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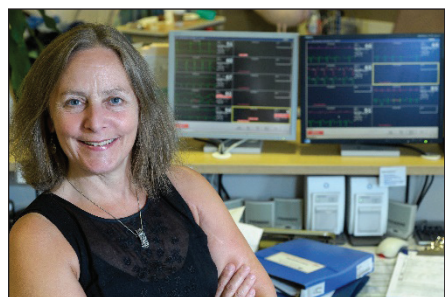
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Oral Abstracts of the 2016 Canadian Council of Cardiovascular Nurses Spring Conference

Clarity, Intrigue and Innovation: Tips for a Successful CCCN Grant Application

S. O'Keefe-McCarthy, Brock University, St. Catharine's, ON, L. Keeping-Burke, University of New Brunswick, Saint John, NB

Advanced nursing practice requires competency in the area of conducting cardiovascular research. Knowledge, skills and abilities are not typically offered to nurses working on the front lines with actual cardiac patients. Writing and submitting an innovative and fundable research proposal requires that: the idea is important, you have the requisite knowledge and skills to conduct the project and the research idea will have far-reaching clinical impact. The objectives of this interactive workshop are to:

1. Describe successful aspects to consider to create a great research or clinical project idea.
2. Discuss strategies to choose the best fit for funding.
3. Demonstrate with examples how to write a strong proposal that includes conceptual innovation and methodological rigor and is rich in substantive content.

Requirement: Participants attending are to bring their research idea to the workshop where they will begin to formulate the question and idea and develop concrete strategies to move the writing of their chosen project forward.

Acute and Neuropathic Pain Characteristics Observed in Men and Women with Acute Coronary Syndromes

S. O'Keefe-McCarthy, Brock University, St. Catharine's, ON, M. McGillion, McMaster University, Hamilton, ON, S. Clarke, Boston College, Chestnut Hill, MA, J.C. Victor, University of Toronto, Toronto, ON, S. Rizza, Trillium Health Partners-Credit Valley Site, Mississauga, ON, J. McFetridge-Durdle, Florida State University, Tallahassee, FL

Background: Cardiac pain arising from an acute coronary syndrome (ACS) has been described as a complex phenomenon. Lacking are cardiac pain assessments that describe acute ACS pain using a multi-factoral pain assessment tool during the first eight hours of an emergent ACS-related pain episode.

Aim: To examine the sensory-discriminative, motivational-affective and cognitive-evaluative dimensions of an emergent ACS-related pain episode.

Methods: A descriptive, correlational, cross-sectional design was used to collect data on cardiac pain intensity scores (numeric rating scale-NRS; McGill Pain Questionnaire MPQ-SF) and state anxiety (Speilberger State-Anxiety Inventory-SAI) on 121 ACS patients.

Results: The mean age was 67.6 ± 13, 50% were female, 40% had Non-ST-Elevation myocardial infarction and 60% had unstable angina. Patients' cardiac pain intensity scores (NRS) remained in the mild range from 1.1 ± 2.2 to 2.4 ±2.7. MPQ-66% of the sample described their global pain as distressing (moderate pain), and 26% reported ACS pain as excruciating (severe pain). ACS pain was described as a mixture of acute injury (nociceptive) and nerve damage (neuropathic) pain. State anxiety was persistent at a high level and ranged from 44.0 ± 7.2 to 46.2 ± 6.6.

Conclusions: ACS patients reported both nociceptive and neuropathic types of cardiac pain. It is unclear if individual pain perceptions are due to: i) the pathophysiology of clot formation, ii) co-morbidities, iii) occurrence of a first or repeat ACS episode, or iv) the equivocal relationship of angina pain and myocardial ischemia.

Significance: Management of ACS-related pain requires an understanding of the interplay of ischemic, metabolic and neuropathophysiological mechanisms that contribute to individuals' cardiac pain experiences. Use of a multi-dimensional pain assessment tool is necessary to screen those at risk for development of persistent cardiac pain.

Infective Endocarditis—A Clinical Complication After a New Year's Resolution

N. Clark, Alberta Health Services/Rockyview General Hospital, Calgary, AB

Although infective endocarditis is not as prevalent as acute coronary syndrome within the North American population, the potential for major adverse complications from this disease process remains very high. Infective endocarditis is often considered a preventable disease. The purpose of this presentation is to review and highlight risk factors that could predispose an individual to infective endocarditis, as well as the medical and surgical management of this patient population. This presentation will be centred on a case study of a patient who made a New Year's resolution to improve his adherence to daily dental and mouth care after many months of neglect. Following this patient's journey with a potentially life-threatening disease process highlighted the opportunity for nurses to engage in health education as a primary prevention for some cardiac disease processes. Health education can be presented to patients and their families with any introduction to health care. Actively participating in assessing health behaviour risk by respectfully identifying potential deficits in a patient's self-care and acknowledging resources for assistance could be one step towards promoting a healthier society. This presentation will conclude with a review of the Canadian cardiovascular guidelines for the management of infective endocarditis and the nursing implications for patient education.

Standardizing the Practice for Temporary Epicardial Wire Removal

J. Frew, QEII Health Sciences Centre, Halifax, NS

Temporary epicardial pacing wires (EPWs) are placed on the epicardium at the end of open heart surgery and are externalized through the skin to permit emergency and therapeutic pacing during the early hospitalized period of recovery. Clinical situations provided the opportunity to examine the practice of temporary epicardial pacing wire removal. A Canada-wide survey of cardiac centres identified inconsistencies in removal criteria and post-removal monitoring practices. As a result, the Central Zone of the Nova Scotia Health Authority developed a policy on removal of EPWs to help reduce the risk of infection and to minimize risk of potentially serious complications following removal. This presentation will highlight the development and implementation of the policy, focusing on the key aspects of pre-removal criteria, removal technique and post-removal monitoring. Incidence and interventions with cardiac tamponade, a life-threatening potential complication post EPW removal, will also be discussed. Developed in 2012, the EPW removal policy has increased health care team awareness around the importance of monitoring patients post EPW removal. In turn, this has led to a rapid response to adverse events following EPW removal.

The Implementation of a Unit Resource Nurse in the Cardiovascular Surgery Setting

P. Rizzotti, QEII Health Sciences Centre, Halifax, NS, J. Frew, QEII Health Sciences Centre, Halifax, NS

In recent years there has been an increase in the number of new graduate nurses hired on the cardiovascular surgery unit at the Halifax Infirmary. This increase has led to limited available support, decline in morale, and a high percentage of inexperienced nurses in the overall staff mix. To assist in the transition to working independently and helping maintain a high standard of care on the unit, the role of unit resource nurse (URN) was implemented. The URN was selected through a request of expression of interest from current registered nurses employed on the unit. Expectations of the role were developed through consultation with a nurse manager, clinical nurse educator (CNE), and the URN. The URN role was customized to the needs of the unit and scheduling was based on the schedules of the new staff members. Responsibilities of the URN include, but are not limited to: arranging for preceptors, mentoring new and IMCU staff, exposing new staff to clinical skills, auditing documentation, enforcing best practice and developing tools to aid in daily practice on the unit. While the evaluation of the role is currently ongoing, feedback has been mostly positive with reports of high levels of support. The role has also supported the CNE by providing feedback on individual nursing needs and educational needs of the unit,

with a resultant decrease in the demand for the presence of the CNE on the unit. As the demand for new nurses continues to grow, the URN provides the much-needed support for all nurses in the health care team during this ongoing phase of transition.

Critical Care Transition Program for Newly Graduated Nurses

L. Pottinger, NSHA/Halifax Infirmary, Halifax, NS

The recruitment of nurses to critical care has been a particularly difficult struggle in recent years. Retirements and movement within the nursing profession paired with required specialty training have compounded this reality. There is no cave of nurses fully trained to step into the vacancies in this specialty area. In the Spring of 2014, a decision was made to recruit newly graduated registered nurses as novice critical care nurses in a tertiary care facility. A pilot Critical Care Transition Program (CCTP) was designed with stakeholders from all levels, including directors, health services managers, clinical nurse educators, preceptors and staff nurses. A year-long internship using didactic learning and preceptored clinical shifts blended with a formal critical care nursing program was developed. By using clear expectations and regular evaluations we were able to build theoretical knowledge, and support time management and organization, as well as help develop critical thinking skills for novice nurses. During this presentation, the development and revision of the CCTP, expectations and evaluation tools of the program will be shared. As well, how stakeholder engagement helped build a successful internship program to support novice nurses socially and clinically in a specialty area will be discussed. The presentation will conclude with the 2014 CCTP program evaluation results and highlights from the recruitment and retention data.

Quality of Life after TAVR: Now I Need a New Hip!

T.L. Cosman, Hamilton Health Sciences, Hamilton, ON, A. Smith, Hamilton Health Sciences, Hamilton, ON

Transcatheter aortic valve replacement (TAVR) was introduced in 2002, as a treatment option for patients with significant aortic stenosis who were non-surgical candidates for valve replacement. Since that time, TAVR has become increasingly common with an estimated 9,000 new TAVR candidates yearly in North America. Patients undergoing TAVR are often elderly with numerous non-cardiac health issues that may significantly impact quality of life. This presentation will describe the trajectory of two patients with significant osteoarthritis who presented for elective orthopaedic surgery following TAVR. Issues addressed prior to surgery and potential postoperative complications related to TAVR will be presented. The case studies will describe clinical issues that arose with these patients postoperatively

and how they were managed. Lessons learned, including how to prepare the nursing staff and improve collaboration with the TAVR Nurse Practitioner will be presented. The growing number of patients undergoing TAVR will result in an increasing number of these patients presenting for non-cardiac surgery. As these patients re-enter the health care system, it is important that all health care professionals have an understanding of TAVR and its impact on clinical care. The significance of TAVR for orthopaedic surgery and the need for education for all staff caring for these patients was noted following these cases. The importance of building collaboration between nursing specialties is important in this patient population to ensure seamless quality patient care.

Cardiomyopathy: A Rare Cause of an Old Foe

C. McIntyre, Alberta Health Services/Rocyview General Hospital, Calgary, AB, N. Clark, Alberta Health Services, Calgary, AB

Cardiomyopathies are conditions that lead to impairment of the heart muscle. The etiologies of cardiomyopathies are varied, with ischemic heart disease being the primary cause. The purpose of this presentation is to review a case study of a middle-aged female who presented to hospital with worsening shortness of breath; initially being treated as a newly diagnosed cardiomyopathy. Preliminary laboratory findings were in keeping with an undiagnosed hyperthyroidism, Graves' Disease. In a hyperthyroid state, TSH levels will be low and free T3 or T4 will be high. Patients usually present with a multitude of symptoms that may include: palpitations, hair loss, heat intolerance and muscle aches/weakness. If left untreated, the body may become thyroid toxic. Although hyperthyroidism is a relatively common endocrine dysfunction, this patient's clinical scenario manifested into significant cardiac complications. The nursing implications of caring for a patient with hyperthyroid-induced cardiomyopathy are significant, as this type of cardiomyopathy is rare and, yet, can result in a major adverse event. Thyroid hormones have a profound effect on cardiovascular hemodynamics. Therefore, a better understanding of the implications of abnormalities of hormone levels will contribute to improved clinical practice.

Incidence of Vascular Complications Among Patients Undergoing Cardiac Catheterization Procedure

N. Khalil, Cairo University , Giza, Egypt

Although cardiac catheterization has reduced morbidity and mortality from cardiovascular disease, this invasive procedure is not without complications. The purpose of this study was to identify the incidence and potential factors that place patients at greater risk of developing vascular complications when undergoing cardiac catheterization. A convenience sample of 100 patients who underwent cardiac catheterization via femoral artery access were recruited from one critical care department affiliated with Cairo University Hospitals. A descriptive cross-sectional design was employed and utilized three data collection tools: demographic data, medical history and a vascular complication observational checklist. The incidence of minor vascular complications revealed that 10% of subjects had femoral oozing before sheath removal, and another 20% developed femoral oozing, and 12% femoral ecchymosis after sheath removal. With respect to the incidence of major vascular complications, 22%of subjects developed a femoral hematoma after sheath removal. The factors identified that place patients at greater risk of developing vascular complications related to older age, female gender, being underweight, illiteracy, and non-ST elevation myocardial infarction. It was concluded that most common peri-cardiac catheterization vascular complications include hematoma, oozing, and ecchymosis. The nurse should be aware of these vascular complications and try to avoid them to improve patient outcomes. Moreover, it is recommended that education is provided to patients undergoing cardiac catheterization to raise awareness about vascular complications induced by the procedure.

Cardiopulmonary Resuscitation Related Musculoskeletal Pain Management in Ventilated Patients

L. Runcie, Saint John Regional Hospital, Saint John, NB, V. MacDonald, Saint John Regional Hospital, Saint John, NB

Post-cardiac arrest patients who receive cardiopulmonary resuscitation (CPR) and remain mechanically ventilated after the return of spontaneous circulation (ROSC), who may or may not be treated with therapeutic hypothermia, experience musculoskeletal chest pain related to resuscitation. Pain management is currently provided on an as needed basis according to physical assessment findings, tradition, nursing experience and professional judgment within the boundaries of a standing order. Pain management becomes very difficult when patients are not able to communicate verbally and/or may be sedated and chemically paralyzed. Currently, the New Brunswick Heart Centre (NBHC) does not have a pain management protocol for this patient population. In this presentation, we will explore the current literature to understand the importance of effective pain management in decreasing length of stay and improving quality of life for this patient population. We will also outline a pain management protocol that is reflective of current best research for analgesic and scheduling according to patient-specific needs such as vital signs, concurrent therapies and nonverbal indicators of pain. We will conclude with a draft protocol for pain management in post-CPR ventilated patients for use at the NBHC.

Poster Abstracts of the 2016 Canadian Council of Cardiovascular Nurses Spring Conference

Code Status: Implications for Patient Care

R. Jill Greeley, Eastern Health, St. John's NL

The purpose of this poster presentation is to provide nurses with the important terms they will encounter when dealing with code status, and to provide information on the ethical and legal implications of code status. By providing this information in poster form, nurses' knowledge regarding code status can be refreshed, while expanding the knowledge base for some nurses. This can lead to nurses being able to better educate and support clients in making the appropriate decision for them. Nursing care is entering a new era. Patients are more informed about their health than ever before. As patients are empowered to make informed health decisions, they are often opting for limited code status. This makes navigating code status more complicated. Nurses play an important role in educating their patients about code status and the associated issues. Often, nurses find themselves having trouble with understanding all of the ethical and legal implications of a patient's code status. This makes it extremely difficult to educate patients when they do not have a good understanding themselves. Most nursing schools include core curriculum on death and dying, but information is often limited; 62% of nurses report that content on end-of-life care in their basic nursing education was inadequate (Hebert, Moore & Rooney, 2011). Nurses deserve to be properly educated about code status. This presentation is one way for increasing nurses' knowledge in this area.

REFERENCE

Hebert, K., Moore, H., & Rooney, J. (2011). The nurse advocate in end-of-life care. *The Ochsner Journal, 11*, 325–329.

