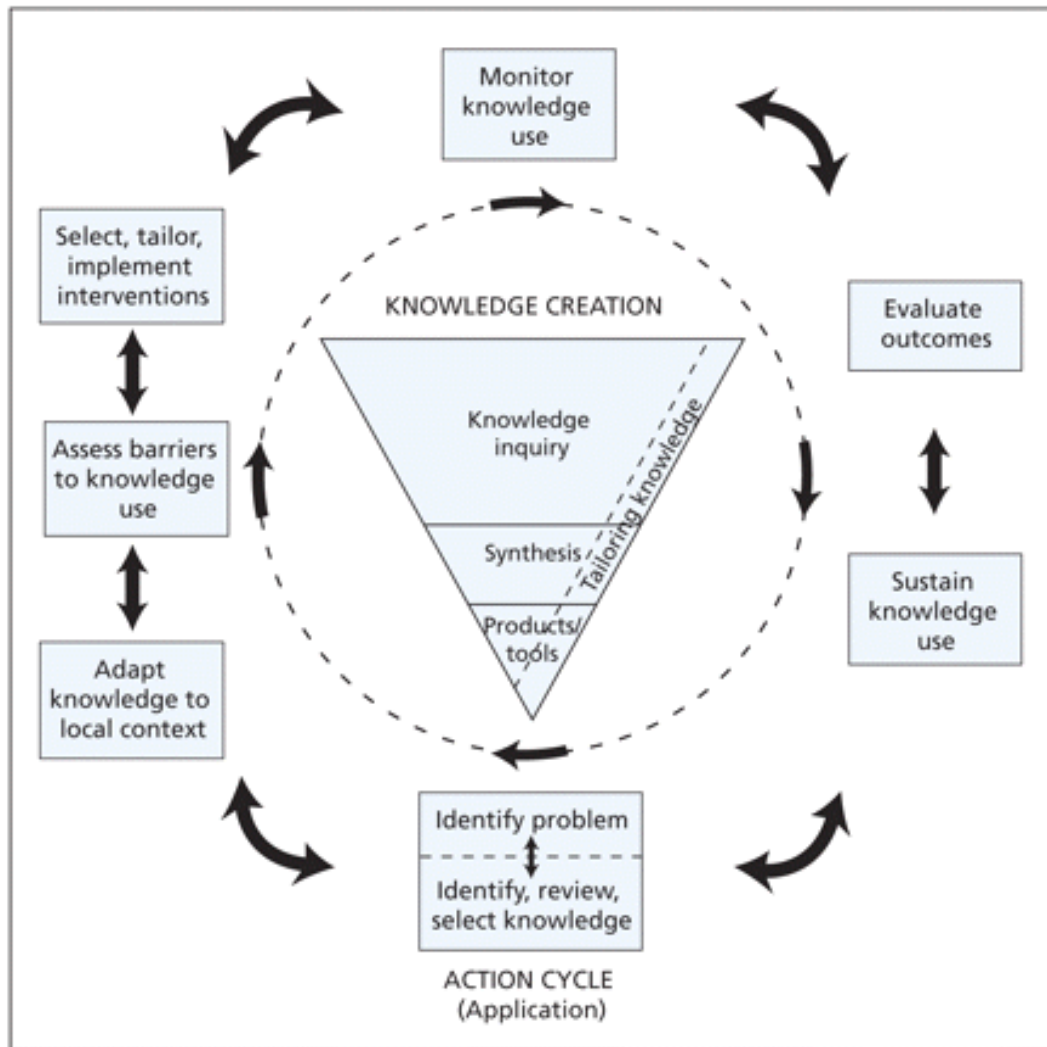


Figure 3: This framework incorporates the knowledge creation funnel and action cycle.

Graham et al., 2006.

The action cycle outlined in **Figure 3** involves a series of processes that attempt to facilitate distilled knowledge into action which can be approached in a step-wise fashion or simultaneously (Straus et al., 2009; UOW, 2007). This approach is a generally accepted model for promoting research into action by the CIHR (Straus et al., 2009) and as such will serve as the framework from which to base our CVD and Depression intervention.

