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ELDERLY MEN AND HEALTH SERVICE PROVISION FOR TYPE 2 DIABETES MANAGEMENT: SYNTHESIS OF KNOWLEDGE GAPS AND IDENTIFICATION OF RESEARCH NEEDS

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ABSTRACT

Chronic long-standing type 2 diabetes and subsequent complications (comorbidities) represent a major clinical and public health challenge for elderly men from a prevention and management viewpoint. In the developed western countries, evidence suggests that 80% of premature deaths and disability due to diabetes and heart disease can be prevented. Diabetes care in the elderly include further challenges in management of comorbidities such as hypertension, the metabolic syndrome (MetS), kidney problems including nephropathy and chronic renal failure, vision abnormalities such as cataract and retinopathy. The comorbidities are subsequent to complex mechanistic processes incurred by the hyperglycemia and reduced insulin sensitivity in diabetes. Management of diabetic elderly patients with type 2 diabetes is further challenged by lack of specific clinical guidelines tailored to this population. Existing clinical guidelines are based on evidence from clinical trials conducted in younger (< 65 years of age) patients. There is a need for designing improved models of health care delivery, assessment of comorbidities and polypharmacy in elderly men, including mental health issues such as depression and dementia that may persist with diabetes. An integrated, comprehensive, and patient-oriented management care plan seems the best practice clinical approach to ensure that the risk of hypoglycemia does not increase while treating elderly diabetic men with existent multimorbidity.

Keywords: *Men's health, elderly; type 2 diabetes; patient-oriented care; health services; hypoglycemia; polypharmacy.*

BACKGROUND

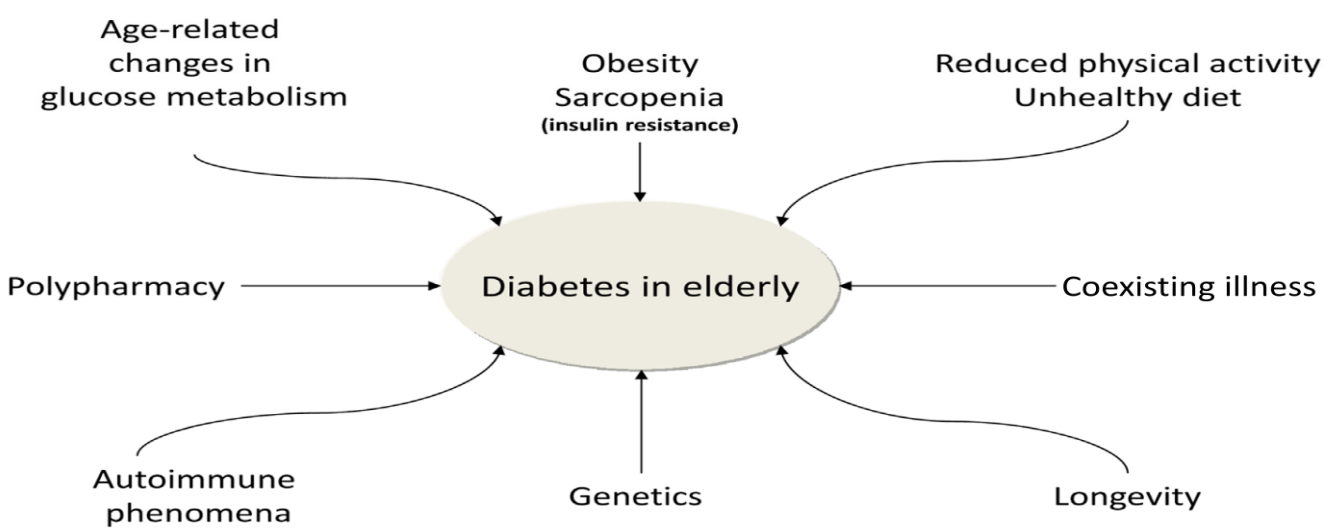
Long-standing type 2 diabetes (T2D) is a chronic and disabling metabolic disorder associated with a number of comorbid complications, including loss of vision (retinopathy), end-stage kidney disease (nephropathy), cardiovascular disease (CVD), and peripheral

angiopathy leading to diabetic foot, gangrene, and lower extremity amputations. The natural history of T2D is such that the prevalence increases with more advanced age. With increasing life expectancy among older adults, particularly among those 65 years and older, there is a tendency to live longer with diabetes and its sequelae/comorbid complications.[1]