Demographic Predictors of Attendance to Cardiac Rehabilitation in the Heart Failure Population

K. Cunningham, University Health Network, Toronto ON

Heart failure (HF) has been classified as the leading cause of hospitalization, with the highest 30-day readmission rates for patients over the age of 65 compared to other medical conditions in Canada. Cardiac rehabilitation (CR) provides an ideal setting for outpatient management of HF and has been effective in improving functional capacity and quality of life while significantly reducing readmission rates. However, only 30% of eligible patients attend CR and there remain long wait periods between referral and intake into CR. A non-experimental, comparative descriptive pilot study will be used to explore different characteristics and the number and type of complications reported in patients with HF who attend CR compared to those who do not attend. The study will be conducted on an inpatient, cardiology unit at an urban teaching hospital with a projected sample size of 30 patients. Data will be collected using a demographic survey with telephone follow-up post discharge. Data analysis will include descriptive statistics, two-way Chi-square and Mann Whitney U tests. Results may have implications for health care providers to tailor referral processes and for CR programs to further explore the needs of patients who choose not to attend. Complications experienced during the wait time for intake into CR can be identified and the information used to improve the coordination and timely access to outpatient CR in an effort to reduce readmission rates.

Outpatient Congestive Heart Failure Surveillance Program

J. Sieben, Peter Lougheed Hospital, Calgary, AB, L. Reed, Peter Lougheed Hospital, Calgary, AB

The Calgary Peter Lougheed Cardiac Function Clinic is a nurse clinician-led outpatient service for patients with congestive heart failure. We see upwards of 175 patients and have implemented a report card surveillance program. This is used in our clinic for both quality of care improvement and to reinforce patient-led symptom management. The report card is an easy-to-read 17-part questionnaire assessing heart failure symptoms. We send this questionnaire to patients via mail every three to four months and use it to streamline clinic visits by having them complete it before seeing the nurse or doctor. The questionnaire indicates by colour the status of symptoms; red (meaning has new or worsening symptoms), yellow (unchanged from patient norms), and green (better or no symptoms). We would like to highlight how this report card surveillance program helps the patient easily identify those symptoms that require more immediate attention and also helps in the long-term management of heart failure. Our goal is to link the program with a decreased exacerbation of this difficult-to-manage patient population. In essence, the heart failure report card program works to streamline patient services and is used as a powerful patient teaching tool. In the future, we would like to develop this program online, or as a smart phone app. Our team will showcase how the implementation of a surveillance program in the outpatient population will increase patient accountability and, ultimately, increase primary disease prevention. ♥

Mind the Gap: Women and Acute Myocardial Infarctions—An Integrated Review of Literature

Clare Koning, RN, PhD(c), Lynne Young, RN, PhD, Anne Bruce, RN, PhD

Abstract

Mortality rates of women suffering from an acute myocardial infarction (AMI) are high, and in young women are on the rise. The goal of this review is to investigate what is known about women's experience of AMI symptoms. By exploring the complexity and intersections evident in the literature though an integrative literature review process, it becomes apparent that the problem involves deeper contextual influences arising from women's situation in society. Key findings in this review suggest that not recognizing the risk or symptoms of an AMI can lead to delayed health care seeking behaviours, and warrants the need for further education. Awareness of these findings has implications for women's health outcomes and mortality rates. This review adds value to clinical practice by reifying the potential gaps in knowledge currently available to women and health care providers, and suggests filling these gaps with new more inclusive ways of knowing surrounding this phenomenon.

Key words: women, acute myocardial infarction, symptoms

Highlights
- Current knowledge does not adequately address the health concerns relating to women and acute myocardial infarctions.
- Women do not recognize their risk for or symptoms of an acute myocardial infarctions, resulting in a delay in health care-seeking behaviour, and could be a result of a lack of education.
- How a woman experiences an acute myocardial infarction is dependent on complex intersecting contextual influences.

Introduction

"When it comes to heart disease, women are not just small men." – Dr Nieca Goldberg

Cardiovascular disease is a well-known topic that has been widely discussed. Causes, risk factors, and treatment modalities are broadcast over the television, the internet, and in health care settings. Yet, even with the public awareness, the epidemiological tracking, and the interventional treatments, cardiac events are still occurring and massive death rates from cardiovascular disease persist. To date, the majority of research has focused on risk factors and treatment initiatives, targeting predominantly male participants and those who present with cardiac issues later in life (Rubin & Borden, 2012). Women, especially young women, have historically been largely under-represented and unexplored in comparison (Health Canada, 1999; Miller & Kollauf, 2002). We are at a moment in time where there is a need to shift the emphasis away from treatment and rather focus on how the cardiac events are experienced, what factors contribute to the incident, and what questions arise during the process—uncovering new ways to understand the phenomenon, as a whole. There is as much value in exploring what is not known about a topic as there is discovering what is known about a phenomenon. How much do we actually know about women who have experienced a critical cardiac event? What can we learn from their stories? This paper aims to find out. The purpose is to examine and synthesize the best available evidence on this topic and raise questions regarding the experience, the current practice, and the available knowledge. The goal is to gain a clearer understanding of the context that surrounds a critical cardiac event, the intersections where women find themselves, and the gaps in knowledge that exist.

Every year thousands of people die of heart disease. In 2011 alone, a Canadian died of heart disease every 11 minutes—totalling more than 47,000 deaths (Statistics Canada, 2011). The World Health Organization (WHO) classifies ischaemic heart disease as the leading cause of death globally (WHO, 2014), and the second most common cause of death among Canadians (Statistics Canada, 2011). We are at a point in history when heart disease can no longer be regarded as a 'male' disease. It is increasingly prevalent in women, causing one in four deaths, and is the leading cause of death for women in the United States (Centers for Disease Control and Prevention, 2015). In Canada, female deaths from cardiovascular disease resulted in 18.7 percent of total Canadian deaths in 2011, only 1.9 percent lower than male's cardiovascular deaths for the same year (Statistics Canada, 2014). While women are dying at almost the same rate as men from heart disease, only half of women recognize that heart disease is their number one killer (Centers for Disease Control

and Prevention, 2015). They do not perceive their risk for heart disease (Litchman et al., 2015) and, as a result, long-term mortality rates have been on the rise (Rubin & Borden, 2012). The female sex has been associated with a higher risk of misinterpretation and misdiagnosis of AMI symptoms (Aufderheide, 2000) and "women under the age 55 were at a higher risk of not being hospitalized" with an AMI (Aufderheide, 2000, p. 1166). The cost of not recognizing an AMI extends beyond the individual, and has global implications. The economic burden of heart disease and stroke amounted to more than $21 billion for Canada in 2000 (Statistics Canada, 2011). This has consequences for health care funding at micro, meso, and macro levels, health care premiums, the allocation of resources, and the overall health of women.

Methodology

The methodological steps involved in this integrative review process include: (1) selecting a review topic and determining the aim of the review; (2) setting inclusion and exclusion criteria; (3) searching and assessing the literature; (4) appraising the quality of the included literature; and (5) analyzing, synthesizing, and disseminating the findings.

Aim

In this review, the current available evidence will be examined and synthesized with the aim of: 1) examining the context surrounding an AMI event experienced by women; 2) accessing what knowledge informs their AMI symptomology; and 3) gaining a deeper understanding of this phenomenon through a review of literature. The first and second author formulated the topic for this review.

Inclusion and Exclusion Criteria

Only studies that exclusively studied women were included and discussed. Other inclusion criteria included that the participants had themselves experienced symptoms of an AMI, the studies were published or retrievable online, and were available in English. No limitation was set on the year of publication. Studies including men were excluded for the reasons that: women have been largely understudied in cardiovascular research (Health Canada, 1999); studies that include both sexes often under-represent women (Health Canada, 1999); results from studies involving both sexes often pool and discuss their results without stratifying sex (Travis, Howerton, & Szymanski, 2012); and the push for personalized health care necessitates the study of women as an entity separate from men (McSweeney & Coon, 2004). The first and second author defined the inclusion/exclusion criteria.

Search

A search of the available evidence shows very little primary literature on this topic, especially relating to young women (mean reported age of 54 years old or younger). The initial intent of this review was to focus on young women. However, the lack of available literature did not allow for this.

The primary author carried out an initial search of CINAHL, JSTOR, PubMed, Medline, Web of Science, Women's Studies International, and JBI EBP databases, as well as a University of Victoria Summon, Google scholar search engines and hand searches on December 8–16, 2014. A total of 552 articles were retrieved from this search using the search terms and criteria: young* women and "acute myocardial infarction symptoms"; peer-reviewed, English, academic journal articles. Due to the lack of information pertaining to young women, a second broader age range search was carried out by a University of Victoria library scientist on May 18, 2015, in CINAHL and Medline databases first searching for the concepts of young/middle aged women and MI and symptoms, and then a second search requesting the young/middle-aged concept to be in title with no key word for symptoms. This search resulted in 700 retrieved articles. The combination of both searches resulted in 151 duplicated articles, and left 1,101 articles for review. Of the 1,101 published articles, only 30 articles discussed women and AMI symptoms. See Prisma diagram (Appendix 1) for a graphic illustration of this search.

Quality Appraisal

Articles were compared, contrasted, and critiqued by the primary author. The Critical Appraisal Skills Program (CASP) (2013) tools were used to evaluate and critically appraise the retrieved articles for quality, rigour, and inclusion. CASP approaches research by asking three questions: is the research valid, what are the results, and are the results useful? Due to the difference in questions needed to appraise different kinds of research, use was made of several checklists that enabled the primary author to appraise quantitative, qualitative, and a combination of these for mixed method studies. The importance of critical appraisal lies in the verification of trustworthiness, validity, value, and relevance of a study to this review (CASP, 2013).

Analysis and Synthesis

Included articles that met the inclusion and critical appraisal criteria were then analyzed and synthesized, with the focus kept on the original purpose and perspective of this literature review. Consistent with integrative review analysis, the focus was on "patterns, regularities, contrasts, paradoxes and irregularities" in and between the retrieved articles (Koning, 2014, p. 25). Through this process, the literature is framed and organized into various categories. The synthesis, review, and revision of these data was conducted collectively by all three authors, contributing valuable expert knowledge to the review process to this piece.

Results

In summary, of the studies included in this review (N=30), the majority were conducted in the United States (17), with Canada following with five, then the U.K. with four, Sweden with three, and Denmark conducted a single study. The years in which the research was published ranged

from 1995 to 2015 with the majority of studies (5) published in 2007. In the 1990s, three studies were published, 19 studies were published between 2000 and 2009, and eight studies between 2010 and May 2015. Of these, 22 were of qualitative nature, six quantitative, and two mixed method studies. Of the 30 included articles, only 21 included or replied to inquiries on the mean age of their participants. The average mean reported age for these 21 articles was 62.21 years; with the highest being 73 and the lowest being 47.9.

In analyzing the literature, three categories were evident: delay in seeking care; symptoms recognition and characteristics; and the need for more education. These categories were shared across different types of literature: quantitative, qualitative, and mixed method and will, thus, be discussed as a collective.

Delay in Seeking Care

One would think that experiencing heart attack symptoms would result in the immediate initiation of emergency services. However, several studies suggest that women delay care-seeking behaviours when experiencing AMI symptoms (Banks & Malone, 2005; DeVon et al. 2011; Dempsey, Dracup, & Moser, 1995; Harralson, 2007; Herning, Hanse, Bygbjerg, & Lindhardt, 2010; Hughes, 1997; Isaksson, 2011; Lichtman et al., 2015; Mohamed, 2007; McSweeney, Cody, & Crane, 2001; Ruston & Clayton, 2007; Turris, 2009). Delays ranged from one hour or more (Harralson, 2007), to an average of 5.4 hours (Dempsey et al., 1995), to a median time-to-treat of three hours (Mohamed, 2007). Davis et al. (2013) states that regardless of the symptoms experienced by the nine women in her grounded theory study, they all delayed seeking care for their AMI. The dissimilar experience to others, the absence of co-morbidities (MacInnes, 2006), and the lack of similarity between the experienced symptoms and those well-publicized symptoms (McSweeney et al., 2001), is suggested to be the reason for delaying health care-seeking behaviour. Herning, Hanse, Bygbjerg, and Lindhardt (2010) suggest an alternative reason, and found that three factors determine the appropriate behaviour in seeking medical attention in women having AMIs: recognizing the cardiac nature of the symptoms, living with or contacting someone, and having an emergency action plan. The evidence suggests that women seem to try to control their situation before seeking help from others. Hughes (1997) and Sjöström-Strand and Fridlund (2008) noted that women sought self-care strategies rather than seeking medical help in an attempt to maintain control over their lives; and hypothesized that the delay in treatment seeking was dependent on an active family member (Hughes, 1997). This means women who are isolated are at greater risk. Some women put social responsibilities above their health needs (Isaksson, 2011), while others used self-medication as a coping strategy when experiencing AMI symptoms (Mohamed, 2007). The time to seek medical attention is thought to be related to a woman's knowledge and experience, according to Ruston and Clayton (2007), who found that women who delayed seeking care for

more than 12 hours had prior knowledge and experience of heart disease and regarded the symptoms as not unusual for their existing state. Similarly, Snyder (2003) found that having previous cardiac symptom experiences influenced a woman's decision to delay seeking help; but also found that those with previous experiences followed a clearer path to seeking attention and diagnosis. This clearer path eludes to the notion that if a woman has a previous history of a cardiac event, the identification and treatment plan is more definite. MacInnes (2006) suggests that the implementation of interventions to modify the illness perception could help to curb the delay in health care-seeking actions. Of interest is that treatment-seeking behaviour has been linked to social processes. That is, women strive to maintain integrity and specific forms of knowledge (Turris, 2009). For example, Turris (2009) suggests that women sought to maintain harmony in their daily lives and did not want to disrupt their social role during a cardiac event, so treatment was delayed due to the symptoms not being ranked as the highest priority. Maintaining integrity: physical, personal, and social, took priority in this case (Turris & Finamore, 2008) in an attempt to secure their sense of self and capacity to be accountable for their role (Turris & Johnson, 2008). With this information in hand, it is not surprising that women are dying from AMIs at similar rates as men, with deaths of young women due to AMIs on the rise. Perhaps recognizing how women perceive themselves in relation to the environment would be of value in curbing delays in care and improving outcomes for this at-risk population.

