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Respiratory Treatments in Post-COVID Patients to Improve Physical Activity

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Walden University
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Abstract

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MSN, University of South Alabama, 2007

BSN, Clayton State University, 2003

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

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November 2022

Abstract

A significant number of individuals affected by the coronavirus (COVID) developed severe acute respiratory syndrome (SARS), causing respiratory dysfunction which led to decreased functional capacity. This project aimed to evaluate the project site's archival data for post-COVID patients to determine whether respiratory treatments improved physical activity, as evidenced by the results of the pre and post 6-minute walk test (6MWT) and oxygen saturation (SpO_2) levels. The Donabedian quality model was utilized to evaluate the resources, the interventions, and the outcomes of post-COVID patients. Sources of evidence used were peer-reviewed articles retrieved from the Walden Library and CINAHL databases using Boolean search operators. The project question focused on whether respiratory treatments in post COVID patients improved the scores on the 6MWT. The project site's archival data from September 2020 to December 2020 were analyzed with EXCEL and SPSS software using one-way analysis of variance (ANOVA) and scientific evidence in the treatment of respiratory diseases. The sample size was 20 with three groups: (a) albuterol, (b) long-acting beta agonist, and (c) other, which included short-acting beta agonists and inhaled corticosteroids . The findings show respiratory treatments were prescribed during the recovery phase. However, there was not sufficient evidence that any specific respiratory treatment improved physical activity. Further research on a larger sample and a longer timeframe is recommended. The positive social change implications of this project are possible improvement in patient outcomes, nursing practice and workflow, and identification of the best interventions for post-COVID patients that can improve respiratory dysfunction.

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Dedication

This project is dedicated to my family who are my biggest fans and supporters. James, my loving husband, I thank you for always saying “you got this,” for your patience, and your love. My kids, Jocelyn, Jennifer, and James II you guys taught me to be fearless and that nothing is impossible. To my parents, Sarah and Henri, thanks because without you all there would be no me. I love you both, your words of encouragement kept me going. Thanks sissy, Cindy, you’re the real Shero and special niece, Tiffany. My grandkids Deion, Jordan, Arionne, Laila, Chad, Trevon, and Travis, my motivators, always strive to be the best YOU! To all my friends and other family members thanks so much for always cheering me along, showing me love, and having faith in me. I love you all.

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Section 1: Nature of the Project

Introduction

The coronavirus disease (COVID-19) was a global pandemic impacting millions with the infection and leaving individuals with residual effects. COVID-19 is an acute respiratory infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), transmissible through droplets (Huang et al., 2020; Wu et al., 2021). Some individuals affected by the virus had residual dysfunction of dyspnea and respiratory weakness, reducing their functional capacity. Due to the long-term effects, "long COVID" was used to describe the symptoms of those individuals who recovered from the acute phase but still reported effects of the infection beyond the expected time frame (Martimbianco et al., 2021). Though some cases were mild, others were more moderate to severe illnesses with residual symptoms that lingered for months requiring supplemental oxygen (Huang et al., 2020). Although many patients with COVID-19 recovered and returned to their baseline, other patients encountered long-term effects from severe pneumonia with constitutional symptoms and uncertainty of returning to their everyday quality of life.

This project was designed to evaluate the quality improvement (QI) initiative implemented by the project site to evaluate post-COVID patients with persistent respiratory dysfunction to improve functional capacity. This QI was implemented to evaluate post-COVID patients who were at least three weeks post-infection with serial radiographs, pulmonary function tests (PFTs), 6-minute walk test (6MWT), and overnight pulse oximetry if indicated by the diagnostics. For those patients with a high

clinical suspicion of sleep apnea, polysomnography (PSG) or a home sleep apnea test was recommended to confirm obstructive sleep apnea, according to a nurse practitioner (NP) at the project site. Normally, PFTs demonstrate obstructive or restrictive airway patterns. The NP further explained that in patients with PFTs demonstrating obstructive airway disease associated with chronic obstructive pulmonary disease (COPD) or asthma, bronchodilator therapy was initiated as an intervention, and the patient was reassessed on a follow-up visit. Other methods to evaluate improvement in symptomatic post-COVID patients utilized were chest radiographs to determine the resolution of pneumonia and identify any disease progression. The 6MWT was the primary method utilized to evaluate improvement in activity tolerance and oxygen saturation (SpO_2) measurements.