The mechanisms by which age influences an increasing drive in incidence of T2D among elderly adults remain poorly understood.[1,2] Previously, it was reported that more advanced age was associated with increased body mass index and higher risk of the Metabolic Syndrome (MetS) in adult men living in Northern British Columbia.[3] Several factors contribute to the high incidence of T2D and the MetS in the older adults. The exact mechanisms and pathogenesis by which long-standing diabetes leads to functional limitation, cognitive decline (and subsequent dementia), depression, and hypoglycemia subsequent to insulin resistance and the development of the MetS have not been completely elucidated. The pathogenesis process is complex and involves various interactive mechanistic pathways. Cognitive decline is evident as it is likely to be initiated early in the natural progression of diabetes, and correlates with overall glycemic control.[4] Figure 1 identifies the main contributing factors leading to high prevalence of diabetes in the elderly population.

The global alarming epidemic of T2D is a consequence of urbanization and lifestyle changes, which include increasing dependency on automobile cars and internet technologies. These changes encourage a sedentary lifestyle and decreased physical activity. Although elderly diabetic individuals are widely represented in clinical practice, focus on diabetes care in this population group, and in particular men, is still relatively scarce.[4] One of the main challenges in managing diabetes and its complications is lack of evidence from randomized clinical trials (RCTs) which incorporate older diabetic men as study subjects to investigate treatment effects (or interventions) for T2D, and other chronic conditions, such as cancer or CVD. A major limiting issue has been the lack of specific current up-to-date clinical guidelines as to treatment and management of T2D in older men. Clinicians and health care professionals have been relying on extrapolated evidence from RCTs conducted amongst younger adults.[4,5] The paucity of evidence from RCTs in the elderly relates, at least in part, to the multiple health issues and underlying conditions experienced by this population. Elderly diabetic patients, particularly men, do experience frequent cognitive decline,

FIG. 1 Determinants of type 2 diabetes in the elderly population (adapted in part from Dardano et al.[4]).



as well as dementia, depression, and undernutrition. The patients can experience physical disabilities, such as increased rates of osteoporosis, bone fracture, and skeletal muscle loss, which are more marked with the presence of diabetes. The elderly patients may even experience issues related to "polypharmacy," which is the multiple use of medications for diabetes and other underlying or comorbid health conditions. For example, these issues can include, fluctuating bouts or episodes of hypoglycemia caused by the polypharmacy of anti-diabetic medications, such as oral hypoglycemic agents[4,6] and other drugs, especially angiotensin-converting enzyme inhibitors used to control high blood pressure (BP) in elderly patients. In a British study known as the *United Kingdom Prospective Diabetes Study*, Hornick and Aron reported that patients who had good control of blood pressure (mean treated BP 144/82 mmHg) had fewer diabetes-related complications, 32% fewer diabetes-related deaths, 34% reduced risk of significant retinopathy and 47% reduced risk of visual deterioration, and 48% reduced risk of stroke than patients who had "usual control" (mean treated BP 157/87 mmHg).[7] The study findings are noteworthy since they provide compelling evidence regarding the benefit of treating hypertension as superior to the benefits of tight glycemic control.[7]

