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What Makes the Heart 'Tick'?—The Cardiovascular Implications of Lyme Disease

Crystal Blakely, RN, MN, CCNC(C)

Abstract

Lyme disease is currently on the rise, reaching endemic proportions in more than 40 communities across Canada. Health Canada has recommended that healthcare professionals further their knowledge of the disease process in order to facilitate timely diagnosis and treatment and to improve patient outcomes. The intention of this review article is to provide cardiovascular specialists with an overview of the prevalence, epidemiology and stages of Lyme disease, focusing on the topic of Lyme carditis, an early disseminated complication of Lyme disease that directly impacts the cardiovascular system. With prompt recognition and treatment, acute Lyme carditis is reversible. As such, cardiovascular

specialists play a pivotal role in caring for this patient population. Evidence-based practices for screening, diagnosis and treatment of Lyme carditis will be discussed by summarizing the literature that currently informs clinical practice. A case study will be used to illustrate these concepts. Given the emerging state of Lyme disease, increased awareness and education will be necessary to address current diagnostic, treatment and research gaps.

Key words: Lyme disease, Lyme carditis, screening, diagnosis, treatment, guidelines

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Clinical Highlights

- Lyme disease is on the rise and has reached endemic proportions in more than 40 communities across Canada.
- Lyme carditis is an early disseminated complication of Lyme disease that results in a variety of cardiovascular manifestations, most commonly conduction abnormalities involving the AV node.
- Lyme carditis is reversible with prompt treatment and, as such, cardiovascular specialists must be competent in screening, diagnosis and treatment practices in order to avoid misdiagnosis or devastating complications. Current guidelines for Lyme carditis involve early recognition of symptoms and exposure risk, diagnosis using two-tier serologic testing and treatment with antibiotics and clinical management of cardiovascular symptoms.
- Future research priorities that focus on evidence-based screening and treatment tools, as well as trials that evaluate current treatment regimens, will be essential in prevention of Lyme disease, and educational initiatives that aim to increase awareness of both the public and healthcare professionals will also be imperative.

Lyme disease is a serious, tick-borne infection that poses a significant public health risk, as it approaches endemic proportions throughout Canada. Lyme disease is caused by the spirochete *Borrelia burgdorferi*, a gram-negative bacterial infection that is transmitted to human hosts via infected ticks (Forrester & Mead, 2014). If left untreated, the bacteria disseminate, invading various parts of the body including the skin, joints, nervous system and heart (Wormser et al., 2006). Since becoming a reportable disease in Canada in 2009, the number of confirmed cases of Lyme disease has steadily increased each year (Government of Canada, 2017a). As a result, Health

Canada (2017) has recommended that healthcare professionals familiarize themselves and further their knowledge of Lyme disease in order to facilitate early diagnosis and treatment to reduce complications associated with the disease.

Objectives

The purpose of this clinical review article is to discuss the epidemiology, prevalence and stages of Lyme disease, with a focus on Lyme carditis, an early disseminated complication that impacts the cardiovascular system of the human host. The intention is to educate cardiovascular specialists by summarizing evidence-based practices for screening, diagnosis and treatment of Lyme carditis, concluding with a discussion of the implications for practice, future research opportunities and educational initiatives. This will enable cardiovascular specialists to gain a deeper understanding of the clinical needs of this patient population that can then be applied to their current and future clinical practice.

Literature Review

A literature search was completed in order to collect a compilation of relevant publications on the topic of Lyme disease and Lyme carditis. The Athabasca University library site was used to access the following databases for the search process: CINAHL, EBSCOHost, Medline, PUBMED and ProQuest Nursing and Allied Health. Select key words and phrases were used for the search process including Lyme disease, Lyme carditis, screening, diagnosis, treatment, guidelines, AV block, symptoms, *Borrelia burgdorferi*, and serology. The literature search was limited to scholarly, peer-reviewed articles and government reports that were accessible in full text, written in the English language and ranging in dates from 1999–2018.

Background

Lyme disease is the most common vector-borne disease in Canada (Government of Canada, 2017a). Since becoming a nationally reportable disease in 2009, there has been a six-fold increase in the number of Lyme disease cases, with the national incidence per 100,000 population increasing from 0.4 to 2.6 (Gasmi, et al., 2017; Government of Canada, 2017a). This increase is due to various factors including climate change, land management, biodiversity, human interaction with nature and an increase in the awareness of Lyme disease (Pearson, 2014). The risk for contracting Lyme disease occurs where infected tick populations have become established, known as endemic risk areas (Ogden, Koffi, Pelcat, & Lindsay, 2014). Lyme disease endemic risk areas are defined as a locality in which there is evidence of reproducing populations of known tick vectors and the transmission of *Borrelia burgdorferi* is likely, based on evidence from active surveillance methods (Government of Canada, 2017a). These endemic areas include rural, woodland and parkland areas along the border of Canada and the United States in the provinces of British Columbia, Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia (Government of Canada, 2017b). It is essential for public, primary and acute care healthcare professionals, especially physicians, nurses and nurse practitioners working in endemic areas, to understand the epidemiology and pathophysiology of Lyme disease, to build awareness regarding the prevalence and risk factors for contracting Lyme disease and to understand the stages of Lyme disease and the associated clinical signs and symptoms to facilitate early diagnosis and treatment.

Epidemiology and Pathophysiology of Lyme Disease

There are a variety of tick species in Canada. However, only two types are known to carry *Borrelia burgdorferi*. These include two types of black-legged ticks, *Ixodes scapularis* in Central and Eastern Canada, and *Ixodes pacificus* in Western Canada (Gasmi et al., 2017). Lyme disease endemic risk areas have been identified in more than 40 communities throughout Canada, with the majority of cases being reported from Ontario, Quebec and Nova Scotia (see Figure 1) (Government of Canada, 2017b). In terms of demographics, individuals at risk include those living in endemic areas, with a slight predominance of reported cases involving males (56%) versus females (44%), and the highest incidence occurring in adults aged 45 to 74 years and children aged five to

nine years (Gasmi et al., 2017). Ticks have a two-year life span, consisting of larval, nymph and adult stages of development and are most active during the spring and summer months (Government of Canada, 2017b). As a result, Lyme disease surveillance data report that 96% of cases in Canada occur between May and November, when ticks are active and Canadians spend more time outdoors (Gasmi et al., 2017).

The risk of disease transmission requires the human host having contact with an infected tick and the odds of contracting infection are directly related to the duration of tick attachment and feeding time (Hatchette, Davis, & Johnston, 2014). The spirochete *Borrelia burgdorferi* migrates from the stomach to the salivary glands of the infected tick before it can be injected to the human host, a process that ranges from 36 to 48 hours (Hatchette et al., 2014; Vasudevan & Chatterjee, 2013). Timely removal of the tick (within this 36- to 48-hour time period) can prevent bacterial transmission and, therefore, decrease the risk of infection (Scheffold, Herkommer, Kandolf, & May, 2015). Once attachment occurs, however, the bacteria are able to invade the tissues and activate various inflammatory mediators in the human host, creating a progressive inflammatory response. As the bacteria disseminates, the host defence mechanisms are compromised resulting in clinical manifestations (Vasudevan & Chatterjee, 2013). The progression of inflammatory response occurs in stages.

Stages of Lyme Disease

The clinical manifestations of Lyme disease are dependent on the time from exposure and the progressive degree of infection. The specific symptoms and treatment depend

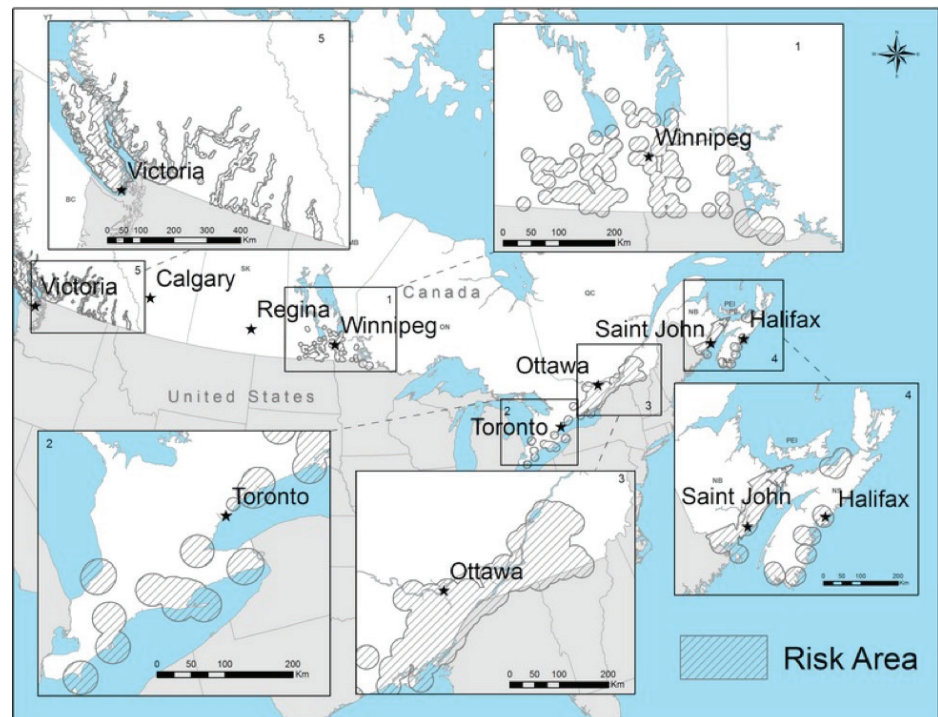


Figure 1: Lyme Disease Risk Areas in Canada. (Government of Canada, 2017b)

on the stages of the disease, which are categorized as early localized disease, early disseminated disease and late disseminated disease (Government of Canada, 2017c). Recognition of these symptoms, in addition to screening patients for risk of exposure, is essential in determining diagnosis.

Early localized Lyme disease. Early localized Lyme disease occurs days to weeks post infection (Government of Canada, 2017c). This phase is characterized by an acute illness presentation manifested by vague symptoms including fever, fatigue, malaise, lethargy, headache, neck stiffness, myalgias and arthralgias (Government of Canada, 2017c). The hallmark sign of Lyme disease at this stage is the appearance of a single skin lesion known as erythema migrans (EM), often resembling the shape of a bullseye (Shapiro, 2014). This usually begins as a small area of painless, non-pruritic erythema at the site of the tick bite that enlarges over time and can occur anywhere on the body (Hatchette et al., 2014; Shapiro, 2014). However, not all patients will present with EM or may present with variant forms of EM including blisters, solid or crusted lesions, bruise-like patterns, etc., which can easily be mistaken for some other type of skin disorder or infection (Government of Canada, 2017c). The symptoms of Lyme disease at this stage often mimic those of other potential viral illnesses. If EM is not present or goes undetected and health-care professionals fail to recognize a patient at risk of exposure, diagnosis at this stage may be delayed or missed. If left untreated in this early phase, the bacteria continue to spread further leading to the early disseminated stage of the disease.

Early disseminated Lyme disease. Early disseminated Lyme disease occurs weeks to months post infection, where the untreated bacteria disseminate via the bloodstream to other body tissues and is characterized by multiple EM lesions and/or acute neurological and cardiovascular symptoms (Government of Canada, 2017c). Neurologic symptoms may include meningitis, cranial neuropathy, facial nerve palsy, sensory and motor neuropathy. Cardiovascular symptoms may include varying degrees of atrioventricular (AV) block, tachyarrhythmias, myocarditis, pericarditis, syncope, dyspnea and chest pain (Government of Canada, 2017c).

Late disseminated Lyme disease. When Lyme disease remains untreated through the first two stages, late disseminated disease occurs. Late disseminated disease presents months to years post infection and is characterized by intermittent or persistent musculoskeletal and neurological manifestations including, but not limited to arthritis, joint swelling, encephalopathy, neuropathy and encephalomyelitis (Government of Canada, 2017c).

Any of these symptoms should promote a high index of suspicion for Lyme disease as a differential diagnosis, as the disease often mimics other infectious, rheumatologic or malignant conditions (Gatewood & Kim, 2014). This is especially true in endemic areas and during peak seasons. It is

during the early disseminated stages of the disease when symptoms start impacting individual systems of the host. These can result in serious complications, particularly when the cardiovascular system is impacted.

Overview of Lyme Carditis

Lyme carditis is a rare, early disseminated complication of untreated Lyme disease. Of the reported cases in Canada from 2009 to 2015, cardiac manifestations were noted in only 3.6% of cases, most commonly among adults aged 20 to 44 years (Gasmi et al., 2017). This is consistent with the literature where Lyme carditis is estimated to occur between 1% and 10% of cases (Forrester & Mead, 2014; Hu, 2016; Krause & Bockenstedt, 2013). Furthermore, the literature indicates a slight male predominance in Lyme carditis, with an approximate ratio of 3:1 in males versus females (Hu, 2016; Krause & Bockenstedt, 2013; Scheffold et al., 2015).