The outcome of the diagnostic evaluation determined the appropriate intervention for the patient. Not all the patients received an intervention; however, some received respiratory treatments when PFTs demonstrated obstructive airway disease, asthma, or COPD, according to a NP at the project site. Patients who demonstrated obstructive airway disease on PFT were started on bronchodilator therapy and then reassessed in a follow-up appointment within 6 to 8 weeks with a repeat 6MWT performed to evaluate improvement in activity tolerance by measuring SpO_2 on room air with a pulse oximetry device, according to a nurse practitioner at the project site. The study conducted by Maniscalco et al. (2021) suggested that treatment with bronchodilators potentially induced functional improvement in post-COVID patients. The American Thoracic Society (ATS) endorsed the 6MWT to evaluate walk endurance and functional capacity (Macchiavelli et al., 2021). This project aimed to evaluate the post-COVID patients'

existing outcome data and determine whether respiratory treatments improved physical activity, as evidenced by the results of the 6MWT. The 6MWT was utilized to evaluate improvement in functional capacity by measuring pre- and post-SpO_2 levels.

Healthcare delivery, patient outcomes, and nursing practice were some of the areas that the Doctor of Nursing Practice (DNP) project shared the potential for positive social implications. Health care organizations and nurses were ill-prepared for the COVID-19 pandemic, which left organizations struggling to accommodate patients with coronavirus and respiratory failure. Nurses faced mental and emotional turmoil and, at the same time, a renewed sense of meaning for their work (Jin & Rosemberg, 2021). The implications of this project encouraged the development of new nursing protocols for preventive and early strategies in patients infected with the coronavirus. According to Jin and Rosemberg (2021), the development of these protocols did support nurses by encouraging team building and well-being during and after a pandemic. Subsequently, protocols influenced leadership visibility and transparency aided in sustaining the organization's morale.

Problem Statement

The symptomatic difficulty in breathing impacts an individual's functional capacity. When patients develop a decrease in functional capacity, it has a cascading impact on their physical health and mental health. The pandemic created challenges to keeping people engaged in physical activity which was inhibited by social distancing and sheltering in place to decrease the spread of coronavirus. One of the leading health indicators of *Healthy People 2030* was reducing the proportion of adults who do not

engage in physical activity and implementing ways to engage people in physical activity (Office of Disease Prevention and Health Promotion, n.d.-a). One of the chief benefits of improving physical activity was the decrease in obesity and the risk of chronic diseases which included hypertension, diabetes, high cholesterol, stroke, osteoarthritis, and some forms of cancer (Office of Disease Prevention and Health Promotion, n.d.-b). Several COVID studies showed a significant number of participants with pre-existing obesity, hypertension, and diabetes conditions.

Immobility increases or worsens comorbidities, which leads to temporary and permanent disability. Halpin et al. (2021) revealed pre-COVID-19 comorbidities in patients with 36.8% obesity, 39.7% hypertension, and 27.9% type 2 diabetes. Cortés-Telles et al. (2021) conducted a study comparing spirometry and the 6MWT in post-COVID patients and found that 52% of the participants were obese, 20% were hypertensive, and 16% were diabetics. These data suggested the potential for worsening chronic diseases in post-COVID patients with limited functional capacity and activity tolerance and a probable correlation between comorbidities and recovery. As of July 2021, the Office for Civil Rights of the U.S. Department of Health and Human Services and the Civil Rights Division of the U.S. Department of Justice established guidance on long COVID as a disability of Title II and III under the Americans with Disabilities Act (ADA), Section 504 of the Rehabilitation Act of 1973, and Section 1557 of the Patient Protection and Affordable Care Act (U.S. Department of Health and Human Services, 2021). Nurses were not prepared to assess long COVID patients. Subsequently, the creation of educational guidelines on the risk of chronic diseases, post-COVID patient

care, and nursing education were developed to improve delivery of care and patient outcomes.

This DNP project evaluated the existing data collected by the project site from September 2020 to December 2020 of post-COVID patients who were at least 3 weeks post-infection with respiratory dysfunction and the clinical response to respiratory therapy in improving SpO_2 measurements during the 6MWT. The problem statement addressed the impact of respiratory treatments by measuring pre- and post-SpO_2 using the 6MWT to evaluate activity tolerance in post-COVID patients after 3 weeks post-discharge or post-infection. The 6MWT was utilized to evaluate functional status relevant to an individual's daily activities with cardiopulmonary disease (Huang et al., 2020). The 6MWT was conducted in a group of post-COVID patients 2 months post-discharge with persistent symptoms of dry cough, dyspnea on exertion, or significant fatigue. A drop in SpO_2 of less than 95% was noted before and after the test (Padalkar et al., 2021). Another study showed that, after 30-day post-discharge, post-COVID patients continue with activity intolerance related to pulmonary sequela and respiratory muscle weakness (Huang et al., 2020; Soni & Nimbalkar, 2021). Maniscalco et al. (2021) conducted a study with post-COVID patients 2 months post-infection; 32% of the subjects had normal findings on PFTs, and 6% had restrictive both obstructive. The study results suggested that bronchodilator reversibility testing was considered in the treatment planning of post-COVID patients with dyspnea (Maniscalco et al., 2021).