OMEGA-3 AND THE ALLEVIATION OF CVD AND DEPRESSION IN INDIVIDUALS 55-67

INTRODUCTION: It is understood that the Canadian population is aging at a rate faster than ever before pressuring stakeholders to take action by alleviating the burden of knowledge drain, economic losses as well as health care costs (CIHR, 2006; Koh and Sebelius, 2010; Morrison et al., 2008). This review has acknowledged that CVD and depression are major *potential* intervention points from which to proceed with multisectorial health promotion, disease prevention and WWP efforts. Finally, Canada is in the midst of a potential retirement-age increase from 65 to 67 years of age escalating the need to address the aforementioned chronic pathologies in individuals 55 to 67 (UofT, 2010).

This report will summarize scientific literature including systematic reviews, meta-analyses and randomized control trials in the context of omega-3's (n-3) and their effect on CVD parameters and depression using the Knowledge-to-Action structure provided by Graham and colleagues and used by the CIHR (Graham et al., 2006; Straus et al., 2009).

CASE REPORT: N-3 fatty acids (FA) have received a lot of attention among the scientific community for their purported effects on cognition and visual acuity in children, Alzheimer's disease, rheumatoid arthritis, CVD and depression (Logan, 2003). The rationale for studies on n-3 FAs in the context of these aforementioned diseases is owing to the structure and function of these FA's. N-3 FAs are a subclass of polyunsaturated fatty acid (PUFA). The n-3 PUFA alpha-linolenic acid (ALA) is derived from plant sources and is considered an essential FA as it

cannot be synthesized by the body (Harper and Jacobson, 2003). ALA can undergo elongation and desaturation to yield eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) which are major FAs found in cold-water fish; however, the conversion from ALA to EPA and subsequently DHA is minimal (~0.3% and ~0.01%, respectively) and therefore dietary or supplemental sources of EPA and DHA are warranted (Holub, 2009; Hussein et al., 2005). N-6 FAs are another class of PUFA where linoleic acid (LA) is the essential FA precursor to arachidonic acid (ARA) – the metabolite (Harper and Jacobson, 2003).

The n-3 PUFAs EPA, DHA as well as the n-6 ARA are well incorporated into the plasma cell membrane. Depending on which subclass of PUFA gets integrated into the membrane and subsequently released by insult or injury, catalysis by COX-2/LOX-5 enzymes results in the production of anti-inflammatory eicosanoids by n-3 PUFAs or proinflammatory by n-6 (Adkins and Kelly, 2010). With respect to CVD, n-3 PUFA metabolism can result in cardiovascular anti-inflammatory and antithrombotic effects (Adkins and Kelly, 2010); whereas n-3 ingestion improves membrane fluidity and neurotransmission in subjects with depression as well as increases the ratio of anti-inflammatory to pro-inflammatory mediators (Lin et al.,2010).

WHAT THE SCIENCE SAYS: A recent systematic review and meta-analysis pooled the results of 11 randomized control trials on fish oil n-3 consumption and death from cardiac causes.