Symptom Characteristics and Recognition

There is conflicting evidence regarding the symptoms that women experience during an AMI. Some researchers attest that the majority of women experience atypical gender-specific symptoms (Carmin et al., 2008; Graham et al., 2008; Sergie et al., 2013; Shin, Martin, & Suls, 2010), while others report that women's symptoms are typical and no different from men or those set out by the European Society of Cardiology (DeVon, et al., 2014; Gimenez et al., 2013). Due to these polar differences, it has been suggested that identification and management of AMIs should not be based on sex, but rather on clinical presentation (Arora & Bittner, 2015). In support of this, a quantitative study exploring the nature of the presenting myocardial symptoms, Albarran, Clarke, and Crawford (2007) discovered three emerging themes from their interviews with hospitalized women: no chest pain; their reactions to symptoms; and gradual awareness. Similarly, Albarran et al. (2007) and MacInnes (2006) conclude that women do not experience the traditional symptom presentation and that the current understanding of a typical myocardial infarction does not apply to this population. These authors suggest that the unique atypical presentation affects women's insights of their symptoms and influences their health care actions—reflecting back on the delay in treatment seeking. Symptom presentation seemed to vary in onset with women reporting that symptoms could progress to an

AMI within minutes, or could last weeks (McSweeney, 1998). These early prodromal symptoms were often not recognized by women or health care providers. In a phenomenological study conducted by Banks and Malone (2005), the atypical cardiac symptoms of 12 African-American female participants were misrecognized and discounted by health care workers. However, it is not just health care providers that dismiss AMI symptoms; many women themselves discount the severity of their symptoms, staying optimistic and hoping for normality—perhaps as a coping strategy (White, Hunter, & Holttum, 2007). In contrast, Dempsey et al. (1995) interviewed 16 women and found that these women recognized their AMI symptoms as abnormal, but did not acknowledge the severity until they had gained control over their situation. Controlling the situation appears to be critical in recognizing the significance of an AMI event and seeking treatment without delay. Of interest is a quantitative prospective study conducted by Méthot et al. (2004). These researchers compared the clinical symptoms of 73 women. The results suggest that pre-menopausal women are more likely to report chest pain in other locations (besides left chest), pressure rather than pain, and atypical symptoms (Méthot et al., 2004). Another interesting study was started in 2012 by McSweeney et al. (2014). This longitudinal study of 1,097 women extended over two years and culminated with the authors suggesting that women who reported one or more of the following symptoms: jaw/teeth discomfort, uncommon fatigue, shortness of breath, general chest discomfort, and arm discomfort were four times as likely to have a cardiac event than women who did not experience any of these symptoms. Furthermore, McSweeney et al.'s (2010b) retrospective study found that there were racial differences in symptoms of the 1,270 women they studied, and McSweeney et al. (2010a) showed that black younger (<50 years) women were more likely to present with powerful prodromal symptoms. These predictions and associations have value in screening, education, and prevention strategies for women and health care providers. Hughes (1997) found in her phenomenological study that women were reporting symptoms that did not fit the 'classic textbook' picture of chest pain radiating to the left arm. Rather, they reported back pain and/or right arm pain with chest pain reported in only 41.6% of her participants (n=12). Similarly, the case study by DeVon, Saban, and Garrett (2011) reported findings of self-misdiagnosis and lack of recognition of symptoms, as well as prodromal symptoms like loss of appetite and unusual fatigue. Some women were experiencing a sequence of symptoms, starting with intangible sensations moving on to a more persistent and acute chest pain (Isaksson, 2011); while other women reported a combination of vague less urgent and more severe symptoms that required medical attention (Snyder, 2003). Psychologically, women described feelings of denial, fear (Rosenfeld & Gilkeson, 2000), uncertainty, depression, worry, frustration, lack of concern (Snyder, 2003), guilt and shame (Svedlund, Danielson, & Norberg, 2001). Symptoms of AMI in women have been theorized to be linked to

a larger scheme of social and structural factors. Schoenberg, Peters, and Drew (2003) suggest that 'typical' symptoms are a social construction based on male standards that result in misidentification of women's symptoms, the discounting of women's knowledge, conflicting social demands, and structural barriers to women's health care decision-making. In her grounded theory study, Turris's (2009) 10 participants discussed their symptoms in relation to their social situatedness and context. Adding to this, several studies highlight the gendered nature of society and health care; the current system neglects to see women as unique individuals—which negatively affects women's health—specifically those experiencing AMIs (Aufderheide, 2000; Canto, Goldberg, & Sopko, 2012; Chen et al., 2005; McSweeney & Coon, 2004; McSweeney et al., 2003; Miller & Kollauf, 2002; Travis et al., 2012). The density of this topic could explain the difference of opinions between researchers and alludes to the complex intersections present when considering women's AMI symptoms.

Need for Further Education

The findings of the included studies suggest that women experiencing an AMI are lacking the necessary education and knowledge. Gender-specific education for women and health care providers is urged, as a way to improve knowledge regarding women's atypical AMI symptoms and decrease women's anxiety during an AMI (Mohamed, 2007). While this may be seen as the opinion of the researchers conducting the included studies, it is identified as a category, as it pertains directly to the knowledge used by the affected women and influences their decision-making process. While health care workers draw on scientific knowledge, women with AMIs are using personal knowledge when understanding symptoms. Building a greater understanding of how women interpret their cardiac symptoms may help health care workers improve women's outcomes (Turris & Finamore, 2008). Banks and Malone (2005) recommend increased education for both women and health care providers, in addition to future research on this topic that investigates the intersections between social, psychological, and physical factors that contribute to health inequalities. Similarly, DeVon et al. (2011), Harralson (2007), Hughes (1997), Herning et al. (2010), Lichtman et al. (2015), MacInnes (2006), and Sjöström-Strand and Fridlund (2008) suggest there is a need to increase awareness of the risk for, and symptoms of AMIs in women. Dempsey et al. (1995), on the other hand, advocate for increased interventions that focus on control during the symptoms onset; decreasing the feeling of being threatened. In a similar qualitative study of 20 women conducted by Isaksson (2011), women struggled to maintain control over the AMI situation in an attempt to preserve their lives and social accountabilities. This suggests again that women are not prioritizing the AMI, and putting gendered, social, and cultural roles ahead of their physical health needs. Davis et al. (2013) cautions that women need to be educated to not overestimate the time they have to seek health care attention when

experiencing an AMI, in addition to education on symptoms recognition. Furthermore, a plan needs to be in place after the onset of AMI symptoms to avoid delayed treatment (Herning et al., 2010), aid in decision-making (Sjostrom-Strand & Fridlund, 2008), improve preventative health care, promote cardiovascular understanding (Litchman et al., 2015; MacInnes, 2006), and improve interpretation and diagnosis of women's symptoms (McSweeney et al., 2010b; McSweeney, Leftler, & Crowder, 2005). McSweeney, O'Sullivan, Cody, and Crane (2004) suggest using a tool, the McSweeney Acute and Prodromal Myocardial Infarction Symptoms Survey to help with women's AMI identification and diagnosis, and these authors advocate for further research on prodromal and acute symptoms in women (McSweeney et al., 2001; McSweeney, 1998). These tools and interventions should be designed to improve symptoms recognition and assess co-morbidities in women (Ruston & Clayton, 2007).

Discussion

For this review of literature, the aim was to examine and synthesize the available evidence surrounding an AMI event experienced by women, accesses what knowledge informed their AMI symptomology, and gain a deeper understanding of this phenomenon. As a result, various issues have been identified regarding women's AMI symptoms, several strategies to improve health outcomes are mentioned, and many gaps in knowledge are discussed. The presentation of the clinical symptoms are difficult to identify, there is a delay in health care-seeking behaviour, and a definite need for more education on this topic. Almost all of the studies included in this literature review advocate for further research into this phenomenon. In addition, this review highlights a serious need for more research of young women's AMI symptoms. We have come a long way in women's health care thus far, and are now starting to recognize the need to study health-related problems specific to women (Miller & Kollauf, 2002). By deconstructing heart disease and removing the gender bias, the opportunity arises to see things differently; moving from identifying the gaps in knowledge, to understanding the gaps in knowledge. Identifying the gaps, like the lack of female-specific AMI knowledge and the lack of public media portraits of atypical symptoms, helps us to understand that this puts women at a higher risk of adverse outcomes (Lichtman, 2015). Identifying women's position in society, as the caregiver, the mother, the wife, the nurturer, helps us to understand that this gendered role could be competing with behaviours associated with seeking help for a critical cardiac event. It is apparent that AMI symptoms in women do not occur in isolation. Similarly, the categories identified in this review should not be seen in seclusion, but rather as single strands of a complex web; one in constant flux and interplay with physical, social, and psychological variables (Suls & Martin, 2010). The only one's who truly understand the gaps are the women themselves. But, in order to mind the gaps, they need the necessary resources. It may be time to look at this phenomenon from a different perspective—one that includes the many complex interactions and intersections inherent in women's lives. By focus on the context—a deeper understanding of why, how, and when this critical event presents itself may come to the forefront.

Implications for Practice

This review of literature highlights several gaps in the ways of knowing that clinicians use to provide competent care to women experiencing acute myocardial infarctions. This subsequent lack of research and knowledge has consequences for preventative interventions, and limits the ability of health care providers to manage women's care. Educating women and health care providers on women's AMI symptoms has been shown to positively influence knowledge of AMI symptoms and responses to AMI symptoms (Buckley et al., 2007; McSweeney & Crane, 2000). Nurses are in a unique position to advocate for and educate themselves and others on issues relating to women's cardiovascular events. It is a moral responsibility, as nurses and researchers, to question the status quo, be aware of contextual influences and gender imbalance in research and practice, inequalities in clinical care provision, and bias in public awareness—and encourage knowledge generation to bridge the knowledge gaps.

Limitations

Initial analysis of primary literature did not allow for this review to proceed with an analysis of young women and AMI symptoms, rather it necessitated the review to focus on women of all ages and AMI symptoms. Discussing the results and categories as a collective, ranging across all types of studies, presents a limitation with regard to the generalizability and transferability of the categories found in this review. While the quantitative evidence in this review suggests generalizability of the findings, the inclusion of a majority of qualitative studies limits this and rather functions to add meaning to the findings.   ♥

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REFERENCES

Albarran, J.W., Clarke, B.A., & Crawford, J. (2007). 'It was not chest pain really, I can't explain it!' An exploratory study on the nature of symptoms experienced by women during their myocardial infarction. *Journal of Clinical Nursing, 16*(7), 1292–1301. doi:10.1111/j.1365-2702.2007.01777.x

Arora, G., & Bittner, V. (2015). Chest pain characteristics and gender in the early diagnosis of acute myocardial infarction. *Current Cardiology Reports, 17*(2), 1–5. doi:10.1007/s11886-014-0557-5

Aufderheide, T., Ruthazer, R., Woolard, R., Feldman, J., Beshansky, J., Griffith, J., & Selker, H. (2000). Missed diagnoses of acute cardiac ischemia in the emergency department. *The New England Journal of Medicine*. doi:10.1056/NEJM200004203421603

Banks, A.D., & Malone, R.E. (2005). Accustomed to enduring: Experiences of African-American women seeking care for cardiac symptoms. *Heart & Lung - the Journal of Acute and Critical Care, 34*(1), 13–21. doi:10.1016/j.hrtlng.2004.08.001

Buckley, T., McKinley, S., Gallagher, R., Dracup, K., Moser, D.K., & Aitken, L.M. (2007). The effect of education and counselling on knowledge, attitudes and beliefs about responses to acute myocardial infarction symptoms. *European Journal of Cardiovascular Nursing, 6*(2), 105–111. doi:10.1016/j.ejcnurse.2006.05.005

Canto, J.G., Goldberg, R.J., & Sopko, G. (2012). A call to standardize symptom presentation in acute coronary syndromes. *American Heart Journal, 164*(6), 801–806. doi:10.1016/j.ahj.2012.08.012

Carmin, C.N., Ownby, R.L., Wiegartz, P.S., & Kondos, G.T. (2008). Women and non-cardiac chest pain: Gender differences in symptom presentation. *Archives of Women's Mental Health,11*(4), 287–293. doi:10.1007/s00737-008-0021-x

Centers for Disease Control and Prevention. (2015). *Women and heart disease fact sheet.* Available from http://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_women_heart.htm

Chen, W., Woods, S.L., & Puntillo, K.A. (2005). Gender differences in symptoms associated with acute myocardial infarction: A review of the research. *Heart & Lung - the Journal of Acute and Critical Care, 34*(4), 240–247. doi:10.1016/j.hrtlng.2004.12.004

Critical Appraisal Skills Programme. (2013). *CASP Checklists* [Online]. Available at http://www.casp-uk.net/#!checklists/cb36

Davis, L.L., Mishel, M., Moser, D.K., Esposito, N., Lynn, M.R., & Schwartz, T.A. (2013). Thoughts and behaviors of women with symptoms of acute coronary syndrome. *Heart & Lung: The Journal of Critical Care, 42*(6), 428–435. doi:10.1016/j.hrtlng.2013.08.001

Dempsey, S.J., Dracup, K., & Moser, D.K. (1995). Women's decision to seek care for symptoms of acute myocardial infarction. *Heart & Lung: the Journal of Acute and Critical Care, 24*(6), 444–456. doi:10.1016/S0147-9563(95)80022-0

DeVon, H.A., Rosenfeld, A., Steffen, A.D., & Daya, M. (2014). Sensitivity, specificity, and sex differences in symptoms reported on the 13-item acute coronary syndrome checklist. *Journal of the American Heart Association, 3*(2), e000586–e000586. doi:10.1161/JAHA.113.000586

DeVon, H.A., Saban, K.L., & Garrett, D.K. (2011). Recognizing and responding to symptoms of acute coronary syndromes and stroke in women. *Journal of Obstetric, Gynecologic, &Neonatal Nursing, 40*(3), 372–382. doi:10.1111/j.1552-6909.2011.01241.x

Gimenez, M., Reiter, M., Twerenbold, R., Reichlin, T., Wildi, K., Haaf, P., Wicki, K., … Mueller, C. (2013). Sex-specific chest pain characteristics in the early diagnosis of acute myocardial infarction. *JAMA Internal Medicine*. doi:10.1001/jamainternmed.2013.12199

Graham, M., Westerhout, C., Kaul, P., Norris, C., & Armstrong, P. (2008). Sex differences in patients seeking medical attention for prodromal symptoms before an acute coronary event. *Am Heart J, 156*(6), 1210–1216.e1. doi:10.1016/j.ahj.2008.07.016

Harralson, T.L. (2007). Factors influencing delay in seeking treatment for acute ischemic symptoms among lower income, urban women. *Heart & Lung - the Journal of Acute and Critical Care, 36*(2), 96–104. doi:10.1016/j.hrtlng.2006.08.002

Health Canada. (1999). Women and Heart Health. Available from http://www.hc-sc.gc.ca/hl-vs/pubs/women-femmes/heart-cardiovascu-laire-eng.php

Herning, M., Hansen, P.R., Bygbjerg, B., & Lindhardt, T. (2010). Women's experiences and behaviour at onset of symptoms of ST segment elevation acute myocardial infarction. *European Journal of Cardiovascular Nursing: Journal of the Working Group on Cardiovascular Nursing of the European Society of Cardiology, 10*(4), 241. doi:10.1016/j.ejcnurse.2010.10.002

Hughes, I. (1997). *The lived experience of women prior to hospitalization for acute myocardial infarction.* (Unpublished dissertation). University of San Diego, United States.

Isaksson, R., Brulin, C., Eliasson, M., Näslund, U., & Zingmark, K. (2011). Prehospital experiences of older men with a first myocardial infarction: A qualitative analysis within the northern Sweden MON-ICA study. *Scandinavian Journal of Caring Sciences, 25*(4), 787–797. doi:10.1111/j.1471-6712.2011.00896.x

Koning, C. (2014). Does self-scheduling increase nurses' job satisfaction? an integrative literature review. *Nursing Management (Harrow, London, England: 1994), 21*(6), 24.

Lichtman, J.H., Leifheit-Limson, E.C., Watanabe, E., Allen, N.B., Garavalia, B., Garavalia, L.S., Spertus, J., … Curry, L.A. (2015). Symptom recognition and healthcare experiences of young women with acute myocardial infarction. Circulation. *Cardiovascular Quality and Outcomes, 8*(2, Suppl. 1). S31–S38. doi:10.1161/CIRCOUTCOMES.114.001612

MacInnes, J.D. (2006). The illness perceptions of women following symptoms of acute myocardial infarction: A self-regulatory approach. *European Journal of Cardiovascular Nursing, 5*(4), 280-288. doi:10.1016/j.ejcnurse.2006.02.003

McSweeney, J. (1998). Women's narratives: Evolving symptoms of myocardial infarction. *Journal of Women & Aging, 10*(2), 6783. doi:10.1300/J074v10n02_06

McSweeney, J.C., & Crane, P.B. (2000). Challenging the rules: Women's prodromal and acute symptoms of myocardial infarction. *Research in Nursing & Health, 23*(2), 135–146. doi:10.1002/(SICI)1098-240X(200004)23:2<135::AID-NUR6>3.0.CO;2-1

McSweeney, J.C., Cody, M., & Crane, P.B. (2001). Do you know them when you see them? Women's prodromal and acute symptoms of myocardial infarction. *The Journal of Cardiovascular Nursing, 15*(3), 26–38.