The global impact of the COVID-19 pandemic and the associated care needed for those with disability following illness significantly impacted nursing practice (Camicia et

al., 2021). During the pandemic, healthcare systems faced an increase in hospital admissions and mortalities, and healthcare workers struggled with providing safe quality care and ensuring appropriate allocation of resources. However, the unexpected chaos with the sudden influx of infected patients and the uncertainty of the virus, affected nursing physically, mentally, and financially. According to Camicia et al. (2021), inpatient rehabilitation nurses were identified as one of the groups negatively impacted by the pandemic with increased stressors of virus transmission, effectiveness, and availability of personal protective equipment (PPE), concerns increased family responsibilities due to school closures, and reduction in family members' income due to unemployment (Camicia et al., 2021). This project was significant to nursing practice in providing new knowledge for future scientific research, useful for replication and critique, and the establishment of evidence for intervention implementation.

The project provided knowledge to help nurses build clinical practice guidelines and protocols to improve evaluation and care delivery. During the pandemic, nurses experienced extremely stressful moments which was partially due to the unknown effects of the virus and concerns for protecting themselves and their loved ones. There were unclear protocols on how and when to use PPE which further complicated the situation. The project identified whether the initiation of respiratory therapy in post-COVID patients demonstrated improvement in physical activity which was advantageous to improving nursing practice, stress, and work environment. The implication of the project was significant to nursing practice in the early identification of those patients with respiratory dysfunction and early ambulation and mobility to improve patient outcomes

and prevention other health risk associated with a sedentary lifestyle. COVID-19 is a novel, highly transmissible virus that affects multiple systems of the body. Hence, these implications of this project will be utilized in nursing practice for future research were considered.

Purpose

The project site developed a QI initiative to evaluate post-COVID patients who required supplemental oxygen and reported persistent dyspnea. This project aimed to evaluate the project site's archival data to determine the effectiveness of respiratory treatment on improving the outcomes of the 6MWT as evidenced by SpO_2 measurements. The coronavirus was novel, and the long-term effect on patients remains under investigation. After 30 days post-hospitalization post-COVID, evidence showed that patients continued with hypoxia muscle weakness and further research was recommended on exercise tolerance (Huang et al., 2020). According to Soni and Nimbalkar (2021), COVID-19 patients showed diminishing activity tolerance with decreasing oxygen saturation and the PFT showed a decline in the lungs' ability to perform proper gas exchange. The failure of the lungs to function properly caused an increase in work of breathing and fatigue. The project site developed a clinical guideline for post-COVID patients with residual respiratory issues, consisting of serial radiographs, PFTs, overnight pulse oximetry, and the 6MWT to evaluate improvement in respiratory status and activity tolerance. The 6MWT was used to evaluate the functional status, which closely resembles the patient's daily activities (Soni & Nimbalkar, 2021).

Some studies indicate patients continued with respiratory symptoms for 6 months, followed by serial lung imaging and PFTs. Post-COVID patients with pneumonia and persistent symptoms of dyspnea 2 months post-hospital discharge demonstrated a clinically significant drop of greater than 4% in SpO_2 from baseline after the 6MWT (Padalkar et al., 2021). Maniscalco et al. (2021) revealed improvements in FEV1 of patients with COPD and asthma after salbutamol with 41.7%, subsequently inducing functional improvement. The practicum site's existing data were not evaluated prior to this project to determine whether the administration of respiratory treatments demonstrated improvement in room air SpO_2 and activity tolerance of post-COVID patients. Consequently, the practice-focused question was as follows: In post-COVID patients who received respiratory treatments, did the pre- and post-results of the 6MWT demonstrate improvement in activity tolerance as evidenced by the room air SpO_2 measurements?

