

STATEMENT OF NEED

Frequently misdiagnosed, pulmonary arterial hypertension (PAH) is a hemodynamic and pathophysiological state associated with several clinical conditions that can lead to progressive right ventricular failure and death.¹ Although complex and difficult to treat, new knowledge about its pathophysiology has led to developments in diagnostic and multiple treatment options that can reduce symptoms and prolong life. These developments are especially significant since the typical PAH patient is a relatively young woman (average age 53 years) in the prime of life, who experiences severe physical and emotional limitations to daily life as a consequence of breathlessness, fatigue, comorbidities, and treatment that can be invasive and painful. Our research indicates that nurses with responsibilities for managing patients with PAH have education needs that are not currently being met.

Clinical Practice Gap #1: Nurses need to be able to identify risk factors for PAH.

Clinical Practice Gap #2: Nurses need to be able to recognize symptoms of PAH and apply treatment algorithms accordingly.

Clinical Practice Gap #3: It is challenging for nurses to remain up-to-date with recommendations for effective treatment strategies, such as combination therapy and goal-oriented therapeutic strategies. Nurses need to be familiar with targeted therapies and their associated toxicities and their implications for nursing management and patient care.

Clinical Practice Gap #4: Nurses need to be able to educate patients about self-care and medication adherence.

Targeted educational activities can bridge these clinical practice gaps and reduce the treatment burden of PAH. This needs assessment identifies key gaps and proposes an online interactive educational activity to address them, supported by specific learning objectives. The goal of this continuing education activity is to enhance nurses' foundational knowledge of and expand their competencies in managing patients with PAH.

METHODOLOGY

- 1) Literature review:** We conducted an extensive analysis of peer-reviewed literature and research findings to evaluate the clinical practice gaps related to the management of PAH and identify their root causes.
- 2) Expert interview:** We conducted an interview with XXX

Burden of Illness

Pulmonary arterial hypertension (PAH) is clinically identified by an increase in pre-capillary pulmonary arterial pressure at rest and is defined according to standard criteria.² As changes in pulmonary vascular resistance occur, patients have additional morbidity and ultimately mortality. The World Health Organization (WHO) classification of PAH includes patients with

idiopathic disease, those with related disorders such as collagen vascular disease, congenital systemic to pulmonary shunts, patients with portal hypertension, HIV disease, and those who may have been exposed to diet drugs or toxins.³ PAH affects 15-50 cases per million adults in Europe,⁴ mostly women 30-50 years old,⁵ although recent data indicate that it is becoming increasingly recognized and in an older population.⁶ In the USA, 1.9 million patients were hospitalized with PAH between 1995—2002, and 117,000 deaths were attributed to PAH.⁷ Without treatment, median life expectancy is 2.8 years.⁸ Risk factors include certain drugs and medications (such as anorectics), Raynaud's syndrome, and genetics, as well as connective tissue disease and HIV.⁹

Patients with PAH typically experience poor quality of life (QoL) associated with physical symptoms such as chest pain and syncope, generalized fatigue, therapy complications (diarrhoea, jaw pain), abdominal pain and peripheral edema,¹⁰ and experience severe emotional impairment.¹¹ While treatment is available in many specialized centres in Europe, access varies. Moreover, it can take up to 18 months for patients to receive a diagnosis and start treatment from the time they first notice shortness of breath.¹² However, European patient organizations and coalitions such as the Pulmonary Hypertension Association are increasingly playing a key role in advocating for policy and resources to address PAH, as are nurses.

CLINICAL GAP ANALYSIS

Clinical Practice Gap #1: Nurses need to be able to identify risk factors for PAH.

Root cause:

- PAH is a rare, though increasing, disease about which nurses are infrequently educated.

Pulmonary hypertension is an abnormal elevation in pulmonary artery pressure, and may be the result of left heart failure, pulmonary parenchymal or vascular disease, thromboembolism, or a combination of these factors. Whether the pulmonary hypertension arises from cardiac, pulmonary, or intrinsic vascular disease, it is generally a feature of advanced disease. Because the causes of pulmonary hypertension are so diverse, it is essential that the etiology underlying the pulmonary hypertension be clearly determined before embarking on treatment.

The pathophysiology of PAH is complex, involves various biochemical pathways and cell types and its various clinical subgroups exhibit different pathology and pathobiology. In addition, the genetic basis for familial transmission has been recognized since 2000, and around 6% of patients with PAH have a family history of this disease.¹³ Knowledge about genetic allelic variants and polymorphisms, as well as other risk factors, such as methamphetamine use, connective tissue diseases (especially limited systemic sclerosis), and congenital heart disease, may enable nurses to identify patients at risk of developing PAH, and so initiate early support or preventive management, including counseling patients on further risks and education about the need to avoid air travel, high altitudes and pregnancy.

Outcome. The pathobiology of PAH is multifactorial. Education that addresses knowledge gaps about advances in the mechanisms, presentations and natural history of PAH can enable nurses to identify risk factors for PAH and so initiate early support and preventive management.