Lyme carditis occurs when the *Borrelia burgdorferi* spirochetes directly invade the tissues of the heart causing inflammation (Forrester & Mead, 2014). It can infect all parts of the heart, including the conduction system, the inner and outer membranes of the heart, the heart muscle and, in rare cases, the blood vessels or heart valves (Krause & Bockenstedt, 2013). The condition is rarely fatal, but is associated with an array of cardiovascular symptoms. Patients present with complaints of light-headedness, syncope, palpitations, dyspnea and/or chest pain with or without co-existing Lyme disease symptoms (Forrester & Mead, 2014; Hu, 2016; Krause & Bockenstedt, 2013). The most common finding is conduction abnormalities due to inflammation of the electrical system of the heart, particularly around the AV node, which can lead to varying degrees of AV block with rapid progression from first to third degree (Wan, Blakely, Branscombe, Suarez-Fuster, Glover & Baranchuk, 2018; Suarez-Fuster, Gul & Baranchuk, 2017). Patients with prolonged PR interval (greater than 300 milliseconds) on electrocardiogram (ECG) are at highest risk and are usually the most symptomatic (Hu, 2016). Other conduction abnormalities have also been identified, but are much less common, including sinoatrial (SA) nodal dysfunction, tachyarrhythmias, fascicular blocks and bundle branch blocks (Hu, 2016). Lyme carditis can also contribute to evidence of pericardial and myocardial involvement. However, cases are usually mild and self-limiting (Hu, 2016). Rarely, pericardial effusion and reduced left ventricular (LV) function may be noted on echocardiogram. Patients with myocardial or pericardial involvement show non-specific ST and T wave abnormalities on ECG (Hu, 2016; Krause & Bockenstedt, 2013; Manek, Kulkarni, & Viera, 2014).

With prompt recognition and early treatment, Lyme carditis is reversible (Wan et al., 2018; Suarez-Fuster et al., 2017). However, this requires cardiovascular specialists, including cardiovascular nurses, to not only recognize the clinical signs and symptoms, but also to appropriately screen and diagnose patients for potential Lyme disease in order to

facilitate early treatment to avoid long-term complications and unnecessary invasive procedures.

Due to the rarity of Lyme carditis, most of the available empirical data and research are based on individual case reports or case series involving limited numbers of patients. Lyme carditis was first described in the 1980s in a case series of 20 patients (Steere et al., 1980). The findings from these cases describe a classic clinical picture of Lyme carditis that consists of new onset AV conduction disturbances, especially in young adults, with or without symptoms of myo-pericarditis and a history of or existing EM or tick bite. Given the increasing prevalence of Lyme disease in Canada, cardiovascular specialists can expect an associated rise in patients presenting with cardiovascular complications secondary to Lyme disease. The use of screening practices, diagnostic methods and treatment strategies that are evidence-based will ensure patients presenting with Lyme carditis will receive high-quality care across various cardiovascular settings.

Screening for Lyme Carditis

Proper screening for Lyme carditis starts with an awareness of Lyme disease itself. Cardiovascular specialists must appreciate not only the risk for exposure to Lyme disease, but must also be competent in identifying the cardiovascular signs and symptoms associated with early disseminated infection. Forrester and Mead (2014) state that cardiovascular specialists should consider Lyme disease as a potential differential diagnosis for those presenting with cardiovascular symptoms and who live in or have visited a known endemic area. Furthermore, any patient presenting with other signs and symptoms of Lyme disease should also be investigated for potential cardiac involvement. This requires cardiovascular specialists to complete a thorough clinical history and physical exam to determine patient risk. The clinical history should include questions about the patient's prior exposure, history of tick bites, travel to endemic risk areas, presence of previous or current EM lesions and co-presenting symptoms (i.e., flu-like symptoms, neurological deficits, etc.), including any timelines for the presentation of symptoms to assist with potential diagnosis (Hu, 2016). For those patients who screen positive for possible or probable Lyme carditis, further investigations to diagnose Lyme carditis are warranted. Depending on the severity of symptoms, patients with a strong clinical suspicion for Lyme carditis should be admitted to hospital for close monitoring of symptoms, diagnostic work-up and response to treatment.

Diagnosis of Lyme Carditis

The diagnosis of Lyme carditis is primarily based on clinical findings including a history of Lyme exposure and the presence of symptoms of early disseminated disease. Cardiovascular specialists should initiate baseline investigations for suspected cases of Lyme carditis to either confirm or negate the clinical diagnosis. The Government of Canada (2017d) provides definitions for both confirmed and probable cases

of Lyme disease. A confirmed Lyme disease case requires clinical evidence of illness with laboratory confirmation by either isolation of *Borrelia burgdorferi* from an appropriate clinical specimen or detection of the bacteria DNA by tissue biopsy. A confirmed case can also be made by clinical evidence of illness with a history of residence in, or visitation to an endemic risk area and with positive laboratory evidence of infection. A probable case of Lyme disease requires one of two scenarios: 1) clinical evidence of illness without a history of residence in, or visitation to an endemic risk area, but with laboratory evidence of infection, or 2) clinician observed EM without laboratory evidence, but with a history of residence in, or visitation to an endemic risk area (Government of Canada, 2017d).

Investigations that support a probable diagnosis when clinical findings and history suggest a suspicion of Lyme carditis include laboratory values that measure inflammatory markers (i.e., C-reactive protein), ECG, echocardiogram and cardiac magnetic resonance imaging (MRI) (Pearson, 2014). According to Scheffold et al. (2015), approximately 60% of patients with Lyme carditis show ST segment depression or T wave inversions, most prominently in the infero-lateral leads on ECG. These changes resolve once treatment is initiated and the patient goes into clinical remission. Review of several case series report a high prevalence of AV block, fluctuating between first, second and third degree on ECG. First degree AV block is the most common finding, with prevalence between 87% and 90% of reported cases. Progression to third degree AV block is also frequent, especially in cases where the PR interval exceeds 300 milliseconds, with prevalence ranging from 44% to 53% (Hu, 2016; Scheffold et al., 2015). Echocardiogram and cardiac MRI are useful in determining pericardial and myocardial involvement. Cardiac MRI assists in identifying the edema of the myocardial wall caused by the inflammatory process of Lyme carditis (Scheffold et al., 2015).

There are two gold standard investigations that confirm Lyme carditis, including myocardial biopsy and two-tier serologic testing in the context of clinical manifestations and history of Lyme exposure (Lindsay, Bernat, & Dibernardo, 2014; Scheffold et al., 2015). In Lyme carditis, myocardial biopsy indicates trans-mural inflammation and lymphocytic infiltrates due to the spirochetal invasion of the tissues between the muscle fibres or the endocardium (Scheffold et al., 2015). Polymerase chain reaction (PMR) assay, which detects *Borrelia burgdorferi* DNA in the biopsy sample allows for diagnosis of Lyme carditis. However, the test is expensive, invasive and requires up to eight weeks of incubation, which limits the ability to attain a timely clinical diagnosis (Lindsay et al., 2014). According to Lindsay et al. (2014), serology is the only form of standardized laboratory testing available for the diagnosis of Lyme disease with cardiac involvement and requires an adequate immune response with production of antibodies to *Borrelia burgdorferi*. The immune response

to the infection is evidenced by the appearance of IgM antibodies in the serum that usually occur within two weeks of the tick bite and persist for months or years despite treatment (Lindsay et al., 2014). IgG antibodies develop approximately one month after infection. A two-tiered approach using enzyme immunoassay (EIA) and Western Blot (WB) tests is currently recommended by the Canadian Public Health Laboratory Network for Lyme disease testing, allowing sensitivity and specificity of the two tests combined to be maximized (Lindsay et al., 2014). EIA is the screening test used to detect IgM and/or IgG antibodies in the serum. The benefit to this test is that it is highly sensitive, but lacks specificity. This screening process has lower sensitivity in the early stage of disease and may produce false negative results (Lindsay et al., 2014). Likewise, certain medical conditions (e.g., infectious mononucleosis, systemic lupus erythematosus, syphilis, etc.) can create false positive results (Pearson, 2014). If the result of the EIA is negative, the second tier of testing is not required unless symptoms persist. In this case, EIA should be repeated with a second sample several weeks after the first screen. For those samples that test positive or equivocal, the second-tier WB test is completed. A positive WB result confirms exposure to *Borrelia burgdorferi* and provides definitive evidence of recent infection of Lyme disease (Lindsay et al., 2014). Serological testing is considered positive when the EIA is reactive (positive or equivocal) and the WB is also positive (Lindsay et al., 2014). Shapiro (2014) indicates that the sensitivity of two-tier testing in early disseminated disease is 80% to 100%. Despite the relatively high sensitivity and specificity of serology in the early disseminated phase of Lyme disease, as in Lyme carditis, serological results should always be interpreted with caution and in the context of clinical symptoms. Negative serology results do not necessarily rule out early phases of the disease and, as a result, treatment should never be delayed if the patient exhibits the clinical signs and symptoms of Lyme disease with a high probability of exposure risk.

Treatment of Lyme Carditis

With early treatment, Lyme carditis carries an overall positive prognosis, with complete resolution of symptoms. However, the evidence for optimal treatment regimens is limited. Treatment of Lyme carditis is two-fold and involves management of the symptoms from cardiovascular manifestations and elimination of the bacterial infection with antibiotic therapy (Hu, 2017; Wormser et al., 2006). Cardiovascular nurses are required to monitor the patient for progression and/or waning of symptoms in addition to the patient's overall response to treatment.

Antibiotic therapy. Eradication of the bacterial infection that causes Lyme disease is the primary goal of treatment, which requires a course of antibiotic therapy as the first line of treatment in Lyme carditis (Wormser et al., 2006). There are conflicting opinions in the literature about the

most effective type of antibiotic and the duration of treatment. This is mainly due to the lack of available evidence to inform these decisions and, as a result, there are challenges to support standardizing such recommendations in clinical practice. A number of clinical trials were conducted in the late 1980s and early to mid-1990s that compared outcomes of various antibiotics in the treatment of Lyme disease. However, these trials were based on small samples sizes and had design limitations that impact their generalizability. Loewen, Marra and Marra (1999) evaluated 11 therapy trials and found data to support the use of oral beta-lactam antimicrobials (i.e., penicillin V, amoxicillin and cefuroxime) and oral tetracyclines (i.e., doxycycline) as the most effective in first-line treatment of Lyme disease with oral macrolides (i.e., azithromycin, erythromycin, etc.) considered second-line treatments. These findings have persisted throughout the years as more evidence becomes available, with rates of cure for first-line treatments at approximately 90% and rates of cure for second-line treatments at approximately 80% (Shapiro, 2014).

Based on the available evidence, best practice guidelines for the treatment of Lyme disease have been developed by two professional organizations including the Infectious Diseases Society of America (IDSA) and the International Lyme and Associated Diseases Society (ILADS). Unfortunately, discrepancies exist between the two documents, making it challenging for healthcare professionals to make consistent clinical decisions when treating this patient population. The two main considerations when deciding on the course of antibiotic treatment for Lyme disease is the type of antibiotic and the duration of treatment. The ILADS recommends oral amoxicillin, cefuroxime or doxycycline as first-line agents in Lyme disease treatment with doxycycline being the preferred medication in the absence of contraindications. Intravenous (IV) route of administration is recommended in patients with disease progression or recurrence with either penicillin G benzathine or ceftriaxone (Cameron, Johnson, & Maloney, 2014). Cameron et al. (2014) found that treatment regimens of 20 days or less were associated with higher failure rates, between 52% and 84%. Therefore, the recommended treatment duration is a minimum of 21 days, with ongoing assessment for symptom resolution and continuation of treatment for those patients who have not fully recovered by the completion of therapy (Cameron et al., 2014). However, these recommendations are based on low-quality evidence.

The recommendations made by the ILADS are somewhat inconsistent to the recommendations made by the IDSA. The IDSA also recommends oral doxycycline, amoxicillin and cefuroxime as first-line agents, but only in the absence of disseminated disease (Wormser et al., 2006). Recommendations for the treatment of Lyme carditis include initial treatment with IV ceftriaxone or penicillin G until signs and symptoms have resolved (Wormser et al., 2006). The recommendations for asymptomatic Lyme carditis are treated

with oral antibiotic therapy for a duration of 14 to 21 days. Patients with symptomatic Lyme carditis (i.e., syncope, high degree AV block, chest pain, dyspnea, etc.) should be admitted to hospital for continuous monitoring and initiation of IV antibiotics. Once the patient's symptoms resolve, they can be switched to an oral antibiotic for the completion of their therapy (Wormser et al., 2006). The recommendations made by the IDSA, similar to the recommendations made by the ILADS, are based on low-quality evidence, mainly cohort and case studies or expert opinion. Health Canada (2017) currently endorses the use of the treatment guidelines developed by the IDSA (see Table 1) (Public Health Agency of Canada, 2017).

Management of cardiovascular symptoms. In addition to antibiotic therapy, where the primary goal is disease eradication, patients can have a variety of cardiovascular symptoms secondary to Lyme carditis that require concurrent and supportive treatments. Patients who are symptomatic require hospitalization, cardiac monitoring and IV antibiotics (Hu, 2016). For patients with myocardial or pericardial involvement secondary to Lyme carditis, monitoring for signs and symptoms of heart failure or pericardial effusions including pain, shortness of breath, and arrhythmias is imperative for patient comfort and quality-of-life measures (Scheffold et al., 2015). Patients with second or third degree AV block may require temporary trans-venous pacemaker implantation until symptoms resolve (Suarez-Fuster et al., 2017). This requires admission to a hospital that is equipped with these services and capable of the monitoring required for this treatment (Forrester & Mead, 2014). Indications for temporary pacing in Lyme carditis are to treat severe symptoms or hemodynamic instability due to AV block and in cases where there is a reversible cause and permanent pacing is unlikely (Hayes, 2017). The limitations of this treatment are that patient mobility is limited and the patient requires a monitored bed for the duration of treatment. Once the patient's heart rhythm and hemodynamics stabilize, trans-venous pacing can be discontinued. However, monitoring should continue for an additional 24 to 48 hours (Hu, 2016).

Given the number of clinical variables that must be considered for patients presenting with Lyme carditis, and due to the lack of available evidence that can be used to assist in the development of high-quality standardized screening, diagnostic and treatment guidelines, clinical judgment becomes critical to the provision of high-quality care. These implications to practice affect not only the role of cardiovascular specialists and the care they provide this patient population, but also create future research opportunities and a necessity for educational initiatives that focus on increasing awareness.