McSweeney, J.C., Cody, M., O'Sullivan, P., Elberson, K., Moser, D.K., & Garvin, B. J. (2003). Women's early warning symptoms of acute myocardial infarction. *Circulation, 108*(21), 2619–2623. doi:10.1161/01.CIR.0000097116.29625.7C

McSweeney, J.C., O'Sullivan, P., Cody, M., & Crane, P.B. (2004). Development of the McSweeney acute and prodromal myocardial infarction symptom survey. *The Journal of Cardiovascular Nursing, 19*(1), 58–67.

McSweeney, J.C., & Coon, S. (2004). Women's inhibitors and facilitators associated with making behavioral changes after myocardial infarction. *MedSurg Nursing, 13*(1), 49–56.

McSweeney, J.C., Lefler, L.L., & Crowder, B.F. (2005). What's wrong with me? Women's coronary heart disease diagnostic experiences. *Progress in Cardiovascular Nursing, 20*(2), 48–57. doi:10.1111/j.0889-7204.2005.04447.x

McSweeney, J.C., Cleves, M.A., Zhao, W., Lefler, L.L., & Yang, S. (2010a). Cluster analysis of women's prodromal and acute myocardial infarction symptoms by race and other characteristics. *The Journal of Cardiovascular Nursing, 25*(4), 311–322. doi:10.1097/JCN.0b013e3181cfba15

McSweeney, J.C., O'Sullivan, P., Cleves, M.A., Lefler, L.L., Cody, M., Moser, D.K., Dunn, K., … Zhao, W. (2010b). Racial differences in women's prodromal and acute symptoms of myocardial infarction. *American Journal of Critical Care : An Official Publication, American Association of Critical-Care Nurses, 19*(1), 63–73. doi:10.4037/ajcc2010372

McSweeney, J., Cleves, M.A., Fischer, E.P., Moser, D.K., Wei, J., Pettey, C., Rojo, M., & Armbya, N. (2014; 2013). Predicting coronary heart disease events in women: A longitudinal cohort study. *The Journal of Cardiovascular Nursing, 29*(6), 482–492. doi:10.1097/JCN.0b013e3182a409cc

Méthot, J., Hamelin, B.A., Bogaty, P., Arsenault, M., Plante, S., & Poirier, P. (2004). Does hormonal status influence the clinical presentation of acute coronary syndromes in women? *Journal of Women's Health (2002), 13*(6), 695–702. doi:10.1089/jwh.2004.13.695

Miller, C., & Kollauf, C. (2002). Evolution of information on women and heart disease 1957–2000: A review of archival records and secular literature. *Heart & Lung : The Journal of Critical Care, 31*(4), 253–61. doi:10.1067/mhl.2002.126050

Mohamed, H. (2007). *Relationships among knowledge, perception, treatment-seeking behavior, time-to-treatment, and psychological distress in women with first time acute myocardial infarction.* (Unpublished doctoral dissertation). Case Western Reserve University, Ohio, United States.

Rosenfeld, A., & Gilkeson, J. (2000). Meaning of illness for women with coronary heart disease. *Heart & Lung : The Journal of Acute and Critical Care, 29*(2), 105–112. doi:10.1067/mhl.2000.105751

Rubin, J.B., & Borden, W.B. (2012). Coronary heart disease in young adults. *Current Atherosclerosis Reports, 14*(2), 140–149. doi:10.1007/s11883-012-0226-3
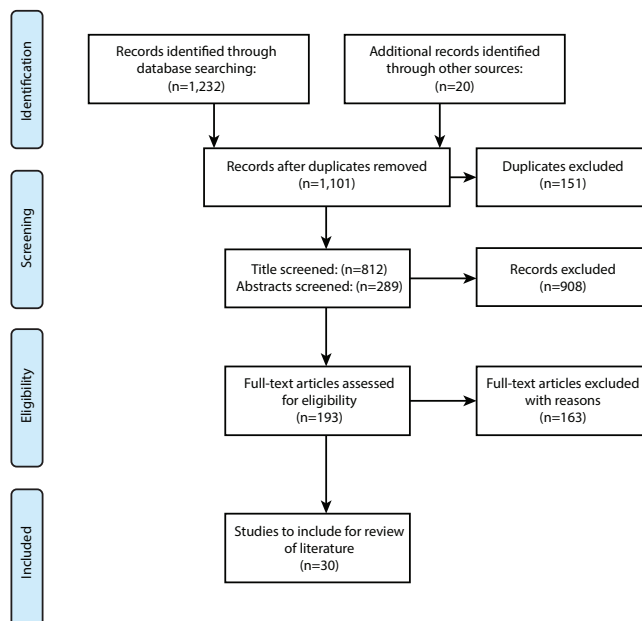
Ruston, A., & Clayton, J. (2007). Women's interpretation of cardiac symptoms at the time of their cardiac event: The effect of co-occurring illness. *European Journal of Cardiovascular Nursing: Journal of the Working Group on Cardiovascular Nursing of the European Society of Cardiology, 6*(4), 321–8. doi:10.1016/j.ejcnurse.2007.04.002

Schoenberg, N.E., Peters, J.C., & Drew, E.M. (2003). Unraveling the mysteries of timing: Women's perceptions about time to treatment for cardiac symptoms. *Social Science & Medicine, 56*(2), 271–284. doi:10.1016/S0277-9536(02)00026-6

Sergie, Z., Mehran, R., Brener, S., Maehara, A., Fahy, M., Zeymer, U., Zama, A., … Stone, G. (2013). Gender differences in cardiac symptoms 30 days after primary pci for anterior myocardial infarction: Insights from infuse–ami. *Journal of the American College of Cardiology, 61*(10), E1656. doi:10.1016/S0735-1097(13)61656-3

Shin, J.Y., Martin, R., & Suls, J. (2010). Meta-analytic evaluation of gender differences and symptom measurement strategies in acute coronary syndromes. *Heart & Lung - the Journal of Acute and Critical Care, 39*(4), 283–295. doi:10.1016/j.hrtlng.2009.10.010

Sjöström-Strand, A., & Fridlund, B. (2008). Women's descriptions of symptoms and delay reasons in seeking medical care at the time of a first myocardial infarction: A qualitative study. *International Journal of Nursing Studies, 45*(7), 1003–1010. doi:10.1016/j.ijnurstu.2007.07.004

Snyder, D. (2003). *The pre-hospital experiences of women with acute coronary syndrome.* (Unpublished master's thesis). University of British Columbia, Canada.

Statistics Canada. (2011). *The 10 leading causes of death, 2011.* [Report]. Available from http://www.statcan.gc.ca/pub/82-625-x/2014001/article/11896-eng.htmak

Statistics Canada. (2014). *Leading causes of death, by sex.* Available from http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/hlth36c-eng.htm

Suls, J., & Martin, R. (2011). Heart disease occurs in a biological, psychological, and social matrix: Cardiac risk factors, symptom presentation, and recovery as illustrative examples. *Annals of Behavioral Medicine, 41*(2), 164–173. doi:10.1007/s12160-010-9244-y

Svedlund, M., Danielson, E., & Norberg, A. (2001). Women's narratives during the acute phase of their myocardial infarction. *Journal of Advanced Nursing, 35*(2), 197–205. doi:10.1046/j.1365-2648.2001.01837.x

Travis, C.B., Howerton, D.M., & Szymanski, D.M. (2012). Risk, uncertainty, and gender stereotypes in healthcare decisions. *Women & Therapy, 35*(3-4), 207–220. doi:10.1080/02703149.2012.684589

Turris, S. (2009). Women's decisions to seek treatment for the symptoms of potential cardiac illness. *Journal of Nursing Scholarship, 41*(1), 5–12. doi:10.1111/j.1547-5069.2009.01245.x

Turris, S., & Johnson, J. (2008). Maintaining integrity: Women and treatment seeking for the symptoms of potential cardiac illness. *Qualitative Health Research, 18*(11), 1461–1476. doi:10.1177/1049732308325824

Turris, S., & Finamore, S. (2008). Reducing delay for women seeking treatment in the emergency department for symptoms of potential cardiac illness. *Journal of Emergency Nursing, 34*(6), 509–515. doi:10.1016/j.jen.2007.09.016

White, J., Hunter, M., & Holttum, S. (2007). How do women experience myocardial infarction? A qualitative exploration of illness perceptions, adjustment and coping. *Psychology, Health & Medicine, 12*(3), 278–88. doi:10.1080/13548500600971288

World Health Organization. (2014). *The 10 leading causes of death in the world, 2000 and 2012.* Available from: http://www.who.int/mediacentre/factsheets/fs310/en/index.html

Appendix. Figure 1: PRISMA diagram illustrating literature search

Easing the Economic Burden of Atrial Fibrillation: Making the Case for a Structured Clinical Nurse Specialist-Led Outpatient Clinic

Tori Minakakis, RN, BScN, MN, CCN(c)

Abstract

As the life expectancy of Canadians continues to increase, so does the economic burden of chronic conditions within the health care system. One chronic condition that has increased over the past decade is atrial fibrillation (AF). With health care costs for AF estimated at more than $800 million and rising, a new approach is needed to manage AF care to reduce hospitalizations and emergency room visits, while improving patients' quality of life. Multidisciplinary outpatient clinics for heart failure patients have been implemented across Canada over the past decade, and have shown a reduction in hospital admissions and emergency room visits. It is probable that the same benefit could be seen with the implementation of a structured, nurse-led outpatient AF clinic. The purpose of this article is to review the existing literature on AF outpatient management, and establish the best approach for a clinical nurse specialist-led AF outpatient clinic within the Canadian health care system.*

Key words: atrial fibrillation, outpatient, clinical nurse specialist, chronic disease management

Highlights

- As the incidence of atrial fibrillation (AF) increases with the aging Canadian population, so does its economical impact on the Canadian health care system
- Despite outpatient clinics for AF patients existing across Canada, little is documented in the literature about their structure, execution and outcomes.
- Based on the literature, a structured, clinical nurse specialist-led outpatient AF clinic, based on the Chronic Care Model, is presented as a method to address the economic burden caused by the complications of AF.

As our population both ages and grows, the Canadian health care system is challenged with hospital bed shortages, emergency room overflow, and increasing wait times for outpatient services. Atrial fibrillation (AF) is the most common cardiac arrhythmia and, therefore, a significant cause of visits to the emergency department, family doctors' office, and hospital admissions. It is a chronic condition that is increasing in prevalence across the country, as our population ages, and is accompanied with a significant financial burden on our health care system. Within the practice of cardiology, this was also seen as an issue with congestive heart failure. There has since been a surge of nurse-led, multidisciplinary, outpatient heart failure clinics, which have successfully addressed the unnecessary and recurrent use of acute care services to treat this chronic condition. It stands to reason that if this approach

has worked for one cardiac patient population, it should then work for another. The purpose of this paper is to review the literature on outpatient management of atrial fibrillation and analyze the most effective structure of a clinical nurse specialist-led outpatient AF clinic to significantly reduce the use of acute care resources and improve quality of life for patients living with atrial fibrillation.

Literature Review

Defining the Issue

Atrial fibrillation (AF) is the most prevalent cardiac arrhythmia and affects an estimated 350,000 Canadians (O'Reilly et al., 2013). O'Reilly et al. (2013) stated that "after the age of 55 years, the incidence of AF doubles with each decade of life" (p. 229). With an aging Canadian population, AF will increasingly burden the health care sector if no strategies are established to effectively manage AF patients in the outpatient setting. It is the complications associated with AF that put the greatest economic strain on the Canadian health care system—including stroke, pulmonary edema, and major bleeding (O'Reilly et al., 2013). Strategies to address these potential complications are effectively addressed through the Canadian Cardiovascular Society (CCS) guidelines, but adherence to these guidelines needs to be strictly followed to be effective (Hendriks et al., 2010). In an effort to establish what ideal outpatient management for an AF patient would look like, a search of the literature was conducted.

Search Strategy

An initial review of the literature was conducted within the CINAHL database, using the search words 'atrial fibrillation' and 'outpatient clinic'. The search was limited to the

years 2008–2015, which yielded only five results. Of these five results, only one article was found to be specific to an outpatient AF clinic. This initial search linked to Science Direct, which showed other related articles, and from this link another four articles were found that related to outpatient AF clinics. A secondary search was conducted within CINAHL using the search terms 'atrial fibrillation clinic', restricted to the years 2008–2015, with the anticipation of yielding higher results. The secondary search yielded only four results, three of which were related to AF outpatient clinics. A tertiary CINAHL search was conducted to ensure a comprehensive search for articles related to AF outpatient clinics had been done. In the tertiary search the search terms 'atrial fibrillation management', restricted to the years 2008–2013 was used, which yielded 13 results, however, none of these related to the outpatient management of AF.

The Web of Knowledge database was searched using the search terms 'atrial fibrillation' and 'outpatient clinic', restricted to the years 2008–2013, English and full text articles, which yielded 102 results. Of these 102 initial results, only four were considered appropriate for the purpose of this article. Three of these four were duplicates of the articles previously found through CINAHL. Google Scholar and Medline were used to search specific article titles, which were found through reviewing the reference lists of the other articles. Six articles were yielded using this method. Ultimately, the articles that were included in this paper were ones that looked at outpatient clinics for the management of atrial fibrillation, despite their structure or outcomes, as well as articles that discussed the economic impact of atrial fibrillation on the health care sector.

Atrial Fibrillation Clinics in the Literature

As highlighted above, the review of the literature surrounding outpatient management of AF revealed a paucity of research in this area. Regardless of where the research was conducted, all the articles agreed that AF is increasing in prevalence with a parallelled increase in AF-associated health care costs. Thus, all of the published research agreed that a new approach needs to be taken in order to reduce the cost associated with AF. There were three European research articles, and one Canadian article that looked at hospital readmission rates as the primary endpoints for patients who attended a dedicated outpatient AF clinic. In all three articles, a reduction in readmission rates was identified (Conti et al., 2012; Gillis et al., 2008; Hendriks et al., 2012; Holding, Tyndall, Russell & Cowan, 2009), which translates into reduced AF-related health care costs, as hospitalizations are seen as the primary economic driver (Wong et al., 2012).

The Netherlands. Hendriks et al. (2012) enrolled stable AF patients who were referred from general practitioners or non-cardiology specialists to the outpatient clinic within the Netherlands health care system. Hendriks et al. (2013) utilized the Chronic Care Model (Wagner, Austin, & Korff, 1996) as a foundational design for their outpatient AF clinic. This

standardized approach appeared to be the most researched method, as Hendriks and associates have published four articles evaluating various outcomes of this clinic, derived from the Chronic Care Model (Wagner et al., 1996). To ensure compliance with their national guidelines, Hendriks et al. (2013) utilized a software program to guide care decisions based on the guidelines for each patient. The initial visit with the nurse lasted 30 minutes, with follow-up visits occurring at three, six, and 12 months and every six months thereafter (Hendriks et al., 2013). In their study, Hendriks et al. (2012) randomized 712 patients with AF to either nurse-led care or usual care. Of the 356 patients assigned to nurse-led care through the AF clinic, 14.3% (or 51 patients) were hospitalized for their AF, while the control group saw 20.8% of patients admitted to hospital (Hendriks et al., 2012). The other endpoint observed was that of cardiovascular death, which occurred in 1.1% of patients in the nurse-led care group, and 3.9% in the control group (Hendriks et al., 2012).