Clinical Practice Gap #2: Nurses need to be able to recognize symptoms of PAH and apply treatment algorithms accordingly.

While mild cases of PAH may present with dyspnea on exertion or nonspecific fatigue, the presence of comorbidities such as HIV, sleep disorders, parenchymal lung disease, and left heart disease add to the complexity of recognizing and diagnosing PAH. Consequently, new European guidelines recommend the use of an algorithm to support the accurate diagnosis of PAH and guide diagnostic testing in cases of suspected PAH using screening tests to gauge hemodynamic profile.¹ Detection and assessment of PAH is based on a direct measurement of mean pulmonary arterial pressure >25 mmHg at rest or 30 mmHg with exertion, and the absence of significant left heart dysfunction,² although there are technical limitations even under optimal conditions that undermine the accuracy and reliability of such measures.¹⁴ Echocardiography is the most portable and widely available noninvasive technology that estimates pulmonary artery pressure and assesses cardiac structure; therefore, it is the screening tool recommended in European guidelines for all cases of suspected PAH.¹

Following detection, assessment of functional class is determined via the World Health Organization functional classification system I-IV (WHO FC). Accurate classification is critical for guiding treatment choices, since inaccurate classification can lead to inappropriate treatment, increase risk to patients, and unnecessarily utilize therapies.¹⁵ However, a major challenge for nurses caring for patients with suspected PAH is that symptoms of the disease are non-specific.¹⁶ Indeed, 5%-25% of clinically diagnosed PAH is comprised of pulmonary veno-occlusive disease (PVOD), thus, **misdiagnosis may, in fact, contribute to failure of medical therapy.**¹⁷

Recognition of symptoms in the early stages of PAH is key to optimal outcomes, and nurses need to be able to undertake baseline clinical assessments prior to initiating therapy. Wendy Gin-Sing notes that not only is recognition of symptoms important, but also:

When nurses are familiar with the subtleties of the disease, they can play a key role in identifying symptoms before they become a significant and traumatic problem, and initiate treatment accordingly.

As additional treatment options are developed, the evaluation and treatment of PAH will continue to increase in complexity. Thus, nurses need to be able to be updated on treatment algorithms and enabled to individualize patient care plans.

Outcome. Accurate recognition and diagnosis of PAH is complicated by the many interrelated molecular and cellular mechanisms that are implicated in the development of PAH. Education can help shorten time to diagnosis by enhancing nurses' competence in recognizing the subtleties of disease symptoms, their ability to perform clinical assessments, and their ability to

apply current diagnostic algorithms recommended in European guidelines.

Clinical Practice Gap #3: It is challenging for nurses to remain up-to-date with recommendations for effective treatment strategies, such as combination therapy and goal-oriented therapeutic strategies. Nurses need to be familiar with targeted therapies, their associated toxicities and their implications for nursing management and patient care.

Root cause:

- Newer, emerging combination therapies are changing the standard of care in the treatment of patients with PAH.

Substantial advances in treatment for PAH have been made during the past decade, such that, while PAH is ultimately incurable, new therapies have impacted treatment goals, which focus on reducing pulmonary vascular resistance, pressure and symptoms and increasing patient activity and longevity. The standard of care for treating PAH includes eliminating risk factors, optimizing therapy for associated conditions, such as left-sided heart disease, adjunctive therapy directed to the consequences of PAH (such anticoagulation, diuretics, oxygen, and digoxin),¹⁸ and pharmacologic therapy to reverse or diminish vasoconstriction and vascular endothelial and smooth muscle cell proliferation. Several classes of drugs have been developed that target and prostacyclin, nitric oxide, and endothelin pathways.¹⁹ These drugs include calcium channel blockers, prostacyclin analogues (treprostinil, epoprostenol, iloprost), endothelin-1 receptor antagonist (ERAs, such as ambrisentan, bosentan) and phosphodiesterase type 5 (PDE5) inhibitors (sildenafil), all of which have been found to improve functional capacity, exercise tolerance and hemodynamic parameters.¹⁴ Nitric oxide, atrial septostomy, and lung transplantation are used in cases of failed pharmacologic treatment of PAH.

Therapeutic choices are based on the WHO functional classification. Nonetheless, treatment options can be complex and vary in their patient and clinical outcomes. For instance, studies suggest that while intravenous epoprostenol is expensive, generates complications such as ascites and thrombocytopenia, and can lead to death if interrupted, it is effective in improving QoL, exercise capacity, hemodynamics and survival.¹⁰ Treprostinil has been shown to improve 3-year-survival but dose delivery can be interrupted by pain at infusion site.²⁰ In addition, there are oral or inhaled endothelial receptor antagonists for patients with less severe disease such as oral bosentan and ambrisentan, which may improve functional status, dyspnea and exercise capacity.²¹ As a consequence of differences in monotherapy outcomes, and in the absence of head-to-head clinical trials, combination therapy is increasingly appealing, since different agents have different modes of action and target different pathways. There is evidence of efficacy and improved outcome measures in several clinical studies,²²⁻²³ which suggest that the combined actions of agents could achieve greater overall therapeutic effect.¹⁰ In addition, studies are currently evaluating the use of oral agents, such as sitaxsentan and riociguat.²⁴ Nurses need to be aware of the range of therapies available, associated toxicities and their implications for dose delay and reduction, and educated about nursing management of delivery systems such as central venous lines.²⁵

Outcome. Education about the range of available therapies and their potential for toxicity can help nurses optimize treatment outcomes for their patients.