Implications for Practice

To demonstrate the importance of the role of cardiovascular specialists in the screening, diagnosis and treatment of Lyme carditis, consider the following clinical case scenario. A

30-year-old male presents to a rural community hospital after noticing a left facial droop while playing hockey. He reports recent symptoms of fatigue, body aches, fever, chills and a headache. Physical exam findings are unremarkable and the patient is discharged home on prednisone with a diagnosis of Bell's palsy secondary to an unknown viral infection. Five days later, the patient experiences several episodes of syncope along with exercise intolerance. ECG on arrival shows a high-degree AV block that rapidly progresses to third-degree AV block and hemodynamic instability, requiring insertion of a temporary trans-venous pacemaker. Clinical history reveals that the patient experienced a "bug bite" several weeks prior and given the reported clinical manifestations, Lyme serology was sent and IV ceftriaxone 2 grams daily was initiated. The patient was transferred to the closest tertiary care centre for consideration of permanent pacemaker implantation. Given the potential for a reversible cause of heart block, the plan for permanent pacemaker was delayed and the patient was admitted to the coronary care unit for cardiac monitoring and continuation of IV antibiotics. Several days later, the clinical diagnosis was confirmed when the serology results came back positive for Lyme disease. His symptoms resolved six days after initiation of IV therapy at which point the temporary pacemaker was removed. He continued to experience

Table 1: Recommended Antimicrobial Regimes for the Treatment of Lyme Carditis

| Drug | Dosage for Adults | Duration |
|------------------------------|---|----------------------------|
| Preferred Oral Regimens | | |
| • Amoxicillin | 500 mg 3 times per day | 14 days (range 14–21 days) |
| • Doxycycline | 100 mg twice per day | 14 days (range 14–21 days) |
| • Cefuroxime axetil | 500 mg twice per day | 14 days (range 14–21 days) |
| Preferred Parenteral Regimen | | |
| • Ceftriaxone | 2 g once per day | 14 days (range 14–21 days) |
| Alternate | | |
| • Cefotaxime | 2 g once per day | 14 days (range 14–21 days) |
| • Penicillin G | 18–24 million units divided every 4 hours | 14 days (range 14–21 days) |

(Government of Canada, 2017c; Wormser, et al., 2006)¹

1. The Government of Canada endorses the guidelines recommended by the IDSA. This table represents the summary of these guidelines.

intermittent periods of varying degrees of AV block with complete resolution of symptoms after 10 days. A pre-discharge stress test was performed to test the stability of the AV block. The patient was able to exercise with no symptoms, maintaining 1:1 AV conduction at a heart rate of 167 beats per minute. The patient received education on prevention of future Lyme recurrence and was discharged home to complete four weeks of antibiotic therapy. Follow-up two weeks after discharge showed complete resolution of AV block with an ECG that showed normal sinus rhythm.

As this case demonstrates, the rural community hospital assessment failed to link the early signs of Lyme disease to the patient's clinical presentation. A misdiagnosis led to improper and delayed treatment. The second presentation, where a more thorough clinical history and symptom correlation were made, led to the proper diagnosis and treatment. Successful patient outcomes were achieved at this point through identification of symptoms, diagnosis and treatment to ensure eradication of the disease, and prevented the need for permanent pacemaker implantation. This provides the foundation for the implications to practice.

Role of the Cardiovascular Specialist

Cardiovascular specialists play an important role in screening patients with unexplained AV block and who experience cardiovascular symptoms, or other concurrent symptoms of Lyme disease. For those with a compatible history, who experience clinical signs and symptoms and who report risk of exposure, Lyme disease should be considered as a differential diagnosis. Cardiovascular specialists should take the steps necessary to confirm the clinical diagnosis by ordering and collecting Lyme serology, initiating the appropriate therapy based on current practice guidelines and providing the appropriate medical management of symptoms (i.e., temporary pacemaker). Cardiovascular specialists, particularly CV nurses, support the patient throughout the entire treatment trajectory, including close monitoring for progression of disease through to the resolution of symptoms. They educate patients and their families regarding the prevention of future Lyme disease exposure risk. This requires increasing awareness about the topic of Lyme disease. Healthcare professionals who are more practised in identifying, diagnosing and treating Lyme disease will achieve better patient outcomes by avoiding disseminated complications, such as Lyme carditis.

Future Research Opportunities

With the emerging state of Lyme disease in Canada and the increasing prevalence of cases, a number of government initiatives are currently underway to address the issue. Key priorities of the *Federal Framework on Lyme Disease Act* (Government of Canada, 2014), as well as the *Action Plan on Lyme Disease* (Public Health Agency of Canada, 2014), focus on research that increases awareness and knowledge of the disease, as well as actions to effectively diagnose and treat it (Hartmann, et al., 2014; Public Health Agency of

Canada, 2017). In addition, it is unclear whether prophylactic treatment of tick bites is effective in the prevention of disease. These are key research priorities moving forward. Challenges exist in the development of standardized tools and practice guidelines for screening and treatment due to the lack of high-quality research studies. This is because the majority of research on the topic of Lyme disease is based on case studies or case series and lack generalizability. However, the development of tools that can assist clinicians to identify and diagnose potential Lyme disease quickly and accurately are required to avoid disseminated complications associated with the disease. There is a need for further research that evaluates and validates current treatment protocols, as well as duration of treatment to address the inconsistencies across current practice guidelines so that clinicians are able to treat patients appropriately and consistently. This will lead to improvement in patient outcomes and help prevent misdiagnosis or unnecessary invasive procedures. Due to the rarity with which these cases are seen, collaboration between public, primary and acute care health professionals will be necessary to achieve high-quality research results.

Educational Initiatives

Lyme disease is a highly preventable disease (Krause & Bockenstedt, 2013). As a result, the *Federal Framework on Lyme Disease Act* (Government of Canada, 2014) and the *Action Plan on Lyme Disease* (Public Health Agency of Canada, 2014) focus on educational initiatives that raise public awareness in order to minimize risk of exposure, as well as to recognize early signs and symptoms of Lyme disease. These initiatives also focus on the education of healthcare professionals, who play an important role in not only educating patients about reducing exposure to Lyme disease, but also in the screening, diagnosis and treatment of Lyme disease. The Government of Canada should advocate for education on Lyme disease to be included in all healthcare program curriculum. Unfortunately, cardiovascular specialists see and treat patients who already have disseminated Lyme disease. However, they will play an important role in the dissemination of knowledge by continuing to share experiences and to help educate front-line and community allied healthcare professionals (i.e., primary care practitioners, nurse practitioners, emergency room practitioners, pharmacists, etc.) to recognize signs and symptoms early so that treatment can be initiated to avoid disseminated complications such as Lyme carditis.

Conclusion

Lyme disease is a serious infection that poses a significant risk to public health, as it reaches endemic proportions throughout Canada. The purpose of this review article was to provide cardiovascular specialists with an overview of the epidemiology, prevalence and stages of Lyme disease, focusing on the evidence-based practices related to Lyme carditis, an early disseminated complication of the disease. The

overview identified the role of the cardiovascular specialist in the screening, diagnosis and treatment of Lyme carditis. The need for future research and educational initiatives that increase awareness and knowledge related to Lyme disease were identified. Given the increase in prevalence of Lyme disease in Canada, more cases of Lyme carditis are expected. This review article provides cardiovascular specialists with a deeper understanding of the clinical needs of this unique patient population. ♥

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Investigating the Psychometric Properties of the Persian Version of Prodromal Symptoms-Screening Scale (PS-SS)

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Abstract

Background: Prodromal symptoms-screening scale (PS-SS) is used for screening people at risk of acute coronary syndrome (ACS) by examining the prodromal cardiac symptoms.

Purpose: This study was conducted to investigate the psychometric properties of PS-SS in patients with ACS in Iran.

Method: In this psychometric evaluation, PS-SS was translated into Persian, and the final version was completed by 196 patients with ACS without any history of cardiac disease and 205 healthy people in terms of cardiac status (the healthy group) at Imam Khomeini Hospital in Ardabil, Iran. The reliability and validity of the scale determined by Cronbach's alpha coefficient, content validity, construct validity, and criterion validity were investigated, and finally, its sensitivity and specificity were determined.

Findings: The PS-SS goodness of fit indices, including comparative fit index, goodness of fit index, and incremental fit index, higher than 0.9 and the internal consistency reliability ($\alpha = 0.75$) confirmed the PS-SS single-factor structure. Considering the higher scores in the patient group than in the healthy group ($p < 0.001$), the criterion validity of the scale was confirmed, but the sensitivity and specificity of PS-SS were calculated at the best state with the cut-off point of 18.5 (65.3 and 52.7).

Conclusion: This study showed that despite the confirmation of the psychometric properties of PS-SS, due to its low sensitivity and specificity, it has no diagnostic value for the screening of ACS in Iran.

Key words: acute coronary syndrome, psychometric, prodromal symptoms-screening scale, myocardial infarction

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Clinical Highlights

- Patients may experience some warning symptoms days and weeks before an ACS as prodromal symptoms.
- Prodromal symptoms are signs of an impending ACS. However, these symptoms are common and may also be experienced in people without coronary heart disease.
- The Prodromal Symptoms-Screening Scale is a tool that can indicate the presence of prodromal symptoms in people, but due to its low sensitivity and specificity, it cannot be considered as a valid tool for predicting ACS.

Background

Cardiovascular disease is one of the main causes of mortality globally. The mortality rate is estimated to be 17.3 million people per year (Mozaffarian et al., 2015; World Health Organization [WHO], 2017). Coronary heart disease, as a subset of cardiovascular disease, was responsible for 7.4 million deaths worldwide in 2015 (WHO, 2017). In Iran, cardiovascular disease, especially coronary heart disease, has been the primary cause of death in women and men (Forouzanfar et al., 2014).

Despite the high prevalence of coronary heart disease and its high mortality, 49%–95% of patients experience some

undiagnosed symptoms as prodromal symptoms before an acute coronary syndrome (ACS) (O'Keefe-McCarthy & Ready, 2016). Prodromal symptoms are signs of an imminent cardiac event that have a new onset or change in severity or frequency before the cardiac event and then disappear or return to previous levels (McSweeney et al., 2003). Anxiety, unusual fatigue, pain or discomfort in the arm, and shortness of breath are some of the symptoms that have been investigated in numerous studies (O'Keefe-McCarthy & Ready, 2016).

Because of the importance of prodromal symptoms and their role in the early diagnosis and effective treatment of coronary heart disease, recognizing these symptoms can reduce mortality due to coronary heart disease (Canto, Canto, & Goldberg, 2014; Mladenovic et al., 2008). In this regard, researchers have designed instruments to anticipate these incidents based on the prodromal symptoms.

The "McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey" is one such instrument that evaluates 30 prodromal myocardial infarction symptoms in women, but considering that it is designed only for women (McSweeney, O'Sullivan, Cody, & Crane, 2004; McSweeney et al., 2014), its effective and comprehensive use has limitations.

Another instrument is the Prodromal Symptoms-Screening Scale (PS-SS), which was introduced in 2016 by O'Keefe-McCarthy and Guo (2016) to predict acute coronary syndrome (unstable angina and myocardial infarction). It is the first instrument that, in addition to evaluating the prodromal cardiac symptoms in women, also evaluates these symptoms in men. The PS-SS is a nine-item scale based on the presence of each symptom and its intensity and frequency. A score of 0 to 10 is allocated to each item, and the total score ranges from 0 to 90 for the entire scale. The PS-SS instrument has been introduced as a two-factor structure, including prodromal-specific and non-specific symptoms (O'Keefe-McCarthy & Guo, 2016).

Considering that the PS-SS has been recently introduced and the initial psychometric properties of the instrument (factor analysis using exploratory factor analysis and internal consistency using Cronbach's alpha) have been confirmed by the scale designers in ACS samples in Canada, it needs to be further reviewed in terms of its validity, reliability, sensitivity, and specificity in other populations.

Purpose of the Study

This study was conducted to investigate the psychometric properties of PS-SS and its predictive value in ACS samples in Iran.

Method

The present study is a psychometric evaluation that examined the psychometric properties of the PS-SS retrospectively. This study was conducted at the Imam Khomeini Hospital, Ardabil, Iran.

Participants

A total of 401 participants were studied over a period of six months (from May to October 2017). They were divided into two groups based on their cardiac status: patients with ACS and healthy people. The former group consisted of 196 patients with a diagnosis of ACS, as determined by a cardiologist and hospitalization in CCU and heart ward of the Imam Khomeini Hospital, Ardabil (patient group). The latter group included 205 people without ACS and referred to the heart clinic of the hospital for cardiac check-ups and were diagnosed as being healthy after the required examinations of cardiac status that were performed by a cardiologist (healthy group).

The criteria for inclusion in the patient group were: (1) diagnosis of ACS by a cardiologist, (2) the ability to communicate verbally, (3) normal status in terms of cognitive function (according to the medical history and clinical record), (4) being Iranian, (5) able to understand the Persian language, (6) lack of history of ACS or other previously diagnosed cardiac diseases, and (7) having a stable physical condition.

The criteria for inclusion in the healthy group were: (1)

healthy in terms of cardiac status, as confirmed by a cardiologist, (2) the ability to communicate verbally, (3) the possibility of making telephone calls to enquire into the occurrence of ACS three months after sampling, and (4) normal status in terms of cognitive function (according to the medical history and clinical record). The participants in the healthy group were followed to detect the occurrence of ACS once in the next three months. All 208 participants in the healthy group were contacted after three months, and three patients were excluded from the study due the occurrence of a cardiac event; therefore the data of 205 people were used for the analysis.