POOLED RESULTS FROM A META-ANALYSIS BY LEON ET AL., 2009 ON FISH OIL CONSUMPTION AND RISK OF CARDIOVASCULAR DEATH

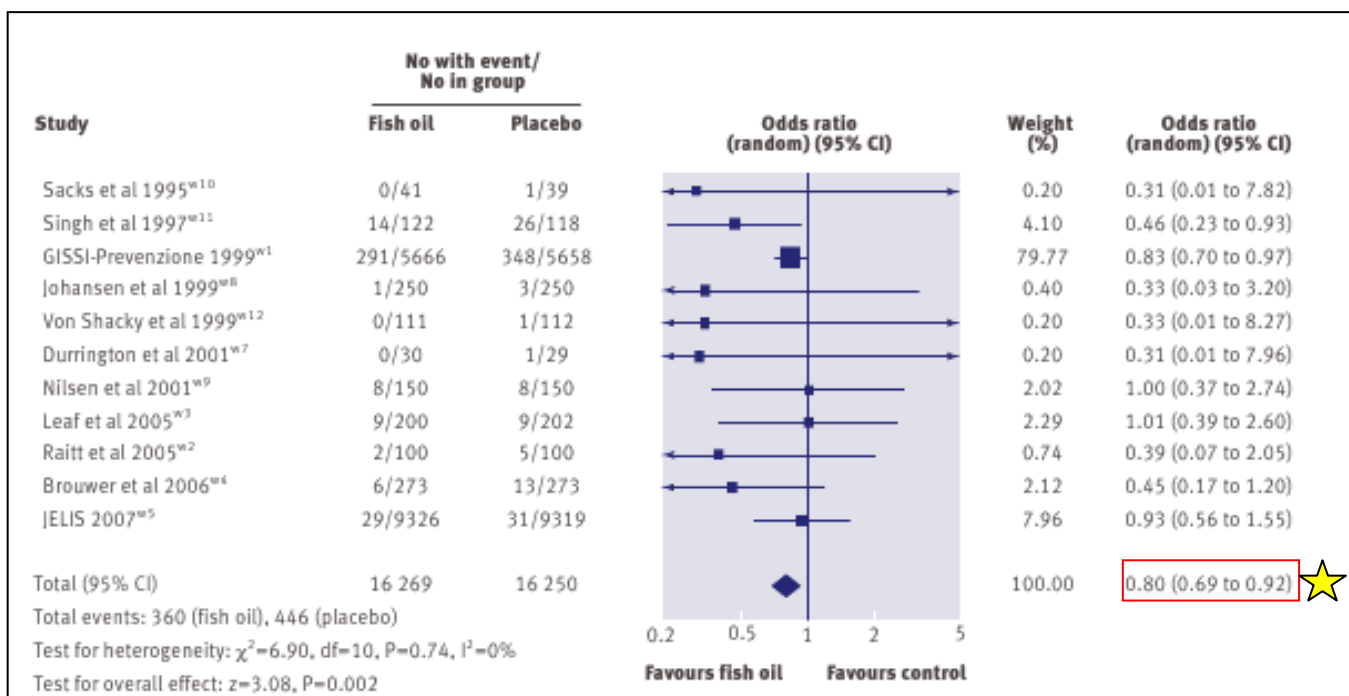


Figure 4: Effect of fish oil on death from cardiac causes. Yellow star highlights pooled risk reduction of 20%.

(Leon et al., 2009).

As seen in **Figure 4**, the pooled risk reduction of fish oil consumption on cardiovascular death is 20% in subjects with a mean age range of 48.5 to 65.7 years (applicable to our target demographic) (Leon et al., 2009). The randomized controlled trials (RCT) included in this systematic review/meta-analysis were ranked using the **JADAD** score to eliminate selection bias

and distinguish high-quality RCTs (Jadad et al., 1996). Of note, however, is the heterogeneity among study parameters, including fish oil dosages, differences in study power, study duration, sample size and patient conditions. Some included studies recruited subjects with myocardial infarction (MI) or coronary heart disease (CHD) while others included those who had received coronary angiography (Durrington et al., 2001; Singh et al., 1997; Von Schacky et al., 1999). Some studies used EPA only (Singh et al., 1997; JELIS, 2007) or both EPA and DHA (GISSI, 2002) while others used an n-3 concentrate (84% versus the standard 35%) (Durrington et al., 2001). This pooled dose ranged from 0 mg to 2000 mg/day EPA and/or DHA making conclusions on optimal dose difficult and inexact. In fact authors admit that the optimal dose is still unknown; however, considering giant studies like GISSI-Prevenzione including ~11,000 subjects (291 of which were in the fish oil group), 465mg EPA/386mg DHA per day is recommended for those with previous MI (GISSI, 2002).