Florence, Italy. Conti et al. (2012) studied the effects of an intensive observation unit that patients were sent to from the emergency department (ED) for observation of their AF followed by attendance at an outpatient clinic. There was minimal explanation as to the design of the outpatient clinic. Although Conti et al. (2012) cited a reduction in hospitalizations, the article focused more on acute care management, and there was little discussion on the impact of the outpatient clinic on hospital readmission rates and, subsequently, its economic impact.

The United Kingdom. Holding et al. (2009) recruited patients to an outpatient clinic who were referred after an initial AF diagnosis, within the British health care system. Holding et al. (2009) did not cite a specific model upon which its outpatient clinic was built, although its description of the key components within the clinic closely resemble that of the Chronic Care Model. Similar to Hendriks et al. (2013), the initial appointment lasted 30 minutes, but Holding et al. (2009) did not discuss the frequency of subsequent follow-up.

Calgary, Alberta, Canada. Gillis et al. (2008) established an outpatient atrial fibrillation clinic where patients were referred from both emergency department physicians and family physicians. There was minimal discussion in the article as to the structure of the clinic. Preliminary data from 2005/2006 showed an 82% reduction in emergency department visits, and a 56% reduction in hospital readmission rates, which positively impacts the economical burden felt by AF (Gillis et al., 2008). Further published data from the long-term outcomes of the clinic were not available, nor were there any discussion of how this clinic affected an AF patients' quality of life.

Direction for Future Practice and Research

Based on anecdotal evidence, it is known that AF clinics and other arrhythmia clinics exist across Canada. However, the literature review conducted for this paper only revealed one published Canadian article, which showed limited

data on the structure and only preliminary outcomes. The domain of research surrounding outpatient management of AF patients within Canada would benefit from quantitative research that is focused on testing a standardized approach to outpatient clinics, as well as qualitative research methods to assess the patient's subjective experience. Additionally, it would be beneficial to develop and evaluate a tool to measure quality-of-life outcomes for AF patients to better quantify the impact of an outpatient clinic on the patient's quality of life.

The Economic Impact of Atrial Fibrillation on the Canadian Healthcare System

Due to the aging population, AF has become an increasingly costly public health burden, with rates expected to continue rising over the next decade (Conti et al., 2012; Gillis et al., 2008). In their study, O'Reilly et al. (2013) published data on the cost of AF within the Canadian health care system by looking at AF or atrial flutter-related admissions, ED visits, and outpatient usage between April 1, 2007, and March 31, 2008, using the Canadian Institute for Health Information-Discharge Abstract Database. The total expenditures in Canada on AF-related admissions was $815 million, accounting for 4.6% of acute care costs, and 2.6% of all hospital admissions (O'Reilly et al., 2013).

The average length of hospital admission for a primary diagnosis of AF was 5.7 days, accounting for approximately $6,718 per admission (O'Reilly et al., 2013). AF-related admissions, which were considered admissions due to complications from AF, accounted for the highest economic burden and included complications such as bleeds ($22,051), pulmonary edema ($19,177), and stroke or transient ischemic attacks (TIA) ($19,113) (O'Reilly et al., 2013). Hendriks et al. (2012) and Berti et al. (2013) stated that increased complications related to AF were associated with practitioners' poor adherence to national guidelines, and cited an outpatient AF clinic as a better strategy to managing AF patients in accordance with national guidelines. With strict adherence to the national atrial fibrillation best practice guidelines through a dedicated AF clinic, complications such as bleeds or stroke from unstable INRs (international normalized ratio), or pulmonary edema from poor rate control, could be reduced. Overall, this would reduce AF-related hospital admissions, which have proven to be the greatest economic factor associated with AF care (Wong et al., 2012).

To justify the initial costs of implementing a nurse-led AF clinic, it is important to show long-term cost savings to key financial stakeholders within the health care system. The three European articles discussed earlier showed a reduction in emergency room visits, and reduced hospitalizations for AF patients who attended a nurse-led outpatient clinic (Conti et al., 2012; Hendriks et al., 2012; Holding et al., 2009). Hendriks et al. (2013), after having proven the health-related benefits of a nurse-led AF clinic, conducted a follow-up study that looked at the overall cost-effectiveness of the same clinic. This secondary analysis showed that nurse-led care reduced costs associated with a reduction in hospitalizations (Hendriks et al., 2013). Hendriks et al. (2013) discussed that initially, costs may actually be higher due to initial training and software set-up, as well as costs for initial diagnostic testing. However, with strict adherence to the national guidelines, hospital admissions were reduced, which contributed in the long-term to a lower economic burden associated with AF care (Hendriks et al., 2013). This shift in care from acute care settings to outpatient clinics for the management of AF has been viewed as a possible solution to the increasing economic burden of AF both nationally and internationally.

The Potential Benefits of a Clinical Nurse Specialist Led Atrial Fibrillation Outpatient Clinic

Improvement on Patient Quality of Life

Although the majority of this article has examined the economic burden of AF, it is important to also gain an understanding of the social burden felt by patients living with AF to truly appreciate the benefit of an outpatient AF clinic. O'Reilly et al. (2013) stated that "symptoms of AF can have a negative impact on patients' physical, social, and mental well-being, which leads to significant morbidity" (p. 229). The physical well-being of patients may be impacted due to symptoms of palpitations, chest pain, shortness of breath, and pre-syncope (Hendriks et al., 2012). However, it is not only the patients' life that is impacted by AF, as their families and caregivers are also burdened by this diagnosis. A nurse-led AF clinic would help to empower patients and families by ensuring they are "educated, empowered, trained and provided with self-management counselling" (Berti et al., 2013, p. 2726) to better manage individual components of their AF. Thus, a dedicated AF clinic would not only reduce the financial burden on the Canadian health care system, but also has the potential to improve quality of life for AF patients and their families.

A Multidisciplinary Approach

At present, cardiologists are primarily responsible for the care of patients living with AF, although it is often first detected at a family doctor's office and subsequent referral is made for the patient to visit the ED or a cardiologist. If a patient is suffering from paroxysmal AF and their family doctor is unable to capture this finding on ECG, a referral may be made to a cardiologist due to the patients' symptoms. However, a patient may wait up to six months for this referral and longer for the appropriate outpatient tests such as a 24-hour holter monitor or an echocardiogram. Holding et al. (2009) stated that with the rapid access to a nurse-led clinic, patients typically were seen within 10–15 days of referral, which significantly reduced the incidence rate of complications associated with untreated AF. This, in turn, reduced ED visits and admission to hospital (Holding et al., 2009).

Another benefit of a nurse-led AF clinic is the increased connectivity patients experience, both through the nurse, and through other health disciplines. Primary physician-led AF care is often focused solely on managing the arrhythmia with little attention being given to patient education and counselling for the patients and their families (Berti et al., 2013; Hendriks et al., 2010). Nurse-led care not only focuses on the treatment of the arrhythmia, but nurses can serve as the connecting point to other health disciplines, play the role of educator, and provide continued support via telephone when required by the patient (Hendriks et al., 2010; Hendriks et al., 2012; Holding et al., 2009). Although the benefits of a dedicated chronic care clinic for AF are poorly documented in the literature, the benefits of such multidisciplinary clinics for chronic heart failure patients have been well established, structured around the Chronic Care Model (Wagner et al., 1996).

Benefits of other Chronic Care Clinics

Hendriks et al. (2010) stated that "implementation of chronic care programs has demonstrated improved patient outcomes, better guideline adherence, and significant increases in quality of life and patient satisfaction among patients with chronic heart failure" (p. 1311). It is reasonable to conclude that if there has been documented evidence of overall improved patient outcomes, with reduced hospital readmissions through use of a dedicated HF clinic, similar results could be expected with an AF clinic. Hauptman et al. (2008) stated that management of chronic diseases in the outpatient setting improves patient care through "early identification of symptom progression, utilization of evidence-based medication, quality-of-life evaluation, and patient education to increase adherence" (p. 801). Hauptman et al. (2008) stated that a necessity within an HF clinic is the ability to provide assistance to patients that addresses social and financial concerns, which is another example of the benefit of having multidisciplinary team members, such as a social worker, at a chronic care clinic. Hauptman et al. (2008) also indicated that chronic care clinics are an effective method at preventing patients from multiple hospital admissions that are due to poor symptom recognition and, subsequently, delayed treatment for these symptoms.

Strict Adherence to National Best Practice Guidelines

As discussed in the section on the economic burden of AF, current practice for the management of AF is often poorly aligned with the national best practice guidelines. Hendriks et al. (2010; 2012; 2013) stated that this gap between best practice and actual practice is the primary contributing factor to increased AF-related hospital admissions. O'Reilly et al. (2013) stated that the highest cost of AF-related admissions are related to pulmonary edema, bleeds, and stroke or TIAs. In looking at the Canadian Cardiovascular Society's (CCS) atrial fibrillation best practice guidelines (Cairns, Connolly, McMurtry, Stephenson, & Talajic, 2011; Gillis,

Verma, Talajic, Nattel, & Dorian, 2011; Skanes et al., 2012; Verma et al., 2014), each of these potential complications has been addressed.

Pulmonary edema. Patients who present with atrial fibrillation prior to treatment typically have 'uncontrolled AF', or a rate of >100bpm. A prolonged, increased heart rate of >120 bpm can cause pulmonary edema from tachycardia-induced cardiomyopathy, which is preventable and reversible with proper rate-controlling medications (Gillis et al., 2011). In a dedicated AF clinic, closer monitoring of heart rate, timelier patient assessment/appointments if a patients' heart rate has increased, and titration of medications in accordance with Skanes et al. (2012) recommendations for rate controlling medications is more achievable (Figure 1). Patients can also be taught to monitor their own heart rate, as part of their clinic visit and educated on when to call into the clinic in regards to increased rates, at which time titration of rate controlling medications may be initiated.

Stroke or TIAs. It is well known that AF is a common cause of stroke. When a patient presents with AF, Cairns et al. (2011) indicated that their risk of stroke should be calculated using the CHADS[2]. However, Verma et al. (2014) developed a simpler algorithm (Figure 2), which is recommended when assessing a patients' stroke risk, to better assist in determining which anticoagulant to use for a particular patient. When these guidelines are strictly adhered to within a dedicated AF clinic, patients are properly risk stratified using the most up-to-date guidelines, such as this new CCS algorithm and, subsequently, these patients are appropriately anticoagulated. Additionally, due to the multidisciplinary approach used within the AF clinic, patients who are taking warfarin therapy can be more closely monitored by attending an anticoagulation clinic, which regularly communicates with the AF
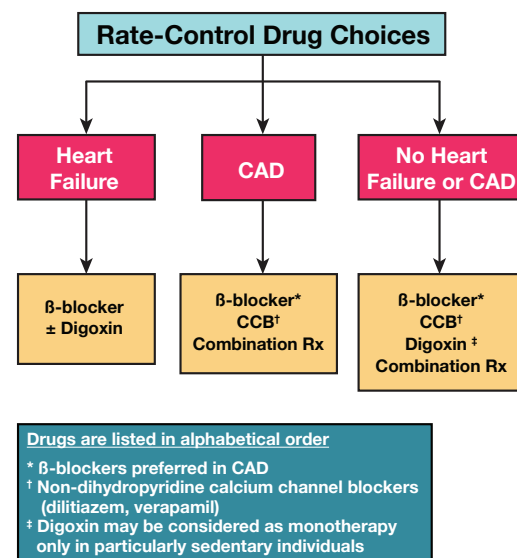

Figure 1.
(Skanes et al., 2012)

clinic. This ensures that patients are more likely to have therapeutic INRs, which, in turn, reduces their risk of stroke and bleeding.

Bleeds. Skanes et al. (2012) stated that patients who are on warfarin therapy experience bleeding at a rate of 3.0% per year. With the novel oral anticoagulants (NOACs), such as apixaban, rivaroxaban, dabigatran and edoxaban, this risk of bleeding is significantly reduced (Verma et al., 2014). However, the NOACs are not recommended for those with impaired renal function (eGFR of <30 ml/min), and therefore warfarin is still the best choice for these patients (Skanes et al., 2012; Verma et al., 2014). In any case, once a NOAC, warfarin, aspirin or clopidogrel has been chosen as the drug of choice to reduce stroke risk for AF patients, Skanes et al. (2012) recommended risk stratifying patients using the HAS-BLED score for bleeding risk prediction (Figure 3). The type of strokes associated with AF are most often fatal or leave severe residual deficits, and therefore Skanes et al. (2012) stated that unless the stroke risk is extremely low, and bleeding risk is high, an increased HAS-BLED score does not mean the patient is safe to go without an anticoagulant. However, for a patient who attends an outpatient AF clinic, closer monitoring for bleeding can occur when a patient has been identified as an increased bleeding risk.

The Key Elements of an Atrial Fibrillation Outpatient Clinic

Among the four clinics that have published data, only one used a specific model to design their AF clinic. Hendriks et al. (2010) designed their AF clinic around the Chronic Care Model, which was originally developed by Wagner, Austin and Von Korff (1996). Due to the well established efficacy of Hendriks et al. (2012) clinic, it is thought that an AF clinic designed around the Chronic Care Model, in keeping with the CCS guidelines, would be ideal for managing AF patients in outpatient settings across Canada.
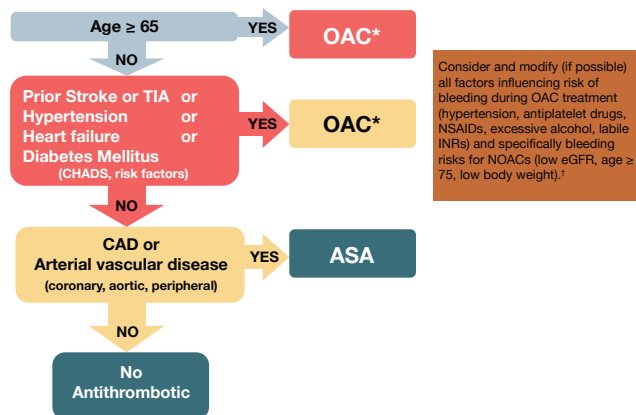

Figure 2.
(Verma et al., 2014)

The Chronic Care Model
Use of Explicit Plans and Protocol. Hendriks et al. (2010; 2012; 2013) discussed that successful chronic disease management programs practice in accordance with evidence-based best practice guidelines (Wagner et al., 1996). As Wagner et al. (1996) indicated, many practitioners are reluctant to embrace this type of care, as they want to be able to exert their individualism and not conform to homogenized care. However, in the 15 years since Wagner et al. published their article, practitioners have shifted their practice and are increasingly striving towards working in alignment with the published best practice guidelines. Hendriks et al. (2010) discussed that in their clinic, the nurse used a software program that guided clinical decision-making according to the national best practice guidelines. Although there is not such a program for the CCS guidelines, the CCS has produced smart phone applications that summarize the guidelines for ease of use.

Reorganization of Practice. The Chronic Care Model (Wagner et al., 1996) outlined the importance of redesigning the delivery of care in chronic illness programs to "meet the needs of patients with chronic health problems and to comply with a protocol or guidelines" (p. 520). Standard care for AF patients at present time has them managed by a cardiologist or general practitioner, with follow-up being inconsistent and relatively infrequent. Practice redesign involves setting up a multidisciplinary chronic illness clinic for AF patients to meet their increasingly complex health care needs. Hendriks et al. (2010) stated that part of the organizational changes lie in the transferring of tasks from the physician to the clinical nurse specialist. It is not only about the experts delivering the care, but the key to success is in the organization of services. With the nurse often serving as the connecting point. Wagner et al. (1996) stated that "delegation of key tasks to appropriate members of the practice team, especially non-physicians, appears to be a central feature of successful programs" (p. 522).