Instruments

Questionnaires for collecting the demographic information and the Persian version of the PS-SS were used. The demographic questionnaire consisted of information related to participants' age, sex, and comorbidities. The PS-SS questionnaire consisted of nine items, of which eight asked about unusually located aches or pains, unusual fatigue, sleep disturbance, headaches, dizziness, shortness of breath, chest pain and anxiety, and the ninth asked about other symptoms, as reported by the individuals. Also, each symptom was assessed in terms of occurrence (No or Yes, scored 0 or 1, respectively), intensity (mild, moderate, and severe, scored 1-3), and frequency (daily, few times week, once a week, two to three times per month, once a month, and less than monthly, scored 6, 5, 4, 3, 2 and 1, respectively) (O'Keefe-McCarthy & Guo, 2016).

The eligible potential participants were invited to the study, and the first author explained the goal of the study and obtained written consent. All the participants were administered the demographic and PS-SS questionnaires. Questions were asked of both groups concerning the past three months. The questions related the first eight items of the PS-SS were asked the first group as "Which of these symptoms did you experience before hospitalization for your chest pain or heart attack?", and the question: "Which of the following symptoms have you experienced in the past three months?" was asked the healthy group. The ninth item was asked of both groups as "Did you experience any other symptoms not mentioned on this questionnaire?" The questions were read to the participants by the researcher and then recorded.

Ethical Considerations

This study was approved by the Committee on Ethics in Ardabil University of Medical Sciences (IR.ARUMS.REC.1395.143). Eligible participants, according to the inclusion criteria, were fully informed about the study objectives and methods prior to the data collection and were entered to the study. They were assured that the study would not influence their care. A written informed consent form was signed by each participant prior to data collection.

The anonymity and confidentiality of the participants were protected.

Procedure

After obtaining permission from the PS-SS developer, the process of translating the PS-SS into the Persian language was carried out using the method of Wild et al. (2005). For this purpose, the original version was first translated from English to Persian by two fluent individuals well-versed in English and Persian, and then, both translations were compared and corrected. The modified version was translated from English to Persian by a third person who was fluent in English and Persian, and then, the Persian and English translations were compared by the translators, modified and revised, and the Persian questionnaire was prepared.

To determine the psychometric properties of the scale, the content validity index, construct validity, criterion validity, and internal reliability were determined. The content validity index (CVI) was used to determine the content validity of the scale. The PS-SS questionnaire was distributed to five nursing faculty members and five expert clinicians in the cardiovascular field, including three nurses with more than 10 years of experience in CCU, an emergency nurse, and one cardiologist. They were asked to comment about the simplicity, clarity, and relevance of each item using the Waltz and Bausell method (Polit, Beck, & Hungler, 2005) and provide a score ranging from 1 to 4. In total, the CVI score for the total scale was determined 0.86.

Confirmatory factor analysis (CFA) was used for construct validity. In the first step, the data from the ACS group were evaluated in both single-factor and two-factor models. The two-factor model was proposed by the author of the scale and includes: 1) four prodromal-specific symptoms with four items, and 2) five prodromal non-specific symptom items (O'Keefe-McCarthy & Guo, 2016).

To determine the criterion validity, we divided the study sample into two groups. The occurrence of ACS in the patient group and non-occurrence of it in the healthy group during next three months was considered as the instrument's criterion. In order to confirm the non-occurrence of ACS in the healthy group, two methods were used: (1) a cardiologist confirmed the non-occurrence of ACS and the cardiac normal status by physical examination and other diagnostic procedures (echocardiography, exercise treadmill test, and electrocardiography), and (2) by following the participants for three months after completing the questionnaires. After comparing the PS-SS scores in the two groups, the criterion validity, sensitivity, specificity, and cut-off point of the scale were determined.

The Cronbach's alpha coefficient was calculated for the whole scale and each dimension to determine the internal consistency reliability. To conduct the CFA, the LISREL software version 8.8 was used, and for other analyses, SPSS software version 15 was used.

Results

Sample Description

The cardiac status data of 196 patients with ACS and 205 healthy participants were analyzed. There was no significant difference between the two groups in terms of age, sex, and comorbidities ($p > 0.05$). The mean age of the patients and those in the healthy group was 57.61 ± 12.33 years and 58.50 ± 12.10 years respectively, with an age range of 19 to 87 years in the patient group and 23 to 90 years in the healthy group. Seventy-four percent were male in the patient group and 65.5% in the healthy group ($p = 0.06$). Hypertension was the most commonly reported disease in both the patient and healthy groups (37.2% versus 40.5%). Most (62.2%) of the patient group were hospitalized because of myocardial infarction. Other details on the demographic information and medical history of the two groups are shown in Table 1.

Table 1: Demographic Characteristics and Medical History by Group

| Parameter | Patient group n (%) | Healthy group n (%) | p-value |
|--------------------------------------|---------------------|---------------------|-------------------|
| Mean Age, y (SD) | 57.61 (12.33) | 58.50 (12.10) | 0.46 ^a |
| Female | 51 (26) | 71 (34.6) | |
| Gender Male | 145 (74) | 134 (65.4) | 0.06 ^b |
| Unstable Angina | 74 (37.8) | – | – |
| ACS Myocardial Infarction | 122 (62.2) | – | – |
| Medical History | | | |
| Hypertension | 73 (37.2) | 83(40.5) | 0.50 ^b |
| Diabetes | 42 (21.4) | 44(21.5) | 0.99 ^b |
| Hyperlipidemia | 43 (21.9) | 44 (21.5) | 0.90 ^b |
| Low Back Pain | 19 (9.7) | 21 (10.2) | 0.85 ^b |
| Rheumatoid Arthritis | 23 (11.7) | 33 (16.1) | 0.20 ^b |
| Thyroid Condition | 9 (4.6) | 13 (6.3) | 0.44 ^b |
| IBS, Peptic Ulcer, Esophageal Reflux | 7 (3.6) | 4 (2) | 0.32 ^b |
| COPD, Asthma | 6 (3.1) | 3 (1.5) | 0.23 ^b |
| Sinusitis, Migraine | 5 (2.6) | 3 (1.5) | 0.33 ^b |
| BPH | 6 (4.1) | 8 (6) | 0.48 ^b |
| Other | 15 (7.7) | 16 (7.8) | 0.95 ^b |

Note. Patient group = participants with ACS incidence; Healthy group = Participants without ACS incidence; ACS = acute coronary syndrome; IBS = irritable bowel syndrome; COPD = chronic obstructive pulmonary disease; BPH = benign prostatic hyperplasia; SD = Standard Deviation.

^a Using independent sample t-test, ^b Using chi-square tests.

Construct Validity

Using CFA, the factor structure of the scale was studied as both single-factor and a two-factor model using the nine items to evaluate the construct validity (Figures 1 and 2). Regarding the acceptable coefficients of the goodness-of-fit indicators, both single-factor and two-factor models were confirmed (Table 2).

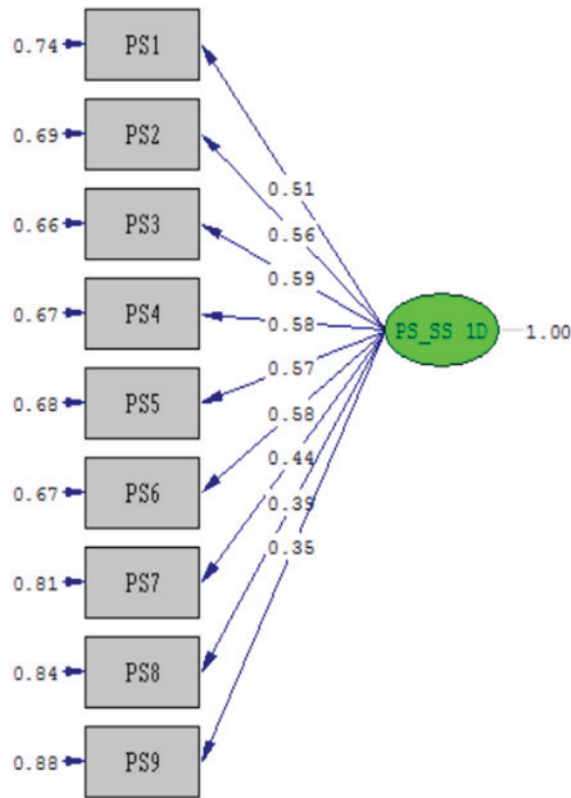


Figure 1: Standardized parameter estimates for Model I (one-factor Prodromal Symptoms-Screening Scale)

Note. PS1 = unusually located aches and/or pains; PS2 = unusual fatigue; PS3 = sleep disturbance; PS4= headaches; PS5 = dizziness. PS6 = Shortness of breath; PS7 = chest pain; PS8 = anxiety; PS9 = other symptom; PS-SS 1D = one-dimensional Prodromal Symptoms-Screening Scale.

Criterion Validity

The criterion validity of the scale was determined by comparing the overall PS-SS score in both the patient and healthy groups. The results showed that the overall PS-SS score was significantly higher in the patient group than in the healthy group. However, on investigating the individual items in the two groups, the scores of the patient group

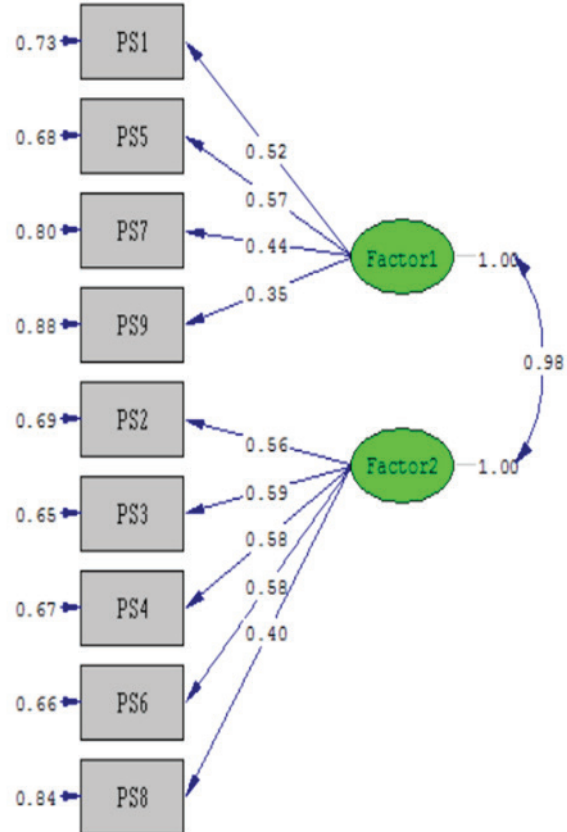


Figure 2: Standardized parameter estimates for Model II (two-factor Prodromal Symptoms-Screening Scale)

Note. Factor1 = Specific Prodromal Symptoms Subscale; Factor 2 = Non-Specific Prodromal Symptoms Subscale

| Table 2: Goodness of Fit Indices of Single Factor and Two Factor Models of Prodromal Symptoms Screening Scale | | | | | | | | | | |
|---|----------------|----|--------------------|-------|---------|-------|------|------|------|------|
| Models | X ² | df | X ² /df | RMSEA | P-value | SRMR | CFI | NFI | GFI | IFI |
| Single factor | 37.73 | 27 | 1.39 | 0.045 | 0.08 | 0.048 | 0.97 | 0.92 | 0.96 | 0.97 |
| Two factor | 37.65 | 26 | 1.44 | 0.048 | 0.06 | 0.048 | 0.97 | 0.92 | 0.96 | 0.97 |

Note. X² = Chi-square; df = Degree of freedom; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized root mean square residual; CFI = Comparative fit index; NFI = Normed Fit Index; GFI = Goodness of Fit Index; IFI = Incremental fit index.

were found to be significantly different from that of the healthy group (Table 3).

Regarding the ninth item (other symptoms), 81 people (41.3%) in the patient group and 27 (13.2%) in the healthy group reported other symptoms not mentioned on the scale. The most common other symptoms experienced in the patient group were sweating ($n = 26$), gastrointestinal symptoms ($n = 17$), and palpitations ($n = 16$), and in the healthy group, gastrointestinal symptoms ($n = 7$) and palpitations ($n = 6$).

Reliability

The internal consistency of the scale among the nine items was 0.75. The Cronbach's alpha coefficient for the prodromal specific and non-specific symptoms were $\alpha=0.523$ and $\alpha=0.668$, respectively.

Sensitivity and Specificity

The sensitivity and specificity of PS-SS were studied in the healthy and patient groups at different cut-off points. In the best state, the cut-off point obtained was 18.5, and the sensitivity was 65.3 and specificity 52.7.

Discussion

The PS-SS is a scale that screens people at risk of ACS by examining the prodromal cardiac symptoms. This study was conducted to investigate the psychometric properties of the PS-SS in patients with ACS without a history of heart disease in Iran.

In a study by O'Keefe-McCarthy and Guo (2016) on the psychometric properties of the PS-SS, they found a PS-SS two-factor structure in the nine items, using exploratory factor analysis. In this structure, the specific prodromal symptoms included four items: unusually located aches or pains, dizziness, chest pain, and other symptoms and the non-specific prodromal symptoms included five items: unusual fatigue, sleep disturbance, headaches, shortness of breath, and anxiety (O'Keefe-McCarthy & Guo, 2016). In this study, the CFA indicated that both the single-factor and two-factor models had an acceptable fit. The assessment of the internal consistency for the two models showed that the Cronbach's alpha coefficient for the whole scale in the form of one dimension was acceptable ($\alpha = 0.75$), but for the two-dimensional model was low ($\alpha = 0.523-0.668$). Further, considering that the confirmation of a single-factor structure should prompt rejection of the multi-factor model of an instrument (Carter, 2016; Koufteros & Marcoulides, 2006; Reichenheim, Moraes, Oliveira, & Lobato, 2011), it can be concluded that based on the proper fitting of the PS-SS single-factor model, its two-factor model is rejected.