Another meta-analysis of 11 RCTs by Bucher and colleagues noted a pooled risk reduction of ~20% for fatal MI in patients with CHD that were supplemented with n-3 in the form of fish oil/DHA/EPA (**Figure 5**) (Bucher et al., 2002). About 75% of subjects included had a mean age of 49 to 66 years and had previously experienced a MI (applicable to our target age group) (Bucher et al., 2002).

**POOLED RESULTS FROM A META-ANALYSIS BY BUCHER ET AL., 2002 ON FISH OIL
CONSUMPTION AND RISK OF FATAL MYOCARDIAL INFARCTION**

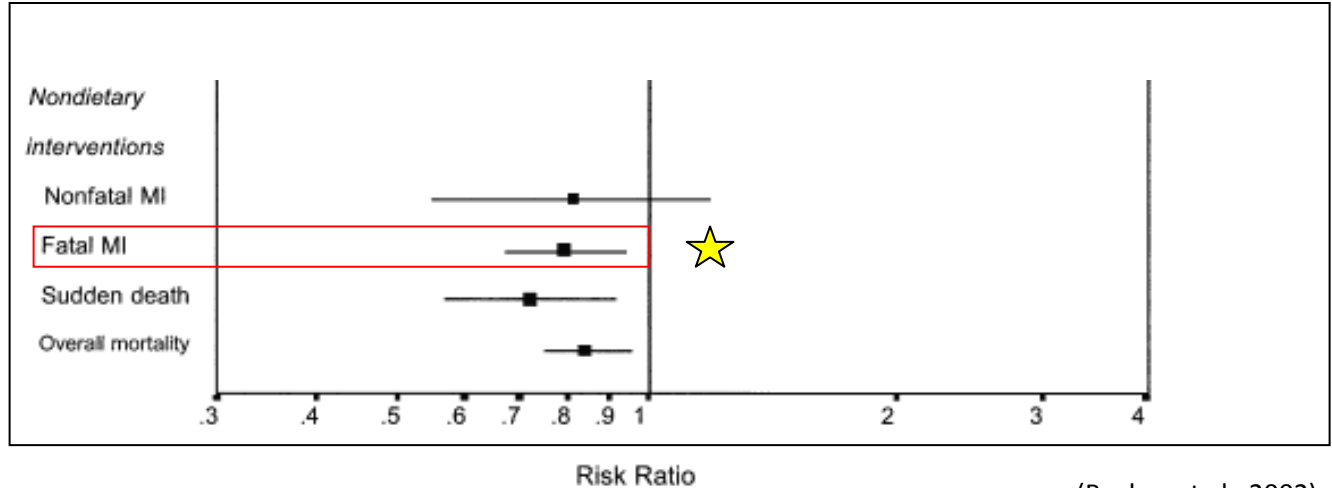


Figure 5: Effect of n-3 on death from fatal MI. Yellow star highlights pooled risk reduction by 20%.

(Bucher et al., 2002).

Based on the pooled secondary interventions that focus on **tertiary aging** by cardiac events it seems as though supplementation with n-3 fish oil could potentially benefit individuals (in this case ~49 to 66 years of age – including our target demographic) with previous history of CHD or MI. Although the exact mechanism within the context of these meta-analyses is unknown, *in vitro* studies have shown that n-3 PUFAs have plaque stabilizing and anti-inflammatory effects as well as inhibit the production of nuclear transcription factors that up regulate pro-inflammatory cytokines (Adkins and Kelly, 2010; Leon et al., 2009).

Aside from cardiac death, fish oil n-3 PUFAs also modulate triglyceride (TG) levels, which are risk factors for the development of atherosclerosis (Gotta, 1998; Patel et al., 2009). The GISSI-Prevenzione as well as Durrington et al., noted improvements in TG levels with fish oil

supplementation in CHD patients with persistent hypertriglyceridemia (Durrington et al., 2001; GISSI, 2002). Although there are far more studies that focus on fish sources of DHA and EPA, algal sources or “veggie DHA” does seem to elicit similar effects on the blood lipid profile including an improvement in TG levels (Schwellenbach et al., 2006). A **Cochrane Collaboration** review on n-3 FA for the prevention and treatment of CVD points out that upon review of ~40 randomized control trials, there is no clear difference in n-3 effectiveness based on fish, plant, dietary or supplemental sources on CVD outcomes (Cochrane, 2004). However, due to the age of this report, more studies including meta-analyses should be done to justify algal DHA and other plant sources of DHA including flax etc for the use of n-3 as an ameliorative treatment for CVD.