Clinical Practice Gap #4: Nurses need to be able to educate patients about self-care and medication adherence.

Root cause: PAH medication regimens are complex and pose a barrier to patient adherence.

Rapid developments in treatment options for patients with PAH bring challenges in patient care, especially since the complex nature of PAH and the need for systematic reevaluation requires that nurses need to be able to work with a multidisciplinary approach. Accordingly, nurses need to be educated in order to be effective members of a multidisciplinary team,¹³ which also provides the optimal environment for educating patients about their condition for successful disease management.²⁰ Moreover, consensus guidelines identify nurses as a central link between physicians and patients,¹⁷ and indeed, Wendy Gin-Sing observes that nurses are well placed to take:

An holistic approach to patient care that includes explaining what patients need to know about PAH; the practical aspect of the process, what to expect from the disease, what particular tests are to be taken by the patient and the reasons for such tests.

In addition, adherence to medication regimens improves patient outcomes in chronic disease.²⁶ In the context of PAH, decreased adherence has been associated with dosing frequencies of three or more times per day in oral therapies.²⁷ Treatment regimens in PAH can be complex and medications that require monthly laboratory testing, such as endothelin receptor antagonists or warfarin, may reduce adherence. Similarly, studies suggest that it can be challenging for patients to adhere to dosing schedules where nebulised therapy is administered many times a day, and in regimens requiring frequent inhaled prostacyclin treatments, patients have reported missed and delayed doses. Therefore, nurses need to be able to assess adherence and educate patients about the importance of medication adherence and self-efficacy.²⁸

Outcomes: Education about strategies that support medication adherence can enable nurses to educate in a multidisciplinary environment their patients about the importance of self-care and self-efficacy in optimizing outcomes.

EDUCATIONAL TABLE

Clinical Practice Gap #1: It is challenging for nurses to identify risk factors for PAH.			
Root Causes	Learning Objectives	Desired Outcomes	Outcomes Measures
PAH is a rare, though increasing, disease about which nurses are infrequently educated.	Identify patients at risk for PAH.	Education that addresses knowledge gaps about advances in the mechanisms, presentations and natural history of PAH can enable nurses to identify risk factors for PAH and so initiate early support and preventive management.	<p><u>Level 3:</u> Likert scale statements and multiple choice questions to measure knowledge about risk factors for PAH.</p> <p><u>Level 4:</u> Clinical case vignettes to assess nurse competence to identify patients at risk for PAH.</p>
Clinical Practice Gap #2: It is challenging for nurses to recognize, diagnose and assess patients with PAH.			
New European guidelines recommend application of a classification system and a diagnostic algorithm.	List symptoms of PAH.	Participants will be prepared to recognize symptoms of PAH, perform clinical assessment, apply the diagnostic algorithm recommended in expert and consensus guidelines.	<p><u>Level 3:</u> Likert scale statements and multiple choice questions to measure knowledge about symptoms of PAH.</p> <p><u>Level 4:</u> Clinical case vignettes to assess nurse competence to recognise and assess patients with PAH.</p>
Clinical Practice Gap #3: It is challenging for nurses to remain up-to-date with recommendations for effective treatment strategies, such as combination therapy and goal-oriented therapeutic strategies.			
Newer, emerging combination therapies are changing the standard of care in the treatment of patients with PAH.	Describe therapeutic regimens and their associated toxicities.	Participants will be prepared to manage toxicities associated with existing and emerging therapies.	<p><u>Level 3:</u> Likert scale statements and multiple choice questions to measure knowledge about current and emerging therapies for PAH.</p> <p><u>Level 4:</u> Clinical case vignettes to assess nurse competence to manage toxicities associated with PAH therapies.</p>
Clinical Practice Gap #4: It is challenging for nurses to assess the efficacy of treatment in patients with PAH.			
PAH medication regimens are complex and pose a barrier to patient adherence.	Develop strategies for self-care and medication adherence.	Participants will be prepared to educate patients about strategies that improve medication adherence and self-efficacy.	<p><u>Level 3:</u> Likert scale statements and multiple choice questions to measure knowledge about barriers to medication adherence.</p> <p><u>Level 4:</u> Clinical case vignettes to assess nurse</p>

			competence to educate patients about self-efficacy and medication adherence.
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DRAFT LEARNING OBJECTIVES (subject to revision by faculty)

1. Identify patients at risk for PAH.
2. List symptoms of PAH.
3. Describe therapeutic regimens and their associated toxicities.
4. Develop strategies for self-care and medication adherence.

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