Considering the significant difference between the patient group and healthy group in the overall PS-SS score and the four items (sleep disturbance, shortness of breath, chest pain and other symptoms), it might seem that the PS-SS criterion validity is confirmed. However, due to the fact that there were

Table 3: Criterion Validity by Groups

| PS-SS Item | Patient group (n=196) Mean (SD) | Healthy group (n=205) Mean (SD) | Mann-Whitney U-test (p) |
|--------------------------------------|---------------------------------|---------------------------------|-------------------------|
| unusually located aches and/or pains | 4.06 (4.13) | 3.37 (4.23) | 0.49 |
| unusual fatigue | 3.89 (4.35) | 3.27 (4) | 0.09 |
| sleep disturbance | 3.91 (4.36) | 3.03 (3.88) | 0.02 |
| headaches | 2.84 (3.74) | 2.54 (3.35) | 0.54 |
| dizziness | 2.27 (3.42) | 1.95 (3.21) | 0.37 |
| shortness of breath | 3.48 (4.07) | 1.70 (3.14) | <0.001 |
| chest pain | 4.35 (3.91) | 0.98 (2.73) | <0.001 |
| anxiety | 4.11 (4.2) | 3.6 (3.85) | 0.15 |
| other symptom | 3.36 (4.22) | 1.04 (2.76) | <0.001 |
| PS-SS full scale | 32.28 (21.18) | 21.81 (18.29) | <0.001 |

Note. PS-SS = Prodromal Symptoms Screening Scale.
Note. SD = Standard Deviation; PS-SS = Prodromal Symptoms Screening Scale.

no significant differences in the five items, "unusually located aches and/or pains," "headaches," "dizziness," "unusual fatigue," and "anxiety" in the two groups, there is doubt regarding the criterion validity of this scale. Given that both groups have obtained the same score for these items, they do not have the required validity to predict ACS. For example, in the item "unusually located aches and/or pains," the location of the pain is not specified. Therefore, unusual aches and/or pains in any part of the body (which may have a non-cardiac origin) is considered as "unusually located aches and/or pains." On the other hand, this mark is not merely indicative of a cardiac prodrome, but may be associated with symptoms of other diseases (Loscalzo, 2016).

Also, "unusual fatigue," "headaches," "dizziness," and "anxiety" are multi-cause symptoms that, in addition to cardiac disorders, can be caused by psychological, and situational factors, and physiological conditions (Faravelli, Scarpato, Castellini, & Sauro, 2013; Fisher et al., 2008; Fumal & Schoenen, 2008; Leach, Christensen, Mackinnon, Windsor, & Butterworth, 2008; Liu, 2006; Loscalzo, 2016; Vink, Aartsen, & Schoevers, 2008). Therefore, people who are not at risk of ACS may also experience them due to many other reasons. Hence, these items can be seen in different individuals, including people without ACS, which causes the two groups (ACS patients and healthy participants) overall PS-SS scores to be close to each other. On the other hand, the four other symptoms (sleep disturbance, shortness of breath, chest pain, and other symptoms) had statistically significant differences between the groups, but in clinical terms, these

symptoms are similar and not considered a decisive criterion for identifying healthy individuals from those who are at risk. As expected, the overall PS-SS score and its individual items in both groups contributed to the low sensitivity and specificity of PS-SS in predicting ACS. The low sensitivity and specificity of PS-SS cause its diagnostic value in the prediction of ACS to be ambiguous in this setting. Considering that there is no similar study that investigates the sensitivity and specificity of PS-SS, it is suggested that further studies be done in various communities.

Limitations

Considering that PS-SS is a scale for ACS prediction, one of the limitations of this research was its retrospective design. It is suggested that future studies examine the predictive validity of the scale and be conducted prospectively. The gold standard for the diagnosis of coronary heart disease is angiography. However, in the present study, it was not possible to perform it in the healthy group to completely exclude heart disease. It was inevitable to rely on the diagnosis by the cardiologist using the diagnostic tests such as the exercise treadmill test, echocardiogram, and electrocardiography. We monitored all the healthy people for ACS three months after enrolment so that the deficiencies associated with this limitation could be reduced. Another limitation of this study was that because this research was in the ACS patient population in Ardabil, the potential to generalize the results to other populations is limited. Hence, it is suggested that the instrument's psychometric properties be investigated in other populations.

Conclusion

Considering the high prevalence of coronary heart disease globally, ACS predictive tools with acceptable reliability and validity have importance. The present study, by examination of the PS-SS validity and reliability indices, showed that the Persian version of this scale, despite some favourable psychometric properties such as content validity, construct validity, and internal consistency, is not a good indicator for predicting coronary heart disease because of its low ability to predict coronary heart disease events (low sensitivity) and the ability to differentiate a healthy group (low specificity). This study can be an important step for wider research in the field of ACS prodromal symptoms and help in designing scales with a high degree of validity in the near future by solving the problems in this scale.

Implications for Practice

Considering the confirmation of the content validity, construct validity, and criterion validity of four items of the PS-SS, the present study showed that patients might experience some warning symptoms days and weeks before an ACS. Although these symptoms may be signs of an impending ACS, some of them are common and may also be experienced by people without coronary heart disease.

The PS-SS is a tool that can indicate the presence of prodromal symptoms in people, but due to its low sensitivity and specificity, it cannot be considered as a valid tool for predicting ACS in the Iranian population. ♥

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A Chronic Disease Management Intervention for Home Care Patients with Cardio-Respiratory Symptoms: The DIVERT-CARE Intervention

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Abstract

The Canadian home care population is growing and cardio-respiratory chronic care needs are more prevalent. Specialized programs for self-management support are usually initiated during an acute episode or upon discharge from hospital. These hospital and community-based outpatient programs are typically delivered by cardiac and respiratory disease management specialists and clinics, and only a small proportion of patients living with cardio-respiratory disorders have access to these. Self-management support provided in settings other than the home fail to account for challenges unique to the patient's home environment where self-management is practised. The DIVERT-CARE Intervention is a scalable, home-based, multi-component intervention to increase health literacy, optimize self-management behaviours,

strengthen community supports, and increase co-management between home care and primary care providers. We describe the DIVERT-CARE Intervention components in detail, including the prerequisite nurse training and education, case-finding, and inter-professional self-management supports. This paper is relevant for the advancement of community nursing practice to adequately support the needs of home care patients with heart failure and COPD-related cardiorespiratory symptoms and promote clinical practice consistency across the healthcare system.

Key words: home care, cardio-respiratory, hospital avoidance, chronic disease management, heart failure, community nursing, self-management

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Clinical Highlights

- The increasingly complex nature and growing number of home care patients with cardio-respiratory disorders necessitates that community-based nurses and allied health professionals are equipped with the knowledge and skills that align with the overall care needs of these patients.
- Chronic disease management strategies initiated in the community can target higher-risk home care patients earlier using the DIVERT-CARE Intervention to effectively prevent future ED visits and hospitalizations.
- Evidence-based clinical care guidelines can be used in the community, thereby strengthening the overall system by providing more consistent chronic disease management across the healthcare continuum.

More than 2 million Canadians required care in the home in 2012 and 85% were 65 years of age or older (Canadian Institute for Health Information [CIHI], 2017; Statistics Canada, 2017). Older patients with three or more chronic conditions use 40% of healthcare resources, and heart failure (HF) and chronic obstructive pulmonary disease (COPD) are main drivers of hospitalization (CIHI, 2014; Wodchis, Austin, & Henry, 2016). At the same time, emphasis on the care of complex patients has increasingly shifted to the community (Goldhar et al., 2014). Chronic disease

strategies that promote self-management have been shown to improve patient outcomes and avoid unnecessary hospitalizations (Heart Failure Society of America, 2006; Kasper et al., 2002). Despite enhanced hospital discharge initiatives, self-management behaviours are often inadequate (Buck et al., 2012; Casas et al., 2006). Patient access to self-management programs typically occurs after multiple hospitalizations and clinical deterioration, and these programs do not focus on self-management in the home environment. A home-based program is needed to address the gap in care for patients with cardio-respiratory management needs. Identification of those most at risk for hospitalization will allow for deployment of a focused community nurse-led self-management program. As in-home care expands proportionate to the aging population, there is a need for specialized care providers, health literacy improvement, and effective health promotion programs to ensure the sustainability of publically funded healthcare (Canadian Medical Association, 2015). DIVERT-CARE (Collaboration, Action, Research and Evaluation) is a proactive intervention targeting home care patients at risk for hospitalization from HF and COPD symptoms.

HF is a leading cause of hospitalization for those 65 years of age and older and is associated with increased severity and frequency of symptoms as the disease progresses (Bui, Horwich,

& Fonarow, 2011; Cardiac Care Network [CCN], 2014). Access to specialized HF care is limited, with the majority of acute medical treatment provided by general internists and family physicians in hospitals (CCN, 2014; Tu, Gong, Austin, Jaakimian, & Tu, 2004). Although home-based HF education and social supports have been shown to reduce hospitalizations, there remain care gaps in chronic disease monitoring and management in community settings (CIHI, 2014; Yancy et al., 2013). Specifically, Foebel et al. (2011a) found 28.6% of home care patients with HF were not receiving any HF therapies, and only 28% were on the recommended combination drug therapy. Additionally, 28.7% of home care patients with HF also have reactive airway disease, and this comorbid combination has been associated with non-use of HF therapy (Foebel et al., 2011a; Foebel, Hirdes, Heckman, Tyas, & Tjam, 2011b). HF and COPD are shown to have concomitant rates as high as 52% in North America, and share the signs and symptoms of fatigue and shortness of breath (Hawkins et al., 2009; Zeng & Jiang, 2012). The presence of COPD must, therefore, be taken into consideration when implementing self-management strategies.

COPD is a respiratory illness affecting more than 1.9 million Canadians in 2011/2012 (Public Health Agency of Canada, 2016). It is a life-limiting disease associated with an increased risk of developing community-acquired pneumonia and exacerbations requiring hospitalization, which impact overall quality of life, prognosis, and healthcare resources (Bourbeau et al., 2003; Williams et al., 2017). A reported 19.4% of home care recipients have COPD, which is likely a conservative estimate of this underdiagnosed disease (Agusti et al., 2016; CIHI, 2017). Community management of COPD is focused on reducing the frequency and severity of exacerbations, smoking cessation and improving exercise tolerance (O'Donnell et al., 2008). Out-patient COPD education has been shown to improve medication adherence with a reduction in the need for rescue inhaler use (Gallefoss, 2004).

The home care sector is ideally situated to be an effective component of an integrated chronic disease management strategy. A reported 55% of adults receive chronic disease counselling and education from their primary care providers, but supportive chronic disease management is constrained by the volume of patients and multiple disease-specific patient education materials required (Schoen et al., 2004; Yarnall, Pollak, Ostbye, Krause, & Mitchener, 2003). Education provided in settings other than the home fail to account for challenges unique to the patient's home environment where self-management is practised (Dickson & Riegel, 2009; Flocke & Stange, 2004; Strömberg, 2005). Education provided in acute care settings is often associated with poor knowledge retention after discharge, reasons cited include an overload of information during a period of stress, the hospital's atypical environment, and limited time to deliver education (Reiley et al., 1996; White, Garbez, Carroll, Brinker, & Howie-Esquivel, 2013). The evidence suggests that education should last a minimum of 60 minutes to optimize

information recall (Flocke & Stange, 2004; Kessels, 2003; White et al., 2013). Providing self-management education at non-acute stages highlights the natural course of the disease, reinforces monitoring during stable periods, and helps integrate knowledge into the patient's home environment (CCN, 2014; Krumholz et al., 2002; Lainscak et al., 2011; Jaarsma et al., 2008). There is a growing body of evidence that supports specialized home nursing as an integral part of community self-management interventions (Casas et al., 2006; Kalter-Leibovici et al., 2017; Ruiz et al., 2017; Tricco et al., 2014). In fact, when compared to telemonitoring, specialized clinic visits, and the use of allied health professionals, nurse home visits were shown to be most effective at reducing hospitalization and all-cause mortality following a hospital admission for HF (Feltner, et al., 2014; Van Spall et al., 2017).

Self-management encompasses the day-to-day chronic disease care, including engagement in monitoring and managing disease signs and symptoms, adopting risk-reducing lifestyle behaviours, and maintaining contact with health professionals (Registered Nurses Association of Ontario, 2010; Schulman-Green et al., 2012). Self-management is a process that changes over the life course of the disease, with patients reporting increased difficulty and time commitment required to control symptoms towards end-stage trajectories (Moser & Watkins, 2008). Additional challenges identified by patients include interpreting symptoms, symptom unpredictability, and what to do with the information collected during the monitoring phase of self-management (Herr et al., 2014; Spaling, Currie, Strachan, Harness, & Clark, 2015; Wingham, Harding, Britten, & Dalal, 2014). Home care patients with HF also have complex functional needs that require care coordination and supportive care (CCN, 2014; Foebel et al., 2011b). Strategies shown to be effective in promoting self-management behaviours include prolonged involvement, patient-centred goal setting, and opportunities to contextualize education to environment (Benzo et al., 2016; Dickson & Riegel, 2009; Jaarsma et al., 2008). The DIVERT-CARE Intervention is comprised of evidence and home-based interventions to promote self-management while leveraging existing tools to improve system integration.