Other studies aside from systematic reviews and meta-analyses should also be included to paint a picture of the “nutrition gap” of “n-3” gap that exists in North America, and justify recommendations for increased intake of EPA and DHA in our aging population. A study performed by renowned n-3 researcher, Bruce Holub and colleagues noted that pregnant women in Canada – who require n-3 for foetal neural development - are consuming only ~ 100mg/day EPA/DHA when the recommended amount for healthy individuals is 500mg/day or 900mg/day for those with CHD set by the AHA (Denomme et al., 2005). To echo this finding, the AHA also points out that n-3 PUFA intake among Americans is ~ 1.6g/day where 0.1g to 0.2g/day comes from EPA and DHA (Kris-Etherton et al., 2003). Moreover, North Americans consume fish only once every 7 to 10 days due to concerns about environmental contaminants, taste and bones (Holub, 2010a). **Negative press** and **misconceptions** about fish contamination can result in a possible under-consumption of DHA and EPA which may result in adverse effects

on health. **The Council for Responsible Nutrition (CRN)** and the WHO have set strict standards for the safety of n-3 supplements (CRN, 2010). The **International Fish Oil Standards (IFOS)** organization is a popular third party for assessing the integrity and potential toxin concentration of fish oil supplements on the market (IFOS, 2010). Therefore, due to highly regulated processes surrounding fish oil supplements, it is safe to conclude that individuals opposed to eating fish can find an effective and relatively harmless alternative with supplements.

With respect to depression, a meta-analysis of 14 randomized control trials showed that patients with depression had lower levels of EPA, DHA, and total n-3 PUFAs (Lin et al., 2010). Authors of this analysis suggested that low n-3 PUFAs could play a part in the pathogenesis of depression providing a rationale for their potential use as part of a preventative or treatment regime. Two other meta-analyses offer further insight on the current state of the literature on prevention and treatment of depression and mood disorders with n-3 PUFAs (Appleton et al., 2010; Lin and Su, 2010). Appleton and colleagues found that there is only some support of supplementation on treatment of depression but not prevention in individuals without a diagnosis of depression (Appleton et al., 2010). Due to publication bias and heterogeneity among study parameters, firm conclusions on dose and outcome were unable to be made; however, authors did note a greater effect of treatment in individuals with more-severe depressive symptoms (Appleton et al., 2010). Lin and Su also noted an anti-depressant effect of n-3 treatment but again, publication bias and heterogeneity make it inappropriate for firm conclusions to dose, form etc to be made (Lin and Su, 2010).

With respect to bioavailability of n-3 supplements, new research indicates the triglyceride form is superior to the ethyl ester form controlled for total n-3, EPA, DHA and alpha-tocopherol (Neubronner et al., 2010). This finding highlights the need for better **quality assurance** whereby the exact formulation of n-3 is known improving transparency of the literature and **reproducibility** in turn effecting **validity** of evidence and knowledge development, and **totality of evidence**. **Jeremy Grimshaw**, a major “mover-and-shaker” for the improvement of professional and health care system performance has helped to create **AMSTAR** - a reliable and valid measurement tool to assess the methodological quality of systematic reviews (Shea et al., 2009). Another tool used to assess systematic reviews in the United Kingdom is the **Critical Appraisal Skills Programme (CASP)** made up of a series of questions to help rate evidence systematic reviews in a non-biased manner (CASP, 2010). However, not much literature exists with respect to n-3 and CVD and depression that use these aforementioned tools.