Multidisciplinary Teams. Sochalski et al. (2009) in their review of 10 randomized control trials (RCTs) looking at heart failure clinics, stated that clinics utilizing a multidisciplinary approach had "significantly fewer hospital readmissions and readmission days than routine care patients" (p. 183). Ideally, a multidisciplinary clinic for AF patients would be composed of a cardiologist, a clinical nurse specialist, a nutritionist, pharmacist and a social worker. The nutritionist is important in educating the patient on weight loss, foods high in vitamin K (for those on warfarin therapy), and overall healthy eating choices that may affect other co-morbidities. A pharmacist is vital for patient education on medications, ensuring there are no interactions between pharmacological therapies, and for assisting both the clinical nurse specialist and physician with appropriate dose adjusting of medications. Regular meetings, including

patient-specific case meetings among the interdisciplinary team members are also associated with better care outcomes for patients attending a chronic care clinic (Wagner et al., 1996). Connecting patients to an anticoagulation clinic would also be an important multidisciplinary team to link the patient to through the AF clinic.

The Clinic Visit. With the reorganization of care delivery, it is important to look at what the ideal patient experience to the AF clinic would look like. Holding et al. (2009) stated that most referrals came from GPs' offices. However, appropriate referrals to an AF clinic may also come from another cardiologist, the ED, or from internists whose patients were recently discharged from hospital with a diagnosis of AF (Gillis et al., 2008). It is important that the length of the initial patient visit is increased to ensure patients have a comprehensive appointment, with 30 minutes being the ideal length of a clinic visit (Hendriks et al., 2010; Holding et al., 2009).

During the first visit to the AF clinic, the patient would meet each of the interdisciplinary members that will be responsible for their care. As outlined by Hendriks et al. (2010) and Holding et al. (2009), the nurse would then take the patient's history, complete a physical examination, go over the pathophysiology of AF, complications associated with AF, the results of the patient's diagnostic tests and then review the options for treatment. The cardiologist would then meet with the patient to titrate and optimize their current treatment. At this point, it would be important to conduct a holistic assessment to investigate the patient's individual needs so that a referral to social work, a pharmacist or a nutritionist can appropriately be made. Holding et al. (2009) discussed that upon leaving the clinic, "patients are given information about the condition and relevant treatments and leave with the arrhythmia nurses' contact details" (p. 278). This piece is integral, as it ensures that patients have the necessary resources to adequately self-manage their condition after leaving the clinic. In addition to ensuring the patient has the nurse specialist's contact details, follow-up visits should also be planned at regular intervals, according to each patient's unique needs (Hendriks et al., 2010; Wagner et al., 1996).

Patient Self-Management and Behavioral Change Support. Wagner et al. (1996) indicated that it is important to move away from solely delivering teaching in a didactic manner, but rather it needs to have a more personalized focus for each particular patient. Hendriks et al. (2010) indicated that in their clinic the nurse specialist implemented a checklist and questionnaire to regularly assess each patient's learning needs. Education needs to be focused on self-management behaviours, so patients feel empowered and encouraged to be active participants in managing their condition daily. It is important to note that education needs to not only be directed to the patient, but family members, as well. Often spouses or other family members living in the household are

Figure 3: HAS-BLED Scoring System	
Clinical Characteristic	**Score**
Hypertension	1
Abnormal renal or liver function (1 pt each)	1 or 2
Stroke	1
Bleeding	1
Labile INRs	1
Elderly (age >65 yrs)	1
Drugs or alcohol (1 pt each)	1
(Cairns et al., 2011)	

significantly impacted by the disease and need to be included in the education, so they feel empowered to help their family member manage the disease. Self-management education for an AF clinic should focus on medication management, instructions on rate and rhythm control, and which signs and symptoms warrant a call to the clinic, or a trip to their family doctor or ED. These are beginning steps to empowering patients and their families in taking control of their AF. Wagner et al. (1996) indicated that behavioural change support programs (for smoking cessation, exercise and diet changes) should also be made available to patients within a chronic care clinic.

Clinical Expertise. The clinical nurse specialists bring a wealth of clinical expertise, as they are master's prepared nurses equipped with expert training and knowledge in a specialty area of nursing (CNA, 2014; Gurzick & Kesten, 2010). Clinical nurse specialists are also experts in both the knowledge and application of national, evidence-based, best practice guidelines (Gurzick & Kesten, 2010). They are "uniquely qualified for this activity due to his or her educational preparation, which includes advanced training in how to incorporate…cost-effective and safety-focused care [based on] evidence-based practice" (Gurzick & Kesten, 2010, p. 43). With the mandate of the proposed AF clinic being to deliver cost-effective care through use of the CCS best practice guidelines, based on their outlined skill set, it is reasonable to conclude that a clinical nurse specialist would be the best-suited candidate to lead this multidisciplinary clinic.

To ensure clinical nurse specialists stay current on the most recent research for AF outpatient care, Kuck, Wissner, and Metzner (2012) recommended that they attend regular education programs. Likewise, Wagner et al. (1996) stated that part of a successful chronic care program is ensuring that the experts engage in regular interventions that will increase their expert knowledge base. Reading new and relevant research, being familiar with current practice guidelines, and attending regular conferences are effective ways for clinical nurse specialists to maintain and improve their clinical expertise in the area of AF.

Supportive Information Systems. Although we are still working towards this initiative universally across Canada, having access to all of a patient's health records is important in ensuring effective communication, and proper continuity of care among various providers. Wagner et al. (1996) stated that "effective chronic illness care appears to be development of a shared plan of care … and their availability in computerized clinical information systems" (p. 528). In addition, such systems as the CardioConsult AF program used by Hendriks et al. (2010) are effective in managing care in alignment with national best practice guidelines, as it also ensures consistency among providers.

Conclusion

Strict adherence to national best practice AF guidelines, implemented through a structured, clinical nurse specialist-led AF clinic, would significantly reduce complications associated with AF, thus improving both the economic and social burden associated with AF. AF has continually increased in prevalence across Canada, as our population is both aging and increasing and, therefore, it is important to have a structured, upstream approach in place to effectively manage this evolving population. A chronic care clinic for AF, based on the Chronic Care Model, is an effective upstream approach aimed at reducing the economic burden while also improving the patients' quality of life. With patients having timely access to a multidisciplinary team of specialized individuals to manage their AF and its associated complications, visits to emergency departments and hospital admissions will be reduced. ♥

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REFERENCES

Berti, D., Hendriks, J.M.L., Brandes, A., Deaton, C., Crijns, H.J.G.M., Camm, A.J., … Heidbuchel, H. (2013). A proposal for interdisciplinary, nurse-coordinated atrial fibrillation expert programmes as a way to structure daily practice. *European Heart Journal, 34,* 2725–2730.

Cairns, J.A., Connolly, S., McMurtry, S., Stephenson, M., & Talajic, M. (2011). Canadian Cardiovascular Society Atrial Fibrillation Guidelines 2010: Prevention of stroke and systemic thromboembolism in atrial fibrillation and flutter. *Canadian Journal of Cardiology, 30*(1), 74–90.

Canadian Nursing Association (CNA) (2014). *Pan-Canadian core competencies for the clinical nurse specialist.* Ottawa: ON.

Conti, A., Canuti, E., Mariannini, Y., Viviani, G., Poggioni, C., Boni, V., … Gensini, G.F. (2012). Clinical management of atrial fibrillation: Early interventions, observation, and structured follow-up reduce hospitalizations. *American Journal of Emergency Medicine, 30,* 1962–1969.

Gillis, A.M., Burland, L., Arnburg, B., Kmet, C., Pollak, P.T., Kavanagh, K., … Wyse, D.G. (2008). Treating the right patient at the right time: An innovative approach to the management of atrial fibrillation. *Canadian Journal of Cardiology, 24*(3), 195–198.

Gillis, A.M., Verma, A., Talajic, M., Nattel, S., & Dorian, P. (2011). Canadian Cardiovascular Society Atrial Fibrillation Guidelines 2010: Rate and rhythm management. *Canadian Journal of Cardiology, 27*(1), 47–59.

Gurzick, M., & Kesten, K.S. (2010). The impact of clinical nurse specialists on clinical pathways in the application of evidence-based practice. *Journal of Professional Nursing, 26*(1), 42–48.

Hauptman, P.J., Rich, M.W., Heidenreich, P.A., Chin, J., Cummings, N., Dunlap, M.E., … Philbin, E. (2008). The Heart Failure Clinic: A consensus statement of the Heart Failure Society of America. *Journal of Cardiac Failure, 14*(10), 801–815.

Hendriks, J.M.L., de Wit, R., Vrijhoef, H.J.M., Tieleman, R.G., Crijns, H.J.G.M. (2010). An integrated chronic care program for patients with atrial fibrillation: Study protocol and methodology for an ongoing prospective randomized controlled trial. *International Journal of Nursing Studies, 47,* 1310–1316.

Hendriks, J.M.L., de Wit, R., Crijns, H.J.G.M., Vrijhoef, H.J.M., Prins, M.H., Pisters, R., … Tieleman, R.G. (2012). Nurse-led care versus usual care for patients with atrial fibrillation: Results of a randomized trial of integrated chronic care versus routine clinical care in ambulatory patients with atrial fibrillation. *European Heart Journal, 33,* 2692–2699.

Hendriks, J., Tomini, F., van Asselt, T., Crijns, H., & Vrijhoef, H. (2013). Cost-effectiveness of a specialized atrial fibrillation clinic versus usual care in patients with atrial fibrillation. *Europace, 15,* 1128–1135.

Holding, S., Tyndall, K., Russell, C., & Cowan, C. (2009). The impact of a nurse-led rapid-access atrial fibrillation clinic. *British Journal of Cardiac Nursing, 4*(6), 276–281.

Kuck, K.H., Wissner, E., & Metzner, A. (2012). How to establish an arrhythmia unit in the 21st Century. *Rev Esp Cardiology, 65*(1), 92–96.

O'Reilly, D.J., Hopkins, R.B., Healey, J.S., Dorian, P., Sauriol, L., Tarride, J.E., Burke, N., & Goeree, R.A. (2013). The burden of atrial fibrillation on the hospital sector in Canada. *Canadian Journal of Cardiology, 29,* 229–235.

Rienstra, M., & Van Gelder, I.C. (2013). A specialized atrial fibrillation clinic: Improving care and costs for patients with atrial fibrillation. *Europace, 15,* 1065–1066.

Skanes, A., Healey, J.S., Cairns, J.A., Dorian, P., Gillis, A.M., McMurtry, M.S., … Nattel, S. (2012). Focused 2012 update of the Canadian Cardiovascular Society atrial fibrillation guidelines: Recommendations for stroke prevention and rate/Rhythm control. *Canadian Journal of Cardiology, 28,* 125–136.

Sochalski, J., Jaarsma, T., Krumholz, H.M., Laramee, A., McMurray, J.J.V., Naylor, M.D., … Stewart, S. (2009). What works in chronic care management: the case of heart failure. *Health Affairs, 28*(1), 179–189.

Verma, A., Cairns, A., Mitchell, L.B., Macle, L., Stiell, I.G., Gladstone, D., … Healey, J.S. (2014). 2014 Focused update of the Canadian Cardiovascular Society Guidelines for the management of atrial fibrillation. *Canadian Journal of Cardiology, 30,* 1114–1130.

Wagner, E.H., Austin, B.T., & Von Korff, M. (1996). Organizing care for patients with chronic illness. *Millbank Q, 74,* 511–544.

Wong, C.X., Brooks, A.G., Lau, D.H., Leong, D.P., Sun, M.T., Sullivan, T., Roberts-Thomson, K.C., & Sanders, P. (2012). Factors associated with the epidemic of hospitalizations due To atrial fibrillation. *The American Journal of Cardiology,* 1496–1499.

Augmentation Index and Pulse Wave Velocity—Agreement of Two Indicators and Relationships to Blood Pressures

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Abstract

Aims: The purpose of the study was to investigate the agreement between carotid-femoral pulse wave velocity (cfPWV) and augmentation index adjusted at heart rate 75 bpm (AI@75) and to examine the relationship of AI@75 and cfPWV to demographic factors and blood pressures (BPs) in Korean Americans.

Methods: This study was a secondary analysis of a previous data set from 102 Korean Americans. AI@75 and cfPWV were measured using the SphygmoCor equipment. Age, gender, height, body weight and brachial BPs were included in the analysis.

Result and conclusion: cfPWV and AI@75 showed a good agreement. DBP was independently associated with both cfPWV (p=.022) and AI@75 (p<.001). Although PP is considered a surrogate measure of arterial stiffness, it was related to neither cfPWV nor AI@75 in our healthy middle-aged Korean Americans. Unlike cfPWV, AI@75 should be measured and analyzed carefully considering height since height was independently related to AI@75 (p<.001).

Key words: pulse wave velocity, arterial stiffness, blood pressure, body weights and measures

Highlights

- Carotid-femoral Pulse wave velocity (cfPWV) and augmentation index (AI@75) have been widely used as indicators of arterial stiffness
- While cfPWV is a well-established measurement of arterial stiffness, AI@75 is relatively less validated.
- Unlike cfPWV, AI@75 should be measured and analyzed carefully considering height, since height was independently related to AI@75 (*p*<.001).

Introduction

Cardiovascular diseases (CVD) continue to be the number one cause of death and disability in industrialized countries (Cernes, Zimlichman, & Shargorodsky, 2008; Laurent & Boutouyrie, 2007). Large-artery stiffness has been identified as an independent subclinical marker of CVD including hypertension (Dernellis & Panaretou, 2005; Liao et al., 1999), left ventricular hypertrophy (Chung et al., 2012), events of heart rate and myocardial infarction (Mitchell et al., 2010), stroke (Laurent et al., 2003), and all-cause mortality (Vlachopoulos, Aznaouridis, & Stefanadis, 2010). In order to early identify CVD risk, valid and reliable measures of arterial stiffness are critical.

Carotid-femoral Pulse wave velocity (cfPWV) and augmentation index (AI@75) have been widely used as indicators of arterial stiffness (Laurent & Boutouyrie, 2007; Laurent, Cockcroft, et al., 2006). Both measures are obtained noninvasively by studying pulse waves from each blood pressure cycle measured at arterial sites. CfPWV is based on estimating the velocity of the pressure wave travelling between carotid and femoral arterial sites. AI@75 is the augmented pressure generated by the return of the reflected waves at the central aorta as a percentage of central pulse pressure and normalized for a heart rate of 75 beats per minute.

While cfPWV is a well-established measurement of arterial stiffness, AI@75 is relatively less validated. Previous studies have reported a significant positive correlation between AI@75 and PWV (Yasmin & Brown, 1999). However, a strong positive correlation does not necessarily imply that AI@75 is a valid indicator of arterial stiffness when comparing to PWV. Rather than correlation, an alternative approach has been suggested by Bland and Altman (1986) to evaluate agreement of two methods based on estimation of the 95% confidence intervals for the ability of one method to predict the other (Bland & Altman, 1986). Nevertheless, no studies have assessed agreement of AI@75 and cfPWV. In addition, because of the dissimilarity in calculating arterial stiffness, associated factors could be different between AI@75 and cfPWV. Previous studies have reported AI@75 was associated with several factors while PWV was not (Bechlioulis et al., 2013; Yang et al., 2011). Thus, concurrent examination of related factors along with agreement of cfPWV and AI@75 may help to better understand each measure of arterial stiffness and prevent presumptive conclusion about the agreement.