Aim

DIVERT-CARE is a home-based chronic disease management intervention. The aim of this paper is to describe how the DIVERT-CARE Intervention (see Table 1) is being used to deliver comprehensive chronic disease management and support in the home. The Intervention's components will be described based on the template for intervention description and replication (TIDieR), an extension of the SPIRIT statement (item 11) (Hoffmann et al., 2014). The role of specialized community-based nurses is highlighted, including delivering education and training recommendations to adequately meet the complex needs of the growing population of home care clients with unstable cardio-respiratory disease.

| Table 1: DIVERT-CARE Intervention Components | |
|---|--|
| DIVERT-CARE Intervention Components | Description |
| Case Finding Using the DIVERT Scale | Use of the DIVERT Scale (embedded in interRAI assessment) to identify home care patients most likely to benefit. |
| Self-Management Education and Supports | In-home assessment of self-management goals and needs, with practical education and skills training to recognize and manage symptoms. |
| Access to an immediate nurse-staffed helpline | Direct phone line staffed by nurses involved in the DIVERT-CARE Intervention to aid with self-management and problem resolution. |
| Promotion of Vaccines | Seasonal flu vaccine and pneumococcal polysaccharide (Pneu-P-23) information and health promotion. |
| Advance Care and Goal Planning | Consultation for advance care and goals of care planning, advanced care decisions, and communication of care wishes. |
| Clinical Pharmacist-Led Medication Review | Review of medication for safety, efficacy and appropriate use of medications and delivery options. |
| Interprofessional Team Case Rounds | Weekly care team meeting to discuss care plan, update goals, and how to support changing care needs. |
| SBAR Communication with Primary Care Providers | SBAR formatted communication to effectively communicate disease relevant information and care updates to primary and specialist care providers. |
| Standardized ED Transition Package/Personal Care Record | A succinct document to support continuity of care throughout health system. Personal care record of goals, plan of care, and community supports. |

Theoretical Foundation: Chronic Care Model

DIVERT-CARE was developed to leverage existing clinical guidelines and education resources used in acute and specialized care areas and apply them in a more targeted manner to the community care sector. This approach aligns the intervention with the hub-and-spoke model that calls for integration across the continuum of care (Canadian Medical Association, 2015; CCN, 2014). The theoretical foundation for the DIVERT-CARE Intervention is based on Wagner et al.'s (2001) Chronic Care Model (CCM). The foundations of the CCM are improved communication, collaboration, and integration between healthcare environments and care partners. DIVERT-CARE aligns with the system delivery elements and patient-centred approach of the CCM (see Table 2). The components of DIVERT-CARE also conform to the essential elements of person-centred care (Brummel-Smith et al., 2016) (see Table 3). Productive interactions are facilitated when the patient and healthcare team have shared goals and use a

| Table 2: Alignment between the Chronic Care Model ¹ and the DIVERT-CARE Intervention | |
|---|--|
| Chronic Care Intervention | DIVERT-CARE Model |
| Prepared Proactive Practice Team | Pre-intervention assessment of competencies Workforce development Nurse education tool kit CORE ² , Lung Association, INSPIRE Guidelines ³ |
| Community Self-Management Support | Patient education, skills training, self-management support |
| Decision Support | DIVERT Scale for patient identification Guideline-based chronic disease patient education Decision Aids—Zones Teach-back methods |
| Delivery System Design | Focus on continuity of care and prevention 15-week nursing component, comprising 4 home visits and 4 phone calls Medication reconciliation Advance care planning (psychosocial support) Care coordination + Usual home care supports Primary Care Physician—sustained follow-up |
| Informed Activated Patient | Patient-centred goals Patient Activation Measure (PAM) ⁴ |
| Productive Interactions | Team case rounds /Huddles Multi component approach (physician, care coordinator, nurse, pharmacy, social/spiritual supports) Shared care plan/ personal care record |

¹Wagner, E.H., Austin, B.T., Davis, C., Hindmarsh, M., Schaefer, J., & Bonomi, A. (2001). Improving chronic illness care: Translating evidence into action. *Health Affairs* 20(6), 64–78. <https://dx.doi.org/10.1377/hlthaff.20.6.64>

²CORE. (2017). *Expert led education for the multidisciplinary management of heart failure*. Retrieved from <http://www.corehearteducation.com/>

³Rocker, G.M., & Verma, J.Y. (2014). INSPIRED[®] COPD outreach program TM: Doing the right things right. *Clinical & Investigative Medicine*, 37, 311–319

⁴Hibbard, J.H. (2017). Patient activation and the use of information to support informed health decisions. *Patient Education and Counseling*, 100 (1), 5–7.

common language. A multi-professional approach is used involving nurses, nurse practitioners, respiratory therapists, care coordinators of various professional designations, spiritual/social councilor, pharmacists, and physicians. In preparation to deploy the interventions, community-based nurses participate in a comprehensive disease-related and self-management education training program (see Table 4.). The DIVERT-CARE Intervention leverages existing decision support tools and patient resources derived from clinical guidelines and best practice evidence, thereby ensuring a consistent delivery platform across disciplines and points of care. Patient education and supports are tailored to clinical needs, self-management skills, and patient centred goals. An individualized care plan is developed to be shared between the home care team and primary care

Table 3: Alignment between Person-Centred Care Elements⁵ and the DIVERT-CARE Model

| Essential Elements of Person-Centred Care | DIVERT-CARE Intervention |
|--|---|
| Individualized goal-oriented care plan | Assessment in home environment Goals established by person DIVERT-CARE interventions selected by person Standardized ED transition package/Personal Care Record |
| Ongoing review of goals and care plan | Review of goals and updates to plan of care with person at each interaction Weekly care team rounds |
| Person as integral team member | Person is the taught to self-manage DIVERT-CARE components selected by person Continual involvement of person, updates and evaluation of care plan and goals |
| One primary lead point of contact | Case Manager is primary lead point for in-home management |
| Active coordination of health care and service providers | Team rounds/Interdisciplinary involvement SBAR communication with Primary and Specialized Care Providers Shared Care Plan on Personal Care Record |
| Continual information sharing/ integrated | SBAR communication Team rounds Immediate nurse-staffed helpline |
| Education and training for care providers, person, and informal caregivers | Provider Education Curriculum: Heart Failure (HF), Chronic Obstructive Pulmonary Disease (COPD), Self-Management, Advanced Care Planning, Teach-back, communication principles Person/Informal Caregiver Education and Training: HF and COPD Teaching Aids Zones Communicating with healthcare providers Chronic disease monitoring and self-management skills training Medication management |
| Performance measurement and feedback from person and caregivers | Care plan evaluation-continual feedback at each point of contact Cardio-respiratory symptom frequency Patient Activation Measure (PAM) Health Related Quality of Life (QOL) |
| ⁵ Brummel-Smith, K., Butler, D., Frieder, M., Gibbs, N., Henry, M., Koons, E., ... & Scanlon, W.J. (2016). Person-centered care: A definition and essential elements. <i>Journal of the American Geriatrics Society</i> , 64(1), 15–18. https://dx.doi.org/10.1111/jgs.13866 | |

physician. The care plan and medication list are also provided to the patient, serving as a communication tool for pertinent clinical information, as the patient moves through various points in the healthcare system. The DIVERT-CARE Intervention is intended to empower the patient as he/she gains knowledge, problem-solving skills, and adopts healthy lifestyle behaviours.

Table 4: Content and Competencies for Disease and Self-Management Nurse Education Training Program

| Content | Competencies |
|---|--|
| CHF and COPD Assessments Pathophysiology | Describe the common causes, pathological features, presentation and trajectory of Heart Failure (HF) and Chronic Obstructive Pulmonary Disease (COPD). Knowledge of monitoring and self-management strategies for optimal treatment and symptom management. |
| Pharmacology | Knowledge of pharmacological approaches (best practice), side effects, and mechanism of action. |
| Guidelines | Knowledge and application of guidelines for optimal treatment. |
| Patient Education Teach-back and PAM | Assess and identify barriers to learning. Develop person-centred care plan. Apply teach-back to ensure understanding. Tailor education to Patient Activation Measure (PAM) level. |
| Self-Management | Individualized patient education for persons with HF and COPD and their caregivers (including: lifestyle management, pharmacological and/or non-pharmacological interventions). |

Intervention: DIVERT-CARE

The DIVERT-CARE Intervention combines knowledge, psychosocial, and behavioural supports. The 15-week intervention tackles the complexity of HF and COPD symptom presentation, self-management behaviour changes, and lifestyle adaptations (Bos-Touwen et al., 2015; Fletcher & Dahl, 2013). Disease-specific self-care educators require the prerequisite competencies of understanding the pathophysiology of common cardiorespiratory diseases such as COPD and HF (Fowler, 2012). This foundational knowledge allows the nurse educator to align symptom management education with the patient's pharmacological regimen, physical assessment findings, and clinical guidelines for management of the disease (Delaney, Apostolidis, Lachapelle, & Fortinsky, 2011). A combination of motivational interviewing techniques, principles of choice and change, and developing achievable patient-centred goals completes nursing preparation for implementing DIVERT-CARE. Full integration of this knowledge is necessary to competently answer patient questions and facilitate problem-solving skills for disease presentation and symptom changes. Ontario's Rapid Response Nurse Program is an example of the contribution nurses with specialized training can make for transitional care and chronic disease management (CCN, 2014).

The DIVERT-CARE Intervention requires system preparation, tools, and skills necessary for effective deployment. It is a sustainable approach with an emphasis on using the existing continuum of care. The components of DIVERT-CARE are designed to be flexible in their delivery and tailored to the specific needs and strengths of the individual. It is defined by the following components:

Component 1: Case Finding Using the DIVERT Scale

Home care coordinators or case managers possess expertise in system navigation and resource allocation based on their clinical knowledge and assessments using the interRAI Home Care (HC). Care coordinators have varied professional backgrounds, including nursing, physiotherapy, occupational therapy, and social work. The interRAI (2017) HC is a comprehensive clinical assessment instrument used to guide care and service planning for long-term home care patients in community settings. The Detection of Indicators and Vulnerabilities of Emergency Room Trips (DIVERT) Scale is a prognostic case finding tool derived from the interRAI (HC) standardized home care assessment (CCN, 2014; Costa et al., 2015). InterRAI is an international collaborative of researchers and practitioners, including nurses, whose mission is to promote evidence informed clinical practice (InterRAI, 2018). The DIVERT scale, as a validated tool, identifies home care patients at risk for an emergency department (ED) visit and hospital admission. The DIVERT scale, therefore, facilitates case finding and ensures that the chronic disease supports are offered to those in need of and most likely to benefit.

Component 2: Self-Management Education and Supports

The first component is composed of nurse-led self-management supports including four in-home nursing visits and four telephone calls over a period of 15 weeks. Home visits include a physical assessment, medication review, and a baseline readiness assessment using the Patient Activation Measure (PAM) (Hibbard, 2017). Patient activation is a reliable measure that coincides with self-management coaching strategies for achievable behaviour change and building confidence (Hibbard, 2017). The PAM includes questions that assess patient readiness to learn and their knowledge of their condition, medications, management of symptoms, and treatment (Hibbard, 2017). Subsequent education content, depth, pace, and support is tailored to the specific needs and goals of the patient. PAM scores range from one to four, with level one patient characteristics representing minimal involvement in self-care and level four representing characteristics of a highly involved and engaged patient (Hibbard, 2017). The physical assessment, with a focus on cardio-respiratory symptoms, is followed up with education to support early identification of signs and symptoms of concern. The nurse consults with involved primary care providers or specialists to optimize the treatment plan, as tolerated by the patient (Howlett et al., 2016). The patient's response is monitored while titrating medications to mitigate adverse drug reactions that are prevalent in individuals over the age of 65 years (Hilmer, McLachlan, & Le Couteur, 2007). Education occurs in the home, face-to-face, where the patient resides and practises self-management. Follow-up visits and phone calls ensure that education is reinforced over the 15 weeks to the minimum standard of the patient stating how to respond to worsening symptoms (Hoving, Visser, Mullen, & Van den Borne, 2010; HQO & MOHLTC, 2015). The *Managing Heart Failure*

Guide produced by the Heart and Stroke Foundation of Canada (2015) is the main resource for HF education. COPD education is taken from Lung Association's *The Breathworks Plan* (Lung Association, 2008). Patient education is delivered using the principles of 'teach-back', where the patient repeats information in his/her own words, and supplemented with visual decision aids. Education sessions include family and informal caregivers who support the patient in self-management and achieving his/her care goals. Recommended topics to be covered include early signs and symptoms of compromise, monitoring fluid intake and weights, sodium reduction, exercise and pacing, medications and inhaler technique, smoking cessation, and how to communicate with health care providers. As the patient acquires knowledge and skills to manage his/her disease, learning how to effectively communicate with healthcare providers will ensure smooth transition to independence at the end of the intervention (Kogan, Wilber, & Mosqueda, 2016).

Component 3: Access to an Immediate Nurse-Staffed Helpline

A nurse-staffed helpline is used to supplement decision-aids and support the patient with problem-solving. The helpline is staffed by nurses who are aware of the aims of the intervention and actively involved in the deployment of its patient education (Roberts, Leeder, & Robinson, 2008). Evidence suggests that patients have increased confidence and comfort discussing their care needs with professionals aware of their medical history (Hurst et al., 2010). The nurse-staffed helpline allows the patient to seek assistance when required and reassurance as he/she learns to manage his/her symptoms independently.

Component 4: Promotion of Vaccines

Patients with pre-existing cardio-respiratory diseases are at an increased risk of acquiring pneumonia and respiratory complications. Based on this identified risk, patients are encouraged and supported with vaccine information. Vaccination for influenza and Pneumococcal Polysaccharide (Pneu-P-23) are recognized primary prevention strategies against community-acquired pneumonia (Almirall, Serra-Prat, & Bolibar, 2016). Vaccination status is checked during assessment and nurses provide education on the benefits of vaccination. The care coordinator and the nurse provide information on existing resources in the community and assist, as needed, to obtain the recommended vaccines. The influenza vaccine is publicly funded to high-risk groups across Canada, including those with cardiac and respiratory disorders (Government of Canada, 2017). Public funding for the pneumococcal vaccine is dependent on risk group and provincial programs (Government of Canada, 2017).