Moving further down the knowledge creation funnel, we see that literature isn't quite up-to-speed with the efforts we wish to embark on whether it's CVD or depression. Therefore, it is recommended that new large-scale, multi-centered studies tailored to refining existing knowledge, should be done that focus on dose (mg, g, ratio of EPA:DHA), n-3 formulation, type and severity of CVD (MI or CHD) or depression (Bipolar, major depression), and study duration to reduce heterogeneity among research and zero in on more concise recommendations. The **Canadian Health Services Research Foundation (CHSRF)** brings researchers and decision makers together to create and apply knowledge and could provide a good resource for federally

funded research with the intention of creating evidence-based decision making tools (CHSRF, 2010).

Applying the existing distilled knowledge above into an **action plan** would require further research to produce an appropriate EPA/DHA dose and formulation to recommend to the public with previous CVD pathology or depression. However, based on up-to-date evidence, advocating the use of n-3 for the treatment and prevention of reoccurring episodes of CVD and depression for individuals 55 to 67 could be *more* beneficial than harmful as only few case studies concerning **adverse events** (i.e. excessive anti-coagulation in patients on blood thinners) have been reported (warfarin) (Holub, 2010b). In fact, doctors in Rome, Italy recommend omega-3 fatty acids to patients after a cardiac event whereas the United States issues pharmaceutical grade n-3 prescriptions (NYT, 2006). The Cochrane Collaboration Review on n-3 and CVD states that there is no evidence that would justify discontinuing the use of n-3 for CVD; however, more high quality trials need to be done to confirm preliminary effects (Cochrane, 2004). Therefore, **Table 3** outlines preliminary recommendations based on the literature retrieved in this review. Recommendations on n-3 dose for CVD come mainly from the GISSI-Prevenzione study (GISSI, 2002) and EPA and DHA formulations should be in the more bioavailable triglyceride form (Neubronner et al., 2010) for the alleviation of subsequent MI or CHD (Bucher et al., 2002). Dose for n-3 and depression is still pending as new research should be developed to evaluate effect of EPA independently, DHA independently and in combination with each other.

RECOMMENDATIONS ON SUPPLEMENT INTERVENTION HEALTH PLAN

Pathology	Dose	Promote for:
CVD	465mg EPA/386mg DHA/day*	Alleviating tertiary aging by MI
Depression	x	Alleviating tertiary aging by depression

Table 3 * Dose from GISSI-Prevenzione study (GISSI, 2002); EPA and DHA in the more bioavailable triglyceride form (Neubronner et al., 2010).X; requires future RCT looking at various levels of just EPA, various levels of just DHA and various levels of both.

Part of the action cycle is to address barriers to knowledge use. It is important to keep in mind that when addressing health issues like CVD or depression the intersection with other determinants of health [i.e. social support networks, income etc] is inevitable (PHAC-HPA, 2001) and may act as stumbling blocks to the success of an intervention. It might not be enough to implement a supplementation regime. Suggesting a diet high in PUFAs like the **Mediterranean diet** might tap into the social and therapeutic aspects of health as it has been found to significantly decrease risk of subsequent MI - proving to have exceptional return on investment (Dalziel et al., 2006). Promoting tobacco cessation, regular physical activity, weight management, stress management/reduction, nutrition education, CVD education on resuscitation / defibrillator training, and changes in the work environment to encourage healthy behaviour should also be included in this action plan (AHA, 2009). Other barriers affecting knowledge use are KT bottlenecks which should be addressed in order to actively facilitate KTT (see [Figure 6](#)).