MATERIALS AND METHODS

Ageing Society Phenomenon

The phenomenon of an ageing society has been frequently raised in scientific, public, and political discussions in the developed western world; in particular Europe, Canada, and the United States (USA). This phenomenon has stirred discussions as to the current and future requirements for health and social care for the elderly (senior) population given the epidemiologic transition and demographic shift influenced by societal and economic developments and changes.[8] As to *demographic shift (development)* data, in Europe it is predicted that an increase will occur in the proportion of people aged 65 years or older from 17.1% in 2008 to 34% by 2030.[6] The number of "octogenarian" people (aged ≥ 80 years) is projected to triple from 21.8 in 2008 to 61.4 million in 2060.[8,9] This reality puts a burden on the health care system in Europe as well as other western countries such as Canada, USA, and Australia – as the projected life expectancy and the ageing phenomenon is similar. It should be noted that some aspects of population aging are an inevitable consequence of the demographic transition noted across the world in various countries, particularly the affluent western societies like Germany.[10]

Economic Development

Concerning *economic development*, higher standards of living and subsequent increase in life expectancy will lead to greater expectations and demands for enhanced quality of health care service delivery systems, and shortage of skilled health care professionals.[8] There are social, economic, and environmental consequences as we continue to face an "oldest-old" population (aged ≥ 80 years). The increasing longevity and life expectancy projected by 2060 for seniors 65 years of age and older, as in the case of Germany's population pyramid,[10] has important implications for economic costs, as well as health care utilization, health promotion program planning, and design of social support programs for an ever-ageing population.

Societal Development

Social systems and fabric/structure influence the future needs of health, wellbeing and social care for individuals in a society. According to Koch,[8] the challenge facing all western societies is twofold: *First*, ensuring that present and future older people continue to enjoy a quality of life (QoL) and independent living to the best of their maximal physical, psychosocial, emotional, and mental health functioning, given the escalating rate and complexities of the multimorbid-ity of the metabolic and physiological abnormalities associated with T2D in the elderly. *Second*, that the society's perception of the older people/elderly as a 'burden' of care needs to change, and that effective enhancement of health care delivery will be more reliant on different technological innovations such as e-Health, telehealth, and mobile health (m-Health). Such innovations and advancements in utility and integration into health care systems should be based on an overarching goal of ensuring "Ambient Assisted

Living" as noted by Koch,[8] where older people, living with comorbid conditions/complications of T2D, are "enabled" to live in their preferred environments (homes) by increasing their self-confidence, autonomy, and independent mobility to carryout "activities of daily living". Furthermore, social and health systems should find ways to provide necessary support to caregivers, families, and community care organizations to increase their productivity and efficiency in using and delivering resources and health services needed by the elderly in their communities.

RESULTS

Men's Health in Older Adults/Elderly

The disability-free life expectancy of men in general is shorter than women across both developed and developing countries by an average of 4–5 years, according to a recent report by the World Health Organization.[11] A number of biological, socioeconomic, and environmental factors contribute to the gap in average life expectancy between the sexes, and there are several peculiar causes of premature death (early life loss). The 2014 WHO report indicates that while the life expectancy among men has increased to 80 years or more in 10 countries, with the highest being in Australia, Iceland, and Switzerland, there still remain chronic conditions that are a major cause of disability and death in men. Ischemic heart disease, stroke, and lower respiratory tract infections are the top three culprits for "years of life lost" in men globally over the period 2010-2013.[11] Women, on the other hand, have also experienced an increase in life expectancy. In the top 10 countries, the life expectancy for women has been 84 years or longer, with the highest life expectancy in the world at 87.0 years among Japanese women, followed by Spain, Switzerland and Singapore.[11] In Canada, the leading causes of death among both sexes is cancer (all types), followed by CVD, and stroke (Statistics Canada-I).[12] Among Canadian men, malignant neoplasms (cancers), CVD, and unintentional/intentional injuries which include road traffic accidents, violence, suicide, and diabetes were the top leading mortality causes.[13] By comparison, the top leading causes of death among Canadian women were cancers, CVD, stroke, chronic lower respiratory diseases, and unintentional injuries caused by accidents.[14]