Component 5: Advance Care and Goal Planning

Chronic disease guidelines and best practices recommend advance care planning and goals of care discussions to adequately prepare for the patient's disease trajectory and illness progression. Care coordinators and nurses are trained

to begin discussions with patients regarding their health goals and care wishes, and includes identification of a substitute decision maker. A social worker or psychosocial support counsellor possess the recommended skills to support and augment discussions for more complex patients. Standardized tools such as *A Guide to Advance Care Planning* and *Speak Up* best capture the appropriate information to be shared with family and health care providers.

Component 6: Clinical Pharmacist-Led Medication Review

Adverse drug events and polypharmacy in the community can lead to clinical deterioration, falls, hospitalization, and mortality (Fried et al., 2014; Hamilton, 2013). Common community risks include hoarding medications, incorrect medication use, label discrepancy, lack of monitoring, and suboptimal dosing (Sorensen et al., 2004). A comprehensive medication review by a pharmacist can eliminate redundant medications, reduce polypharmacy, and ensure that pharmacological management is optimized according to best practice guidelines. This review is also an opportunity to identify if medication devices are used correctly and if packaging alternatives are required. Results from the review are communicated to the primary care physician for follow up and resolution. The nurse supports this component by engaging the patient and family during scheduled visits to augment best practices in medication management.

Component 7: Interprofessional Team Case Rounds

Team case rounds underpin the interprofessional nature of the DIVERT-CARE Intervention. The care coordinator facilitates system navigation and aligning supports with the needs of the patient. Interdisciplinary weekly rounds are conducted to identify, discuss, and clarify outstanding issues and update the plan of care. Rounds are an opportunity for collaboration while maintaining a consistent approach to therapeutic goal achievement.

Component 8: SBAR Communication with Primary Care Providers

Communication between the nurse and primary care provider is based on the Institute for Healthcare Improvement's Situation, Background, Assessment and Recommendation (SBAR) technique. Structured communication processes reduce care delivery inefficiencies and clinical errors (Crawford, Omery, & Seago, 2012). This standardized common language approach is used in both written and verbal communications to ensure that clinical issues are conveyed in a direct and consistent manner.

Component 9: Standardized ED Transition Package/ Personal Care Record

Home care patients involved in the DIVERT-CARE Intervention receive a personal health record to support flow of information between transitions in care. The personal care record includes relevant clinical information and a patient-centred

chronic disease management plan. The record is portable and is taken by the patient as he/she interacts with healthcare providers at different points in the healthcare system.

Tested and Feasible

The DIVERT-CARE Intervention was developed from a thorough review of current clinical guidelines, clinical expert and scientific review panel, and pilot study results. The intervention was tested in Southern Ontario in a non-randomized cluster trial that established its feasibility and effectiveness in a single setting and is now in further testing through a pan-Canadian pragmatic, cluster-randomized trial (#NCT03012256). Forthcoming publications will describe the overall feasibility and effectiveness of the catalyst trial and the study protocol in detail.

Conclusion

The aim of this paper was to describe the components of a pre-emptive chronic disease intervention for long-stay home care patients with cardio-respiratory disorders in the community setting. The DIVERT-CARE Intervention is an evidence-based chronic disease management approach that is proactive in the early identification of high-risk home care patients to avoid hospitalizations. It strengthens relationships between the patient, his/her community, primary, and specialist care providers. Cardio-respiratory diseases are complex and necessitate that additional training and education be provided to the professionals delivering the components. The approach is patient-centred, incorporates systems thinking principles to improve collaboration, continuity, and communication, while leveraging existing resources and guidelines to maximize transferability and uptake. ♥

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Poster Abstracts of the 2018 Canadian Council of Cardiovascular Nurses Spring Conference

A Primer on Hyperkalaemia: A Closer Look at this Common Condition

E. Estrella-Holder, St. Boniface Hospital, Winnipeg, MB, R. Grant, St. Boniface Hospital, Winnipeg, MB, D. Barker, St. Boniface Hospital, Winnipeg, MB, S. Chartrand, St. Boniface Hospital, Winnipeg, MB

Hyperkalaemia is a potentially life-threatening metabolic problem caused by inability of the kidneys to excrete potassium, impairment of the mechanisms that move potassium from circulation into the cells, or a combination of these factors. Hyperkalaemia is uncommon in the general population. However, many conditions including the presence of cardiovascular disease, renal dysfunction, and advancing age increase the incidence of hyperkalaemia from 10% to as high as 50%. Hyperkalaemia is associated with an increase in mortality. The significant side effect profiles of many cardiac medications such as those potentially causing hyperkalaemia, can often stall the efforts to achieve optimum doses of guideline directed treatments.

By using a case-based interactive discussion, this presentation will:

- 1) discuss the prevalence of hyperkalaemia in the general population
- 2) discuss the pathophysiology of hyperkalaemia
- 3) identify conditions where hyperkalaemia is common
- 4) discuss available treatments for hyperkalaemia
- 5) identify barriers to using recommended treatments for patients with hyperkalaemia or at risk for hyperkalaemia, and
- 6) integrate effective strategies to optimize treatment for patients with hyperkalaemia or at risk for hyperkalaemia.

Because hyperkalaemia is encountered in a variety of settings and can be life-threatening, it is relevant to all clinicians, including cardiovascular nurses, to have astute clinical skills in evaluating and managing patients with hyperkalaemia and to be able to identify those at risk to reduce their risk for potentially significant adverse outcomes.

Anemia and Heart Failure: Future Therapies Directed at Correcting Iron Deficiency Anemia

R. Grant, St. Boniface Hospital, Winnipeg, MB, E. Estrella-Holder, St. Boniface Hospital, Winnipeg, MB

Heart failure (HF) is a complex syndrome associated with multiple comorbidities. Anemia is common in patients with chronic HF. The prevalence of anemia in patients with HF can vary widely and range from 4% to 55%. Anemia in chronic HF is directly linked to increased mortality, reduced exercise capacity, and reduced quality of life. The World Health Organization (WHO) defines anemia as a hemoglobin < 13 g/dL for men (normal 140-160 g/l) and 12 g/dL for women (normal 120-140 d/l). Iron deficiency (ID), with or without anemia, has been identified as a common and ominous comorbidity in patients with HF.

The purpose of this presentation is to provide an interactive, dynamic forum to augment cardiovascular nurses' knowledge, skill and approach in assessing and managing patients with anemia and specifically ID. The presentation will cover the following topics: a) pathogenesis of anemia and ID, b) screening for anemia and ID, c) clinical and prognostic consequences of ID in HF, d) treatment strategies and ongoing research in management of ID, and e) challenges with currently available treatments. Given the prevalence of anemia and ID in patients with HF, it is imperative that cardiovascular nurses meet the challenges related to the management of this condition in order to have a positive impact on patient outcomes.

Content Validity of the Prodromal Symptoms-Screening Scale [PS-SS]: An Expert Panel

W. Heedo Lee, McMaster University, Hamilton, ON, J. Tsang, McMaster University, Hamilton, ON, S. O'Keefe-McCarthy, Brock University, St. Catharines, ON

More than 16,000 Canadians die each year from unrecognized myocardial infarctions, which accounts for 29% of all mortality in Canada per year. Despite advances in treating acute coronary syndrome (ACS), there are many individuals who do not recognize the warning symptoms of ACS. To remedy this, the Prodromal Symptoms-Screening Scale (PS-SS) was developed. It is a tool that guides both patients and clinicians to identify encroaching heart disease, explore problematic symptoms, and assess individuals at risk. However, prior to the PS-SS being used in clinical practice, we need to ensure that it is a tool that reflects the experiences

of the patient. To do this, our study will derive the content validity index (CVI) of the PS-SS, a 13-item tool designed to evaluate prodromal symptomatology in men and women with coronary artery disease. **Methods:** 10 clinical and scientific experts and affected citizens will rate the relevance of each item by using a four-point scale. The content validity will be completed for each item (I-CVI), as well as the total scale expressed as the mean item CVI (S-CVI/AVE). Items with an I-CVI greater than 0.7 will be retained. Items with an I-CVI ranging from 0.5-0.7 will be revised and clarified. Items containing I-CVI less than 0.5 will be discarded, unless supported by current scientific literature. This presentation will discuss the expert panel and results of conducting CVI.

Significance: The PS-SS has the potential to impact patients' knowledge of warning prodromal signs, as well as provide a new screening tool for clinicians to individualize risk factor profile management, provide pre-emptive cardiovascular diagnostic evaluation, and target individuals who are at risk for the development of obstructive heart disease.

Heart [ART-INFORMED] Journey through Cardiac Pain: An Interpretation Through Use of Photography and Poetry

S. O'Keefe-McCarthy, Brock University, St. Catharines, ON, K. Taplay, Brock University, St. Catharines, ON, L. Keeping-Burke, University of New Brunswick, Saint John, NB, A. Flynn-Bowman, Brock University, St. Catharines, ON, M. Vasilaki, Brock University, St. Catharines, ON, J. Salfi, Brock University, St. Catharines, ON

Denial, disbelief, fear-provoking pain, self-recrimination, and encroaching heart disease are themes that emerged from the stories shared by 23 individuals with obstructive coronary artery disease of their cardiac pain and journeying through cardiovascular illness. Empathetic and compassionate understanding of the experience of cardiac pain required the use of arts-informed research to enhance clinicians' critical awareness of the experience. Focus groups and individual qualitative semi-structured interviews were conducted, audiotaped and transcribed verbatim. Qualitative description was used to generate categories and themes. Seminal words and phrases were extracted from the interviews and constructed into poetry. Patients' stories were further conceptualized and informed the photographic images that metaphorically represent the participants' cardiovascular illness experiences.

Significance: Arts-informed research provides meaningful and embodied introspection and reflection from the patients' perspective. It has the power to engage clinicians at a visceral insightful level that allows meaning to be transferred differently, patient stories to be heard, visualized and felt. It provides a means for patients who suffer with cardiac-related pain to share their journey.

Standardized Nursing Care Plan Documentation for Heart Failure Community Care Patients

L. Reid, HNHB LHIN, Simcoe, ON, C. Schumacher, McMaster University/HNHB LHIN, Hamilton, ON, N. Martin, HNHB LHIN, Simcoe, ON

Heart failure is a chronic disease that transcends all facets of the healthcare system. The community care sector is responsible for care and self-management support of the heart failure patient between acute episodes. Provision of integrated care is enhanced through the use of common language and clinical practice consistency. Inconsistent documentation practices were identified through chart audits, specifically, nursing interventions and patient responses to nursing interventions. The purpose of this clinical improvement project was to develop and implement NANDA diagnoses-based standardized nursing care plans that integrate clinical guideline interventions for community care recipients with heart failure. A plan-do-study-act cycle methodology was used to guide implementation and refinement of content and processes. Community care patients at risk for hospitalization were identified using the DIVERT scale, targeting clinical subgroups with cardiorespiratory symptoms. Rapid response nurses who provide self-management supports and education to these patients used the standardized care plan to document clinical issues, interventions, plan of care, and progress. Nursing Outcome Classifications (NOC) were used to evaluate effectiveness of nursing interventions. Chart audits and focus groups will be used to evaluate uptake of clinical guidelines, documentation consistency, and ease of use. This project will improve documentation, align clinical practices in the community with heart failure evidence-based guidelines, and enhance continuity of care across health delivery sectors. Heart failure standardized care plans provide a mechanism for clinical practice evaluation and program evaluation. The results will inform future research and recommendations for clinical practice improvement.

Combining a Secondary Stroke Prevention and Cardiac Clinic

J. Shaw, Chatham Kent Health Alliance, Chatham, ON, L. Butler, Chatham Kent Health Alliance, Chatham, ON

Chatham-Kent is a small, rural community with a high proportion of vascular disease. Our challenge is to meet the needs of this population and sustain physician coverage in our Secondary Stroke Prevention/Transient Ischemic Attack (SSPC/TIA) and Coronary Artery Disease (CAD) Clinic.

Our SSPC/TIA and CAD clinics began in 2006 as separate clinics and in 2015 were combined into one with a more vascular approach. With this move, we combined all diagnoses into a daily, combined clinic so that our numbers could sustain an Internal Medicine physician's commitment

for the afternoon, as well as meet best practice stroke recommendations.

In our clinic we developed many tools for communication; data tools to track diagnoses, interventions, need for follow-up, wait times, a vascular plan of care and patient itinerary. This project instigated further collaboration between our clinic, emergency and diagnostic imaging in order to plan flow and priority testing times. In our clinic, patients are assessed within 24 hours and receive health teaching, diagnostics and consultation with the Internal Medicine physician or Neurologist all within one visit. Our service is

patient-focused, involving volunteers to assist patients with their itinerary. Team collaboration has been positive with increasing stroke, cardiac and TIA awareness throughout the hospital. In conclusion, daily clinics in a small community can meet best practice for cardiac and stroke patients through interdisciplinary collaboration. Our vascular patients are assessed timely in follow-up, post discharge and also urgently. Our clinic is a work in progress according to our clients' needs while adapting in a constantly changing healthcare environment. ♥

Oral Abstracts of the 2018 Canadian Council of Cardiovascular Nurses Spring Conference

A "Novel", Arts-Based Approach to Improve the Patient Experience: A Cardiovascular Surgery Children's Storybook

B. Bailey, University Health Network, Toronto, ON, E. Ruthig, University Health Network, Toronto, ON, S. Spataro, Hospital for Sick Children, Toronto, ON, K. Foster, University Health Network, Toronto, ON

University Health Network's primary value and above all else: The needs of the patient come first.