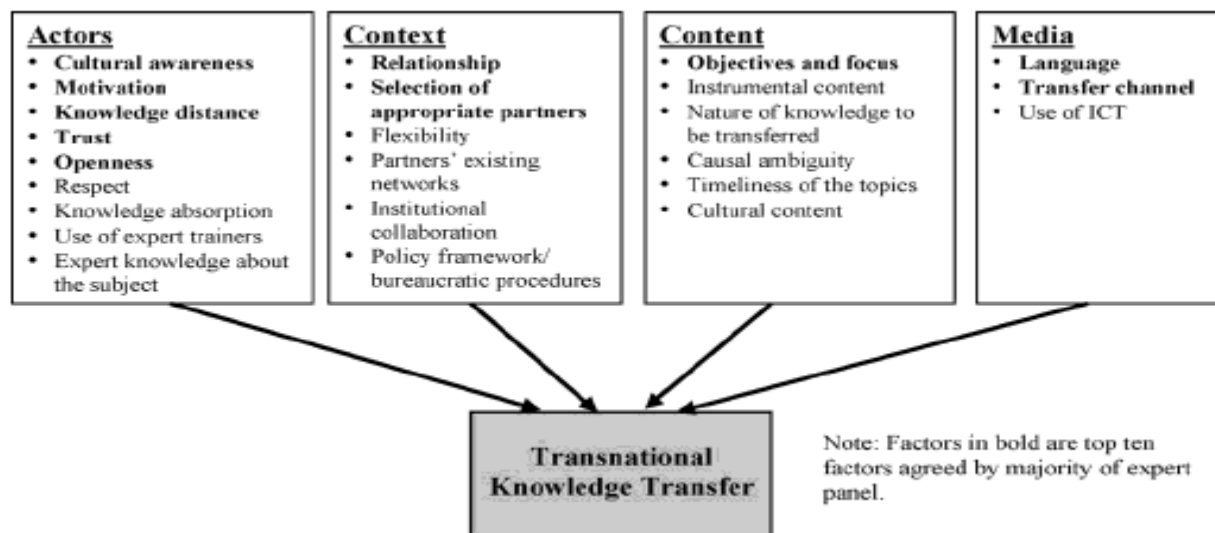


Figure 6: Factors affecting KTT.

(Duan et al., 2010).

Conclusion: The Canadian population is aging and by 2021, 1 in every 3 individuals will be 55 or over (PHAC, 2007). With increased age comes increased risk for chronic diseases like CVD - which tallied \$7.6 billion in health care costs and a \$14.6 billion loss in economic productivity in 2000 (PHAC-CVD, 2009). Depression is also on the rise, contributing to increased health care costs, reduced work productivity and absenteeism (Cochrane, 2009). Interestingly, these two pathologies are not mutually exclusive as individuals diagnosed with CVD have reported at least one depressive episode shortly before the onset of a cardiovascular event (STATS CAN, 2008).

Canada plans to spend \$757.5 million on health promotion programs geared toward preventative measures including tobacco cessation and increased physical activity (MHP, 2010); however, the literature on n-3 and CVD/depression is currently conveying a treatment

approach to health promotion as opposed to a primary preventative one. Exact doses for either pathology are still preliminary and foundations like the CHSRF can help initiate new research that may one day yield better evidence in support of a dose and duration of treatment with respect to severity of pathology. Implementing a WWP, health promotion or disease prevention program engages stakeholders on many different levels including employers, employees, unions, insurers, health professionals, provincial and federal government, the business community, financial institutions, individuals, communities and populations (Morrison et al., 2008; PHAC, 2001). In order to ensure that the best possible policy is implemented, the best possible research should be available. This allows for current research to be distilled or new knowledge to be created and disseminated across researchers and policy makers for the development and implementation of a successful action plan. It is important that potential barriers like insufficient incentives, inconvenient locations, poor marketing and low interest, and time conflicts be addressed so that efforts by stakeholders involved are justified (Person et al., 2010).

Implementing an n-3 supplementation program can intersect with other health issues or determinants of health [i.e. social support networks, income etc]. Therefore, promoting a multi-factorial plan that incorporates the Mediterranean diet (containing high amounts of n-3 PUFA) and exercise could help create a therapeutic approach to treatment.

In sum, n-3 PUFAs provide some benefit to treating CVD and depression without harm. Therefore, n-3 PUFAs should be pursued further as a potential ameliorative therapy that could alleviate health care costs and encourage health and wellness in older individuals 55 to 67.

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