Over the past three years, men's health research has gained considerable interest in many countries, including, for example, Canada, USA, Australia, and New Zealand. The notion of "men's health" has been commonly associated with male-specific conditions, such as urinary system abnormalities or sexual health-related issues. For the purposes of this critical synthesis paper however this notion applies to specific prevention and management approaches for diabetic elderly men (65 years of age and over). In Canada, Goldenberg notes that Canadian men spend their later years in poorer health status compared with their female counterparts.[13] The variability in this gender gap is still debatable as to whether this applies to other countries, and whether this gender gap reflects issues of inequity in access to health services, biological factors, or masculinity topographies. Furthermore, what compounds the fact that men die earlier than women in Canada, and that men live fewer healthy years may be their reluctance to use health care services, especially when such services are readily available. Part of the issue may be that in the western culture, and certainly in Canada, men are not "programmed" to see their health as a priority, and that there are prevailing societal/cultural expectations of masculine, risk-taking, and invincible "strong silent" personalities and behaviours.[13] Previ-ous research studies conducted between 1998 and 2002 revealed that men were thought to be reluctant to visit health care service providers unless necessary. Men were noted to uphold a masculine image by being stoic, strong, and able to take care of their own health and becoming the "serious user of health service." This male oriented behaviour has been regarded as unhealthy and unhelpful in advancing the provision of health services, and it was thought that such behaviours are influenced by complex societal and social contexts which change dynamically over the life course of a man.[14]

Healthcare in Elderly Men

One of the key objectives of health services, including primary care research, is analyses of the demand for health services to determine the best possible action for case management. This includes analyses

of indicators and outcomes of service performance, utilization, effectiveness, and resource management to improve QoL in the elderly.

According to Tong et al.,[14] the literature on primary care doctors' views on men's health in general, and elderly men in particular, has been scarce. Some recent advances and attempts at understanding men's health globally, such as in the United Kingdom, Spain, Australia, and New Zealand have started. Historically, according to the literature included in this review, there were gender-sensitive approaches to men's health service delivery that seemed logical because the help-seeking behaviour of men were very different from those of women. Health care professionals, such as doctors and nurses who adopted the views of a universal approach to service delivery for both sexes might not recognize that such needs warrant a distinct approach when dealing with men's chronic conditions, such as T2D. In some Asian countries, such as Malaysia, China, and South Korea primary care doctors are still puzzled as to the best approach in caring for their elderly male patients who suffer from diabetes and its complications.[14,15]

In regards to elderly men's T2D prevention and management, there is little or no evidence-based practice guidelines tailored to an ever-aging population in the developed or developing countries. The prevalence of abnormal hyperglycemia among older adults/elderly is high, which subsequently leads to detrimental effects of geriatric dementia, falls, depression, and incontinence – all secondary to the effect of diabetes on functional status. A high proportion (30–40%) of the elderly population has diabetes and three quarters (75%) has pre-diabetes or clinically diagnosed diabetic states.[16]

DISCUSSION AND CONCLUSIONS

Chronic diseases such as T2D, CVD, and cancer represent a major clinical and public health challenge for the elderly population. In developed countries, evidence suggests that 80% of premature deaths and disability due to heart disease and diabetes can be prevented.[17]

The elderly are a heterogeneous population with widely varied metabolic and physiologic profiles, functional capacities, and life expectancy. Despite being sometimes classified as "young-old" (age 65-80 years) and "oldest-old" (≥ 80 years of age), this distinction in the elderly population is simplistic for clinical decision making with regard to treatment and management of chronic conditions, particularly T2D. Considered a heterogeneous condition, T2D is distinguished according to whether it developed in the "young-old" or "oldest-old" cohort. Ageing is associated with significant decline in beta-cell function and lower blood insulin levels independent from insulin resistance.[7] The ageing process is characterized by natural reduction in cognitive functions, independent of any diabetic state or hypoglycemia status. This can reduce a patient's ability to carry out treatment consistently with oral hypoglycemic or other diabetes medications. Furthermore, there are age-related changes in metabolism and degradation (i.e., pharmacokinetics) of the various medications used by elderly individuals. This "polypharmacy" coupled with multimorbidity increase the risk of drug interactions and side effects, particularly drug-induced hypoglycemia which in severe cases can lead to hypoglycemic coma and death.