Many patients within the Adult Congenital Heart Disease (ACHD) program at Toronto General Hospital, may also be parents of young children. One such patient needed help to explain her upcoming surgery to her child. A fruitless search for appropriate materials and, the subsequent PowerPoint™ deck she developed for her daughter became the inspiration for a new resource for children of patients having cardiac surgery. The multi-disciplinary approach to this yielded "Henry's mom needs heart surgery" (Bailey, Ruthig, Spataro, & Foster, 2017), an illustrated storybook for children aged 3 to 12. This presentation will describe the evidence-based patient education process by which we developed a high-quality, art-based, literary resource to improve the patient experience. Patient feedback to date indicates that this innovative storybook and partner tip sheet helps to alleviate anxiety and worry. In addition, it provides cardiac surgery patients a tool that addresses health literacy by offering access to reliable information, multimodal learning resources, and support to be able to cope together with their children. The developmental process and impact of this project can be generalized into many diverse practice settings.

Heart Failure 101: Practical Tips for Every Practitioner

N. Jamal, Sunnybrook Health Science Centre, Toronto, ON

Heart failure rates continue to increase worldwide with more than 600,000 Canadians living with heart failure today. There have been significant advancements in heart failure management over the past several years including new classification systems, prognosis and risk stratification scores, pharmacotherapy, and nonpharmacological and non-device management options. The fundamentals of heart failure management include care delivery in an integrated system that focuses on the general principles of chronic disease management and prevention. The overall objective of this presentation is to anticipate the evolving goals and complexity of aging patients through their entire journey with heart failure by liaising with specialized services and community supports. It is also imperative that when managing this patient population, discussions about end-of-life care according to the patient's preferences are continually addressed, as they continue on the heart failure disease trajectory.

The purpose of this session is to provide practical tools to manage heart failure in both the acute and community care settings using the 2017 comprehensive update of the Canadian Cardiovascular Society Guidelines for the Management of Heart Failure. Using a case-based approach, practical tips for managing patients with heart failure will be provided. The goal is to increase knowledge in heart failure management using principles from the new guidelines, thereby using this knowledge to translate into changes in clinical practice.

The review of cases will be completed using learnings from the Heart Function clinic at Sunnybrook Health Science Centre in Toronto, Ontario. This clinic manages more than 1,000 patient visits yearly under the care of two

physicians and a Nurse Practitioner. As the Nurse Practitioner in the clinic, I will review some key principles that we have incorporated to manage heart failure, including our strong emphasis on self-management. Sliding scale Lasix regimens are used with all of our patients with great outcomes, which will be presented during this talk.

Out-of-Province Air Transport of Cardiac Inpatients: Are Guidelines Recommended?

C. Kuttinig, St. Boniface Hospital, Winnipeg, MB, L. Avery, St. Boniface Hospital, Winnipeg, MB, E. Hyde, St. Boniface Hospital, Winnipeg, MB, R. Labossiere-Gee, St. Boniface Hospital, Winnipeg, MB, R. Love, St. Boniface Hospital, Winnipeg, MB

Cardiac patients in Manitoba who require medical interventions, such as transplantation or lead extraction, are transported out of province by air to a Canadian cardiac centre that provides these interventions. Often the air carrier responsible for the interprovincial transport of Manitoba residents is unable to provide a transport team. This requires that the Cardiac Sciences Program (CSP) provides an escort for the patient transport. As neither clearly defined escort criteria nor guidelines outlining processes, equipment needs or responsibilities existed, a safety risk was identified.

A clinical practice guideline (CPG) was informed by a review of the evidence, legislative requirements, and appraisal of benefits and harms of alternate care options. Our team set out to develop a CPG to clearly define processes and responsibilities of the escort team. Our CPG provides recommendations in key areas including decision making, communication, team responsibilities, escort requirements, equipment, and documentation. It takes into consideration all aspects of the patient transport from the time of decision to transport to the patient being received at the referring facility and the repatriation of the escort team back to our hospital. This presentation will outline the steps that were taken and the considerations for nursing practice in the development of this CPG for out province air transports.

Cultivating Professional Innovation in Cardiovascular Nursing: Highlighting the Benefits of Engaging in a CCCN Mentor/Mentee Relationship

S. O’Keefe-McCarthy, Brock University, St. Catharines, ON, A. Buckle, MCERT Nova Scotia Health Authority, Lunenburg, NS

Advanced cardiovascular nursing requires competency in the areas of clinical practice, education, administration and research. Opportunities to engage in all of these areas are not typically offered to nurses working on the front lines with actual cardiac patients. The CCCN mentor/mentee program is designed to help build the knowledge base and

competencies of the program’s participants within cardiovascular nursing. The structure is flexible and allows participants to shape their learning goals in a way that is mutually agreeable and specific to their area of interest. Participation in this kind of relationship offers both mentors and mentees the opportunity to experience professional growth. This workshop will highlight a dynamic mentor/mentee relationship of one novice CCCN member with aspirations to transition into cardiovascular research with a seasoned CCCN member currently conducting research.

The objectives of this interactive workshop are to:

1. Understand the purpose of the CCCN mentorship program.
2. Describe successful aspects to consider to create a professional mentoring relationship in either clinical/education/administration/or research.
3. Learn through an example CCCN mentorship of how to navigate this professional learning and relationship that includes: Application, Initial introductions, Defining the boundaries, Leadership of innovation activities.
4. Determine if engaging in the CCCN mentorship program is a good fit for you.

Exploring the Educational Needs and Preferences of Women and Health Care Providers: Designing a Knowledge Dissemination Strategy of Cardiac Prodromal Warning Symptoms

S. O’Keefe-McCarthy, Brock University, St. Catharines, ON, L. Keeping-Burke, University of New Brunswick, Saint John, NB, K. Taplay, Brock University, St. Catharines, ON, K. Stearne, Heart Niagara, Niagara Falls, ON, D. Gibson, Heart Niagara, Niagara Falls, ON, B. Kennedy, Cardiac Health Foundation of Canada, Toronto, ON, L. Boyd, Niagara Health, St. Catharines, ON, I. Chalmers, Pivot Design, Toronto, ON, J. Sawdon, Cardiac Health Foundation of Canada, Toronto, ON, A. Flynn-Bowman, Brock University, St. Catharines, ON, M. Vasilaki, Brock University, St. Catharines, ON, J. Hoelzli, Brock University, St. Catharines, ON, J. Randall, Niagara Health, St. Catharines, ON

Objective: To explore the educational needs and preferences of women with coronary artery disease to target knowledge uptake of the differences in prodromal warning symptoms of ischemic heart disease between women and men.

Methods: A descriptive qualitative design was used. Four healthcare providers (HCPs) and eight women were interviewed using semi-structured interview guides. Data were transcribed verbatim and NVivo 10 was used to assist with sorting, organizing, and coding the data into themes.

Results: Participants wanted targeted messaging of the differences and similarities of prodromal symptoms experienced between men and women. Educational tools were requested with suggestions to include the production of: 1) a phone application of the Prodromal Symptoms-Screening [PS-SS] for self screening and as a means to discuss symptoms with HCPs, 2) an experiential video of women with heart disease talking about their PS experience for educational purposes, 3) social media messaging (i.e., infographic to accurately message about: a) the PS-SS APP, b) the warning signs to be aware of, c) access to e-products on a common website with the ability to download a copy of the PS-SS or summaries of the research for reference, and d) clinician focused educational products [slide deck with narration for clinical education and research summaries of current studies].

Conclusion: Access on-line to evidenced-based knowledge about prodromal warning signs and targeted messaging of the differences between women and men were viewed as critical methods for improving accessibility and availability of this important education and information.

An End User-Designed Application for Emergent Acute Heart Pain: The ACUTE-PAIN APP! Phase I

S. O’Keefe-McCarthy, Brock University, St. Catharines, ON, L. Keeping-Burke, University of New Brunswick, Saint John, NB, K. Taplay, Brock University, St. Catharines, ON, J. Tsang, Niagara Health, St. Catharines, ON, C. Glover, University of Ottawa Heart Institute, Ottawa, ON, C. Norris, University of Alberta, Edmonton, AB, J. Price, Women’s College Hospital, Toronto, ON, S. Morris, Horizon Health Network, Saint John, NB, B. Kennedy, Cardiac Health Foundation of Canada, Toronto, ON, K. Stearne, Heart Niagara, Niagara Falls, ON, A. Flynn-Bowman, Brock University, St. Catharines, ON, M. Vasilaki, Brock University, St. Catharines, ON, J. Hoelzli, Brock University, St. Catharines, ON, J. Randall, Niagara Health, St. Catharines, ON

Proactive immediate treatment of acute pain is critical in the first hours of acute coronary syndrome (ACS) onset to prevent transition to persistent cardiac pain. The purpose of this research was to design the Acute-Heart PAiN-APP. There are no known digital health technologies (DHTs) APPs developed or evaluated to treat acute cardiac pain during an emergency hospital admission for ACS that are designed by patients and healthcare providers (HCPs). The vision for this APP includes both symptom management of acute cardiac pain and anxiety along with nonpharmacological management techniques such as coached guided imagery, relaxation and/or music. In Phase I, we conducted qualitative interviews with individuals with ACS and HCPs to determine the preferred content and format for the APP.

Results: Six patients and three HCPs suggested that the APP consist of four interactive parts: 1) educational/coaching through the acute heart pain, 2) symptom tracking of pain and anxiety, 3) goals to manage the pain: a) coached relaxation-paced breathing, b) guided imagery, c) music, and 4) immediate visual representation of pre-and-post APP effect on pain and anxiety levels.

Conclusion: The Acute-Heart PAiN-APP is an interactive DHT treatment to be offered at the immediate point of healthcare for acute cardiac pain and anxiety experienced during an emergent ACS episode. The APP will permit a therapeutic level of patient control, symptom monitoring and self-management of ACS-pain. More importantly, this intervention may preserve threatened ischemic myocardial muscle, which may circumvent the transition to persistent forms of cardiac pain and disability.

Access to Care from a Stand Alone Heart Cathlab; A Regional Collaboration

T. Rogers, Niagara Health, St. Catharines, ON, L. Boyd, Niagara Health, St. Catharines, ON, J. Randall, Niagara Health, St. Catharines, ON

Our multi-site community hospital offers stand-alone Cath lab services. A partnership agreement exists between our hospital and the tertiary cardiac centre within our LHIN. Cath lab patients requiring an immediate increased level of care are transported to the tertiary centre. At times, transport of these patients is delayed. The outcome of these delays presents a potential risk to patient safety and delays access to care.

The opportunity for improvement became clear to the team. Addressing the delays in transport would decrease risk while increasing safety and access to care. A system-wide analysis of the current state was undertaken revealing gaps in process. The team, including registered staff, physicians, and leadership, collaborated with external stakeholders to develop and refine steps in the process. An algorithm dictating specific roles, responsibilities and timelines for all team members was created. Clearly outlined expectations decreased role confusion for the team and tightened timelines for transport. During this process, logistical gaps were also identified and addressed.

Our experiences creating this system-wide tool are transferable to any area with a stand-alone Cath lab. Transport timing challenges will not be unique, and the gains made by this project may decrease risk, increase safety and timely access to care for patients at like centres.

A Nursing Education Strategy to Optimize and Support Heart Failure Self-Management in the Community

C. Schumacher, McMaster University/HNHB LHIN, Hamilton, ON

Nurses play a key role in providing self-management supports and education for patients with chronic heart failure. Specialized nursing within the home care sector has taken on an expanded role in the management of complex patients with heart failure. Knowledge of heart failure management guidelines and clinical assessment best practices is required. The purpose of this presentation is to describe the development of a preparatory education program for the community rapid response nurse. These specialized community nurses have identified specific areas where additional preparation is required; heart failure medication optimization and triple therapy recommendations, distinguishing care options for preserved and reduced ejection fraction, and assessment

skills relevant to the community setting. The content is designed to complement primary care and address patient needs over the natural course of the disease. Education content is focused on etiology, clinical presentation, pharmacological recommendations, Canadian Cardiovascular Society Guidelines, patient education and readiness principles, use of decision aids, and effective communication with primary and specialist care partners. Adequate preparation is essential to maintaining a consistent approach to chronic disease management and ensuring that the patient's movement through the healthcare system is seamless. The recommended education reflects the unique practice challenges inherent to community nursing and emphasizes building capacity within the system to elevate the patient experience. As the prevalence of heart failure and complexity of home care patients increase, community nurses will require corresponding preparation to maintain quality care. This education can inform recommendations for the development of community nursing competencies for chronic disease management. ♥

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CCCN is announcing a Call for Abstracts related to any aspect of cardiovascular and/or cerebrovascular nursing for presentation at the Annual Spring Conference and Annual General Meeting, May 24th – 25th, 2019, Winnipeg, MB.

Abstract submissions are invited for presentation in English or French. Please indicate on the abstract form the language in which you would like to present. Abstracts are invited as four presentation options: Workshop, Oral, Poster, Oral or poster. Submissions are peer-reviewed in one of two categories: research and non-research.

The submission of an abstract constitutes a commitment by the author(s) to attend the meeting and to present. All presenting authors must register for the meeting and are responsible for their own transportation and accommodation. Abstract grading is performed by blind review and notification of acceptance or rejection of an abstract occurs by email in January 2019.

Please note: CCCN has an online submission process and all abstracts must be submitted on our website at www.cccn.ca. The online submission process opens September 17th, 2018 and closes November 18th, 2018 at 2400 hours.

For more information, visit www.cccn.ca or contact info@cccn.ca.