As there is a great interest in cyclic blood pressure curve rather than the highest (systolic) and lowest (diastolic) points

of blood pressure, pulse pressure (PP) has been advocated as a surrogate measure of arterial stiffness by many researchers (Mackenzie, Wilkinson, & Cockcroft, 2002). PP is known to be a stronger independent predictor of CVD morbidity and mortality than SBP and DBP (Glasser et al., 2014). Although PP was reported to be associated with arterial stiffness (Matsui, Ishikawa, Shibasaki, Shimada, & Kario, 2011; Miljkovic et al., 2013), few studies have examined the relationship between PP and arterial stiffness. Moreover, because Korean Americans are known to have a high prevalence of hypertension (Kim, Kim, Juon, & Hill, 2000), investigation on their cardiovascular risk is essential. Several studies have shown arterial stiffness in Korean Americans (Logan & Barksdale, 2013; Suh, Barksdale, & Logan, 2014), however, no further evaluation including AI@75 was found.

Purpose

This study used data from a prior study that explored effects of psychological stress on carotid-femoral pulse wave velocity in Korean Americans.(Logan & Barksdale, 2013). The purpose of the study was: (1) to investigate the agreement between AI@75 and cfPWV and (2) to examine the relationship of AI@75 and cfPWV to demographic factors and BP including PP in healthy Korean Americans.

Methods

Design/Sample

The design consisted of a secondary analysis of a previously collected dataset (see Logan & Barksdale, 2013). The study from which the data were obtained has been carried out to assess arterial stiffness and BP in Korean Americans. The institutional review board at University of North Carolina at Chapel Hill approved the study. We employed a correlational design to investigate agreement of cfPWV and AI@75, and related factors of the two methods. One hundred and two Korean Americans were included in the original study. The subjects were aged 21 to 60 years from North Carolina, U.S. In order to exclude any factors that may influence arterial stiffness, people who were pregnant, who had known cardiac conditions (e.g., pacemaker, heart failure, coronary artery disease, or valvular heart diseases), vascular conditions (e.g., peripheral vascular diseases), or diabetes, and those who were taking antihypertensive medications were excluded.

Measures

Arterial stiffness

AI@75 and PWV were measured using the Sphygmo-Cor equipment (AtCor Medical, Sydney, Australia). For the AI@75 measurement, augmentation pressure (AP) was derived from carotid-femoral pulse wave analysis (cfPWA), which indicates the additional aortic systolic pressure generated by the return of the reflected waves at the central aorta (O'Rourke, Pauca, & Jiang, 2001). Augmentation index (AI) is defined as the ratio of AP to pulse pressure. Since AI is affected by heart rate, AI@75 as AI adjusted to heart rate of 75 beats per minute was used (O'Rourke et al., 2001). For cfPWV measurement, the distance from the suprasternal notch to the carotid artery site (d-carotid) and the distance from the suprasternal notch to the femoral artery site (d-femoral) were measured in metre using a standard measuring tape. In order to measure the time in second from ventricular contracture to arrival of pulse wave to the carotid artery (t1) and femoral artery (t2), a tonometer was placed on carotid and femoral arterial sites along with a three lead electrocardiogram configuration attached on subjects' chests. The cfPWV was calculated as the distance between d-femoral to d-carotid divided by the mean difference between t1 and t2, which indicates the speed of the pressure wave as it travels through the aortoiliac pathway (Millasseau, Stewart, Patel, Redwood, & Chowienczyk, 2005).

Blood pressure

Peripheral brachial BP was measured using a Welch Allyn Vital Signs Monitor 300 Series (New York). BP was measured twice in the supine position with a two-minute rest between measures and the average of two measures was used for the study. PP was calculated as the systolic pressure minus the diastolic pressure.

Age, gender, height and weight

Age and gender were self-reported. Height (in cm) was measured with a wall-mounted stadiometer (Accu-Hite, WA, USA), and weight (in kg) was measured with an electronic scale (Withings, PA, USA).

Procedure

Prior to data collection, all subjects refrained from consuming coffee, smoking, and eating for at least three hours and drinking alcohol for 10 hours. For data collection, the researchers visited subjects' homes. The subjects rested at least 10 minutes in the supine position before measurement. Brachial BP was measured first, then arterial stiffness was measured according to the European Society of Cardiology's recommendations by one of the authors (J.G. Logan). Data collection was conducted between 7 AM and 11 AM to minimize the variation caused by circadian rhythm of arterial stiffness (Laurent, Cockcroft, et al., 2006).

Data analysis

SPSS 18.0 software for Windows (SPSS Inc., IL, USA) was used for statistical analyses. Descriptive statistics were used for all variables. A Bland–Altman plot was used to evaluate agreement between cfPWV and AI@75. Because of the difference in units of cfPWV and AI@75, the raw scores were transformed into Z-scores. To assess the degree of agreement between the two methods, a corresponding 95% confidence interval was determined. Supplementary to Bland-Altman plot, one-sample t-test was conducted to check the presence of fixed bias. For proportional bias, the difference between the measurements was regressed on the average of the two

measurements. Pearson's r was used to analyze the relationships of the indicators of arterial stiffness and study variables including PP. Multiple regression analysis was used to determine factors that were independently related to cfPWV and AI@75. The level of statistical significance was set at $p<0.05$.

Results

Characteristics of participants are shown in Table 1. The data were obtained from 102 participants, including 41 men and 61 women. The mean age was 39.64 years. The mean height and weight were 163.8cm and 63.43kg, respectively. Average SBP was 119.71 mmHg. For arterial stiffness, average cfPWV was 7.0 m/s and average AI@75 was 18.59%.

Agreement of AI@75 and cfPWV

As shown in Figure 1, the Bland-Altman plot revealed that most of the data points were clustered within the range of the 95% level of confidence between AI@75 and cfPWV, with only 2.9% of the measurements falling outside the 95% level of confidence (Figure 1). The mean difference was not significantly different from zero, indicating the absence of fixed bias. There was no evidence of proportional bias, as indicated by the lack of relation from linear regression analysis between the difference and the average of the measurements.

AI@75 and cfPWV in relation to age, gender, weight and height

Higher AI@75 was significantly correlated with older age ($p<.001$), female gender ($p<.01$), lower weight ($p<.01$) and shorter height ($p<.001$), whereas higher cfPWV was only significantly correlated with older age ($p<.001$) (Table 2).

AI@75 and cfPWV with BPs and PPin relation to BPs

Regarding BP, AI@75 was significantly correlated with DBP ($p<.01$). PWV showed significant and strong correlation with SBP ($p<.001$) and DBP ($p<.001$). However, PP was not correlated with either cfPWV or AI@75.

Factors related to AI@75 and cfPWV

Our multivariate regression analysis included factors significant in bivariate analysis above ($p<.05$). In multivariate analysis, AI@75 was independently related to age ($p<.01$), height ($p<.01$) and DBP ($p<.01$). However, cfPWV was independently related to age ($p<.01$) and DBP ($p=.022$) (Table 3).
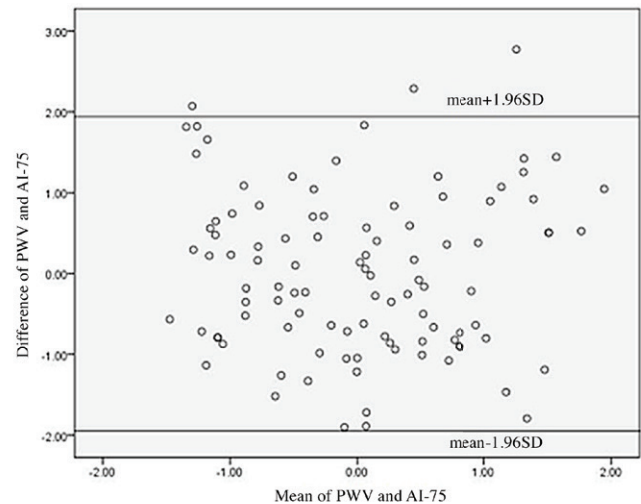
Figure 1: Bland-Altman plot of the PWV and AI-75
PWV = Pulse Wave Velocity; AI-75 = Augmentation Index adjusted at Heart Rate 75 bpm.

Table 1: Characteristics of participants (N=102)	
	N (%) or mean(±SD)
Age (year)	39.64(±9.89)
Gender	
Female	61(59.80)
Male	41(40.20)
Height (cm)	163.8(±9.08)
Weight (kg)	63.43(±11.52)
SBP (mmHg)	119.71(±14.92)
DBP (mmHg)	71.92(±9.28)
PP (mmHg)	47.78(±9.23)
cfPWV (m/s)	7.00(±1.14)
AI@75 (%)	18.59(±12.25)

SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure; PP = Pulse Pressure; cfPWV = carotid-femoral Pulse Wave Velocity; AI@75 = Augmentation Index adjusted at Heart Rate 75 bpm.

Table 2: Correlation of demographic data, blood pressures and arterial stiffness measured in cfPWV and AI@75		
	cfPWV, r (p)	AI@75, r (p)
Age	.609(.000)	.636(.000)
Gender	-.090 (.371)	.317(.001)
Weight	.121(.227)	-.305(.002)
Height	-.133(.184)	-.583(.000)
SBP	.450(.000) / .001(.989) *	.184(.065)
DBP	.558(.000) / .370(.000) ≈	.325(.001)
PP	.166(.096)	-.029(.775)
AI@75	.493(.000)	

*Partial correlation after controlling for DBP
≈Partial correlation after controlling for SBP
SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure; PP = Pulse Pressure; cfPWV = carotid-femoral Pulse Wave Velocity; AI@75 = Augmentation Index adjusted at Heart Rate 75 bpm.

Discussion

Cartoid-femoral pulse wave velocity (cfPWV) and augmentation index adjusted at heart rate 75 (AI@75) are frequently used as clinical indices for evaluating arterial stiffness. This is the first study that investigated agreement of these two indicators in measurement of arterial stiffness, as well as that explored related factors including age, gender, BPs and PP to each indicator in Korean Americans.

The distribution of the measurement difference between AI@75 and cfPWV provided an indication of comparability, although we could not compare the difference of two measurements in absolute terms due to the difference in units. Previous studies have shown no relationship between cfPWV and AI@75, inconsistent with our results (Sakurai et al., 2007; Vyas et al., 2007). Unfortunately, augmentation index (AI) was not adjusted for heart rate in their studies. No agreement between cfPWV and AI may also be explained by the difference of cfPWV and AI in age-related changes. The previous findings were from populations whose age was older than 60–65, and older aged people might show different patterns in AI@75 and/or cfPWV. AI in people older than 60 years of age has been reported to level off or even fall at a time when cfPWV continued to increase (McEniery et al., 2005). Since further evidence suggests a significant correlation between AI@75 and cfPWV in a younger population (Yasmin & Brown, 1999), it is likely that cfPWV could be comparable with AI for measuring arterial stiffness in young and middle-aged adults. The agreement between cfPWV and AI@75 in older adults needs to be further examined.

DBP was significantly (and positively) associated with both AI@75 and cfPWV in this sample of healthy, middle-aged subjects. SBP was not associated with AI@75, but was associated with cfPWV in univariate correlation. However, the significant association between SBP and cfPWV disappeared in multivariate analysis controlling for DBP, while the association between DBP and cfPWV remained after controlling for SBP. This is in concordance with previous findings (Jerrard-Dunne, Mahmud, & Feely, 2008; Nurnberger, Dammer, Opazo Saez, Philipp, & Schafers, 2003), suggesting that DBP may reflect arterial stiffness better than SBP in the healthy young population. When arterial walls are stiff, the reflected wave arrives during late systole, resulting in the augmentation of SBP and the decreased DBP. However, in younger or middle-aged healthy subjects when arterial walls are still compliant, reflected pulse wave returns during the diastole resulting in an increase in DBP (O'Rourke & Pauca, 2004; Safar, Levy, & Struijker-Boudier, 2003). This may be applied for healthy young subjects without underlying conditions in cardiovascular system because the association of DBP with AI@75 has not been shown in the population with hypertension or white coat hypertension (Jachymczyk et al., 2006; Wimmer, Sathi, Chen, Townsend, & Cohen, 2007). Further, the measure of cfPWV using the SphygmoCor device locates the foot of each pulse wave form as the reference timepoint, which belongs to the end-diastolic period. Thus, the measurement using the SphygmoCor is considered to indicate arterial stiffness at the diastolic cycle (Hermeling et al., 2012).

Contrary to previous findings (Matsui et al., 2011; Miljkovic et al., 2013), PP was related to neither cfPWV nor AI@75 in our study. Inconsistent results may be attributable to the difference in severity of arterial stiffness in study populations. Previous studies included older patients with cardiac diseases and their mean cfPWV was 14.3, which is higher than 7.0 in our healthy younger adults. As described above, stiffer artery leads to early arrivals of reflected wave during late systolic period resulting in increased SBP, decreased DBP and, thus, increased PP (Safar et al., 2003). Moreover, because PP was considered as late manifestations of pathologic arterial alteration (Nilsson, Khalili, & Franklin, 2013), it might not increase in spite of increased cfPWV when other hemodynamic indices are stable (Mohiuddin, Rihani, Laine, & Quick, 2012). The discrepancy may come from an ethnic trait of Asian. Peripheral PP was not associated with cfPWV in Chinese stroke patients either (De Silva et al., 2008). Moon et al. (2008) suggested that various conditions including obesity, insulin resistance and inflammation may act in concert to increase PP in Korean people. Therefore, it is likely that PP is not associated with cfPWV nor AI@75, at least in a healthy Korean American population.

In this study, AI@75 was associated with various factors including weight, height, gender and age, whereas cfPWV was related only to age. Regarding gender differences, women after menopause were known to have stiffer arteries than men at the same age (Tomiyama et al., 2003). Since women in our sample were younger than men, gender difference in cfPWV seems to be attenuated. Furthermore, according to Vermeersch et al. (2008), aortic stiffness did not show gender differences, but femoral or carotid stiffness did (Vermeersch

Table 3: Multiple regression analysis of arterial stiffness measured in PWV and AI_75

		B	SE	β	t	p
cfPWV	Age	0.054	0.009	.469	5.964	.000
	SBP	0.007	0.009	.092	0.752	.454
	DBP	0.037	0.016	.300	2.321	.022
	Constant	1.381	0.693		1.994	.049
AI_75	Age	0.570	0.084	.456	6.807	.000
	Gender	-2.066	2.275	-.083	-0.908	.366
	Weight	-0.025	0.087	-.023	-0.286	.775
	Height	-0.615	0.134	-.459	-4.607	.000
	DBP	0.334	0.090	.253	3.703	.000
	Constant	75.077	21.579		3.479	.001

SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure; PP = Pulse Pressure; cfPWV = carotid-femoral Pulse Wave Velocity; AI@75 = Augmentation Index adjusted at Heart Rate 75 bpm.

et al., 2008). Thus, AI@75 representing systemic vascular conditions (Stoner, Young, & Fryer, 2012), may be more sensitive to a gender difference.

However, in multivariate analysis, height remained to be independently associated with AI@75, when other demographic factors were controlled. AI@75 increased with decreased height, consistent with previous findings (Hughes et al., 2013; Song et al., 2009). Shorter individuals have shorter arteries and, thus, seem to have reduced peripheral reservoir function. Decreased reservoir function results in increased augmentation pressure (Davies et al., 2007; Schultz et al., 2013), which may contribute to increased AI. Because AI@75 is determined by wave reflection from not only large arteries, but also peripheral arteries (Cheng et al., 2012; Davies et al., 2010), it is likely that AI@75 is more influenced by height than PWV. Accordingly, AI measured in European populations tended to be lower than that in our Asian populations (Hughes et al., 2013). Therefore, height should be considered as an important confounding factor regarding AI@75.