Further challenges in diabetes care for the elderly include comorbidities or underlying health conditions co-existent with the diabetic status, such as hypertension, vision abnormalities including cataract and retinopathy, and renal insufficiency/nephropathy. These comorbid conditions make doctors likely to undertake a vigorous approach to hyperglycemia treatment, fearing that the loss of partial function of an organ, such as eye or a kidney, may lead to total impairment and failure of the organ. Examples of this include, loss of vision and blindness due to long-standing retinopathy, as well as kidney failure requiring dialysis subsequent to secondary, diabetes-induced nephropathy.

Since 2005, and as a method for early detection the *American Diabetes Association* (ADA) recommends screening of fasting plasma glucose level every 3 years starting at age 45 years.[18] It has been argued that this method may not be sufficient for the elderly. Some suggested that screening should be done more often in those considered "high-risk" for diabetes. Such elderly individuals would have obesity, inactivity, dyslipidemia, and hypertension. It may be that targeted screening among patients with hypertension would be the most cost-effective strategy.[7]

Management of T2D in the elderly represents a complex and multi-faceted challenge. In designing improved models of health care delivery, assessment of an elderly patient's unique constellation of polypharmacy and multimorbidity, including cognitive state and mental health issues, such as depression and/or dementia, should be considered. Once cognitive loss has occurred there is a reduced ability for a person to self-manage both hyper- and hypoglycemia. Hence, elderly diabetic patients require a coordinated, integrated, and comprehensive care strategy to ensure that the risk of hypoglycemia does not increase while treating all existent multimorbidity.

Existing guidelines are based on evidence from clinical trials that have been conducted in patients with a single condition, and in relatively homogenous and younger (less than 65 years of age) segments of the population with diabetes. Elderly people have historically been systematically excluded from clinical trials because of the fear of extent of multimorbidity and polypharmacy involved. This fact further narrowed the population studied in clinical trials of T2D. Overall, 81% of RCTs published in high-impact journals excluded patients with medical comorbidities.[21]

This paper recommends a patient-oriented approach to engagement of elderly patients in their own clinical assessment and care, as partners. A multidisciplinary approach of clinical and patient-oriented decision making in the management of chronic type 2 diabetes (T2D) and associated comorbidities such as the MetS, and other complications such as hypertension, diabetic nephropathy, and diabetic retinopathy is warranted. It is important to adopt individualized patient-oriented diabetes care and treatment recommendations for elderly patients. While there has been some published guidelines for the care of the older adults with diabetes,[22] these guidelines were not intended to serve as "one-size fits-all approach" in lieu of sound individualized clinical judgement and decision making on the part of diabetologists, primary care physicians and other healthcare providers.

This paper is a critical synthesis presenting knowledge gaps and issues related to diabetes. The paper has a limitation in that it is not considered a scoping review. Rather, the paper represents a Commentary by the current authors as to how best to tailor diabetes care to elderly individuals suffering from comorbidities associated with chronic long-standing diabetes particularly, for elderly men residing in rural and northern Canadian regions such as Northern British Columbia where access to health care services and primary care for diabetes management represent significant challenges for rural elderly men and their families.

IMPLICATIONS FOR DIABETES MANAGEMENT IN ELDERLY MEN

Future research studies should focus on an evidence-based approach based on sound individualized clinical decision making using a multidisciplinary approach in diabetes care for elderly men. There is an urgent need to conduct randomized controlled trials (RCTs) that would include comparative effectiveness evidence for elderly diabetic men in rural and northern areas in Canada and the United States (USA). Such clinical evidence is currently lacking and warrants further investigation based on individualized best practice treatment approaches for type 2 diabetes (T2D) in elderly men.

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