A significant limitation of this study relates to the sample size, which was relatively small and limited to young and middle-aged Korean American adults. As a result, the findings may not be generalizable to all Korean Americans. In addition, the possibility of unhealthy condition in subjects is possible, even though indicators measured in the study showed normality. This study did not examine factors such as hyperlipidemia, lack of exercise or unhealthy dietary habit, which may influence on arterial stiffness. Further studies including these important factors are needed in order to speculate effects of the factors on the indices of arterial stiffness.

Conclusion

AI@75 can be used as a useful indicator of arterial stiffness, since the result of our study showed a good agreement between cfPWV and AI@75 in healthy middle-aged Korean American adults. Nevertheless, the strong relationship between height and AI@75 implies that AI@75 should be interpreted carefully considering height. While SBP was related only to cfPWV, DBP was independently associated with both cfPWV and AI@75. Although PP is considered a surrogate measure of arterial stiffness, it was related to neither cfPWV nor AI@75 in the current study. In order to better understand predictive strengths of SBP, DBP, and PP for cardiovascular risk including arterial stiffness and apply them to clinical practice, further studies are guaranteed to replicate these results in a large group of population with different races and health conditions. ♥

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REFERENCES

Bechlioulis, A., Vakalis, K., Naka, K.K., Bourantas, C.V., Papamichael, N.D., Kotsia, A., … Michalis, L. K. (2013). Increased aortic pulse wave velocity is associated with the presence of angiographic coronary artery disease in overweight and obese patients. *Am J Hypertens, 26*(2), 265–270. doi:10.1093/ajh/hps039

Bland, J.M., & Altman, D.G. (1986). Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet, 1*(8476), 307–310.

Cernes, R., Zimlichman, R., & Shargorodsky, M. (2008). Arterial elasticity in cardiovascular disease: Focus on hypertension, metabolic syndrome and diabetes. *Adv Cardiol, 45*, 65–81. doi:10.1159/0000115188

Cheng, K., Cameron, J.D., Tung, M., Mottram, P.M., Meredith, I.T., & Hope, S.A. (2012). Association of left ventricular motion and central augmentation index in healthy young men. *J Hypertens, 30*(12), 2395–2402. doi:10.1097/HJH.0b013e328358bee2

Chung, C.M., Lin, Y.S., Chu, C.M., Chang, S.T., Cheng, H.W., Yang, T.Y., … Hsu, J.T. (2012). Arterial stiffness is the independent factor of left ventricular hypertrophy determined by electrocardiogram. *Am J Med Sci, 344*(3), 190–193. doi:10.1097/MAJ.0b013e318242a354

Davies, J.E., Baksi, J., Francis, D.P., Hadjiloizou, N., Whinnett, Z.I., Manisty, C.H., … Hughes, A.D. (2010). The arterial reservoir pressure increases with aging and is the major determinant of the aortic augmentation index. *Am J Physiol Heart Circ Physiol, 298*(2), H580–586. doi:10.1152/ajpheart.00875.2009

Davies, J.E., Hadjilizou, N., Leibovich, D., Malaweera, A., Alastruey-Arimon, J., Whinnett, Z.I., … Hughes, A.D. (2007). Importance of the aortic reservoir in determining the shape of the arterial pressure waveform—the forgotten lessons of frank. *Artery Research, 1*, 40–45.

De Silva, D., Woon, F.P., Chen, C., Chang, H.M., Kingwell, B., Cameron, J., & Wong, M.C. (2008). Profile and associations of central pulse wave velocity and central pulse pressure among ischemic stroke patients. *Eur J Neurol, 15*(2), 196–198. doi:10.1111/j.1468-1331.2007.02024.x

Dernellis, J., & Panaretou, M. (2005). Aortic stiffness is an independent predictor of progression to hypertension in nonhypertensive subjects. *Hypertension, 45*(3), 426–431. doi:10.1161/01.HYP.0000157818.58878.93

Glasser, S.P., Halberg, D.L., Sands, C., Gamboa, C.M., Muntner, P., & Safford, M. (2014). Is pulse pressure an independent risk factor for

incident acute coronary heart disease events? The REGARDS study. *Am J Hypertens, 27*(4), 555–563. doi:10.1093/ajh/hpt168

Hermeling, E., Vermeersch, S.J., Rietzschel, E.R., de Buyzere, M.L., Gillebert, T.C., van de Laar, R.J., … Reesink, K.D. (2012). The change in arterial stiffness over the cardiac cycle rather than diastolic stiffness is independently associated with left ventricular mass index in healthy middle-aged individuals. *J Hypertens, 30*(2), 396–402. doi:10.1097/HJH.0b013e32834e4b75

Hughes, A.D., Park, C., Davies, J., Francis, D., Mc, G.T.S.A., Mayet, J., & Parker, K.H. (2013). Limitations of augmentation index in the assessment of wave reflection in normotensive healthy individuals. *PLoS One, 8*(3), e59371. doi:10.1371/journal.pone.0059371

Jachymczyk, T., Cwynar, M., Zyczkowska, J., Klich-Raczka, A., Wizner, B., & Grodzicki, T. (2006). Arterial stiffness is increased in hypertensive centenarians. *Blood Press, 15*(6), 362–366.

Jerrard-Dunne, P., Mahmud, A., & Feely, J. (2008). Ambulatory arterial stiffness index, pulse wave velocity and augmentation index--interchangeable or mutually exclusive measures? *J Hypertens, 26*(3), 529–534. doi:10.1097/HJH.0b013e3282f35265

Kim, M.T., Kim, K.B., Juon, H.S., & Hill, M.N. (2000). Prevalence and factors associated with high blood pressure in Korean Americans. *Ethnic Disparities, 10*(3), 364–374.

Laurent, S., & Boutouyrie, P. (2007). Recent advances in arterial stiffness and wave reflection in human hypertension. *Hypertension, 49*(6), 1202–1206. doi:10.1161/HYPERTENSIONAHA.106.076166

Laurent, S., Cockcroft, J., Van Bortel, L., Boutouyrie, P., Giannattasio, C., Hayoz, D., … Struijker-Boudier, H. (2006). Expert consensus document on arterial stiffness: Methodological issues and clinical applications. *Eur Heart J, 27*(21), 2588–2605. doi:10.1093/eurheartj/ehl254

Laurent, S., Katsahian, S., Fassot, C., Tropeano, A.I., Gautier, I., Laloux, B., & Boutouyrie, P. (2003). Aortic stiffness is an independent predictor of fatal stroke in essential hypertension. *Stroke, 34*(5), 1203–1206. doi:10.1161/01.STR.0000065428.03209.64

Liao, D., Arnett, D.K., Tyroler, H.A., Riley, W.A., Chambless, L.E., Szklo, M., & Heiss, G. (1999). Arterial stiffness and the development of hypertension. The ARIC study. *Hypertension, 34*(2), 201–206.

Logan, J.G., & Barksdale, D.J. (2013). Pulse wave velocity in Korean American men and women. *J Cardiovasc Nurs, 28*(1), 90–96. doi:10.1097/JCN.0b013e3182376685

Mackenzie, I.S., Wilkinson, I.B., & Cockcroft, J.R. (2002). Assessment of arterial stiffness in clinical practice. *QJM, 95*(2), 67–74.

Matsui, Y., Ishikawa, J., Shibasaki, S., Shimada, K., & Kario, K. (2011). Association between home arterial stiffness index and target organ damage in hypertension: Comparison with pulse wave velocity and augmentation index. *Atherosclerosis, 219*(2), 637–642. doi:10.1016/j.atherosclerosis.2011.09.027

McEniery, C.M., Yasmin, Hall, I.R., Qasem, A., Wilkinson, I.B., Cockcroft, J.R., & Investigators, A. (2005). Normal vascular aging: Differential effects on wave reflection and aortic pulse wave velocity: The Anglo-Cardiff Collaborative Trial (ACCT). *J Am Coll Cardiol, 46*(9), 1753–1760. doi:10.1016/j.jacc.2005.07.037

Miljkovic, D., Perret-Guillaume, C., Alla, F., Salvi, P., Erpelding, M.L., & Benetos, A. (2013). Correlation between peripheral blood pressure and pulse-wave velocity values in the institutionalized elderly persons 80 years of age and older: The PARTAGE study. *Am J Hypertens, 26*(2), 163–173. doi:10.1093/ajh/hps042

Millasseau, S.C., Stewart, A.D., Patel, S.J., Redwood, S.R., & Chowienczyk, P.J. (2005). Evaluation of carotid-femoral pulse wave velocity: Influence of timing algorithm and heart rate. *Hypertension, 45*(2), 222–226. doi:10.1161/01.HYP.0000154229.97341.d2

Mitchell, G.F., Hwang, S.J., Vasan, R.S., Larson, M.G., Pencina, M.J., Hamburg, N.M., … Benjamin, E.J. (2010). Arterial stiffness and cardiovascular events: The Framingham Heart Study. *Circulation, 121*(4), 505–511. doi:10.1161/CIRCULATIONAHA.109.886655

Mohiuddin, M.W., Rihani, R.J., Laine, G.A., & Quick, C.M. (2012). Increasing pulse wave velocity in a realistic cardiovascular model does not increase pulse pressure with age. *Am J Physiol Heart Circ Physiol, 303*(1), H116–125. doi:10.1152/ajpheart.00801.2011

Moon, J. Y., Park, S., Ahn, C.M., Cho, J.R., Park, C.M., Ko, Y.G., … Chung, N. (2008). Increase of metabolic syndrome score is an independent determinant of increasing pulse pressure. *Yonsei Med J, 49*(1), 63–70. doi:10.3349/ymj.2008.49.1.63

Nilsson, P.M., Khalili, P., & Franklin, S.S. (2013). Blood pressure and pulse wave velocity as metrics for evaluating pathologic ageing of the cardiovascular system. *Blood Press*. doi:10.3109/08037051.2013.796142

Nurnberger, J., Dammer, S., Opazo Saez, A., Philipp, T., & Schafers, R.F. (2003). Diastolic blood pressure is an important determinant of augmentation index and pulse wave velocity in young, healthy males. *J Hum Hypertens, 17*(3), 153–158. doi:10.1038/sj.jhh.1001526

O'Rourke, M.F., Pauca, A., & Jiang, X.J. (2001). Pulse wave analysis. *Br J Clin Pharmacol, 51*(6), 507–522.

O'Rourke, M.F., & Pauca, A.L. (2004). Augmentation of the aortic and central arterial pressure waveform. *Blood Press Monit, 9*(4), 179–185.

Safar, M.E., Levy, B.I., & Struijker-Boudier, H. (2003). Current perspectives on arterial stiffness and pulse pressure in hypertension and cardiovascular diseases. *Circulation, 107*(22), 2864–2869. doi:10.1161/01.CIR.0000069826.36125.B4

Sakurai, M., Yamakado, T., Kurachi, H., Kato, T., Kuroda, K., Ishisu, R., … Ito, M. (2007). The relationship between aortic augmentation index and pulse wave velocity: an invasive study. *J Hypertens, 25*(2), 391–397. doi:10.1097/HJH.0b013e3280115b7c

Schultz, M.G., Davies, J.E., Roberts-Thomson, P., Black, J.A., Hughes, A.D., & Sharman, J.E. (2013). Exercise central (aortic) blood pressure is predominantly driven by forward traveling waves, not wave reflection. *Hypertension, 62*(1), 175–182. doi:10.1161/HYPERTENSIONAHA.111.00584

Song, B.G., Park, J.B., Cho, S.J., Lee, S.Y., Kim, J.H., Choi, S.M., … Park, S.W. (2009). Pulse wave velocity is more closely associated with cardiovascular risk than augmentation index in the relatively low-risk population. *Heart Vessels, 24*(6), 413–418. doi:10.1007/s00380-009-1146-1

Stoner, L., Young, J.M., & Fryer, S. (2012). Assessments of arterial stiffness and endothelial function using pulse wave analysis. *Int J Vasc Med, 2012*, 903107. doi:10.1155/2012/903107

Suh, M., Barksdale, D.J., & Logan, J.G. (2014). Morning blood pressure surge and nighttime blood pressure in relation to nocturnal sleep pattern and arterial stiffness. *J Cardiovasc Nurs, 29*(2), E10–17. doi:10.1097/JCN.0b013e318291ee43

Tomiyama, H., Yamashina, A., Arai, T., Hirose, K., Koji, Y., Chikamori, T., … Hinohara, S. (2003). Influences of age and gender on results of noninvasive brachial-ankle pulse wave velocity measurement—A survey of 12,517 subjects. *Atherosclerosis, 166*(2), 303–309.

Vermeersch, S.J., Rietzschel, E.R., De Buyzere, M.L., De Bacquer, D., De Backer, G., Van Bortel, L.M., … Segers, P. (2008). Age and gender related patterns in carotid-femoral PWV and carotid and femoral stiffness in a large healthy, middle-aged population. *J Hypertens, 26*(7), 1411–1419. doi:10.1097/HJH.0b013e3282ffac00

Vlachopoulos, C., Aznaouridis, K., & Stefanadis, C. (2010). Prediction of cardiovascular events and all-cause mortality with arterial stiffness: A systematic review and meta-analysis. *J Am Coll Cardiol, 55*(13), 1318–1327. doi:10.1016/j.jacc.2009.10.061

Vyas, M., Izzo, J.L., Jr., Lacourciere, Y., Arnold, J.M., Dunlap, M.E., Amato, J.L., … Mitchell, G.F. (2007). Augmentation index and central aortic stiffness in middle-aged to elderly individuals. *Am J Hypertens, 20*(6), 642–647. doi:10.1016/j.amjhyper.2007.01.008

Wimmer, N.J., Sathi, K., Chen, T.L., Townsend, R.R., & Cohen, D.L. (2007). Comparison of pulse wave analysis between persons with white coat hypertension and normotensive persons. *J Clin Hypertens (Greenwich), 9*(7), 513–517.

Yang, W.I., Park, S., Youn, J.C., Son, N.H., Lee, S.H., Kang, S.M., & Jang, Y. (2011). Augmentation index association with reactive hyperemia as assessed by peripheral arterial tonometry in hypertension. *Am J Hypertens, 24*(11), 1234–1238. doi:10.1038/ajh.2011.132

Yasmin, & Brown, M.J. (1999). Similarities and differences between augmentation index and pulse wave velocity in the assessment of arterial stiffness. *QJM, 92*(10), 595–600.

Canadian Journal of Cardiovascular Nursing

Author Guidelines

Information for Authors

The Canadian Journal of Cardiovascular Nursing (CJCN) publishes four issues annually, featuring articles in both French and English. CJCN welcomes original articles dealing with research findings or issues relating to cardiovascular health and illness.

The Journal provides a forum for:

- Research Papers
- Short Reports
- Reviews
- Commentaries and Responses to Commentaries
- Discourse Relevant to Cardiovascular Nursing
- Case Studies
- Arts Informed Scholarship

Letters to the Editor in response to our articles or columns are encouraged.

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The manuscript should be sent by email to: Canadian Council of Cardiovascular Nurses, email: **david@cccn.ca**

All manuscripts submitted to CJCN must include the following:

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Other contributing individuals and sources of research funding that resulted in this manuscript may appear in the acknowledgement section of the paper.

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