The respiratory status of patients infected with COVID-19 change rapidly. Subsequently, during the pandemic, nurses in the acute care setting were essentially responsible for assessing and monitoring the respiratory status of these patients for changes requiring a higher level of hospital care. After hospitalization, a significant number of patients were followed closely in the outpatient setting by advanced practice registered nurses (APRN) to be reassessed for improvement in their respiratory status and to determine whether respiratory therapy help to improve the patient's breathing and physical tolerance. This close follow-up increased the workload for APRNs and disrupted their workflow. This project addressed the practice gap of whether respiratory treatments

improved activity tolerance in post-COVID patients, thus improving both patient outcomes and nursing practice workflow.

Air exchange was important in gas exchange component in symptomatic post-COVID patients. Some post-COVID patients exhibited difficulty in the exhalation of air which led to air volume retention causing dyspnea and shortness of breath or obstructive airway disease. Maniscalo et al. (2021) study revealed the effectiveness of bronchodilators in post-COVID patients with concomitant obstructive lung disease and how expiratory air volumes or forced expiratory volumes in one second (FEV_1) improved on an average of 41.7 milliliters after bronchodilators. This study suggested treatments with bronchodilators induced functional improvement and breathing in post-COVID patients (Maniscalo et al., 2021). Thus, the results of this doctoral project were an addition to the current evidence on the effectiveness of bronchodilator therapy to improve activity tolerance in post-COVID patients and provided evidence for new clinical practice guidelines for evaluating breathlessness and mobility.

Nature of the Doctoral Project

Walden University's *Quality Improvement Manual* was reviewed, and the recommended guidelines were followed to evaluate the project site's QI initiative. The evidence for the doctoral project came from primary and secondary sources. Systematic reviews, meta-analyses, scholarly peer-reviewed articles, and retrospective studies were obtained through the Walden Library using Boolean search operators and nursing databases such as CINAHL (Cumulative Index to Nursing and Allied Health Literature), Medline, ProQuest Nursing, and PubMed. Public websites such as the Centers for

Disease Control and Prevention (CDC), the World Health Organization, and the Georgia Department of Public Health were utilized for local and world statistics associated with coronavirus. The advanced search was conducted using the keywords *COVID-19, long-COVID, long haulers, 6MWT, six-minute walk test, respiratory dysfunction, bronchodilators, asthma, COPD, and COVID pneumonia, nurses, APRN, pulmonary treatments,* and *oxygenation*.

Since the evidence on post-COVID patients was rapidly evolving, I utilized the highest evidence and quality based on the Johns Hopkins Evidence-Based Practice (JHEBP) which included systematic reviews and meta-analysis with and without randomized controlled trials (Johns Hopkins, n.d.). According to Gray et al. (2017), systematic reviews and meta-analyses were the most robust research evidence to manage the practice problem. I examined the quality of the evidence for consistent results, sample size, and design and used a literature review matrix to organize and analyze the evidence. The literature review included the results, the limitations, and the level of the research evidence. The evidence was downloaded into Endnote Library for easy access, review, and reference. After Walden Institutional Review Board (IRB) approval, I evaluated the practice site's archival data, which I stored in a password-protected Microsoft Excel file. Each patient was assigned a de-identifier. The data analysis allowed me to examine the connection between respiratory treatment in post-COVID patients and improvement in activity tolerance demonstrated by improved SpO_2 measurements with the 6MWT.

Significance

The results from the DNP project provided the physicians, nurse practitioners, and administrative staff with information on the effectiveness of bronchodilators in improving functional capacity in patients with an obstructive component on PFTs with persistent dyspnea and reduced SpO_2 measurements. These results brought awareness to the stakeholders about the aggregate population's demographics, post-COVID patients seen within the project timeframe, how many patients completed the 6MWT on the initial visit and showed improvement of room air SpO_2 after respiratory treatments, and the existence of other comorbidities. The results provided evidence to improve clinical practice guidelines and eliminate unnecessary medication administration. Subsequently, the purpose of this project was to determine the impact of respiratory treatment in patients infected with coronavirus and the improvement in physical activity.

DNP Essential VII (Clinical Prevention and Population Health Improving the Nation's Health) prepared me to analyze epidemiology and biostatistics of individual, aggregate, and population health to address health promotion and disease prevention (American Association of Colleges of Nursing, 2020. p.16). Through scholarship, nursing research, and systematic review, I had the evidence to encourage a scientific approach for the promotion and evaluation of interventions for aggregates and populations at risk for long COVID. This DNP project provided knowledge for nursing on post-COVID patients with persistent dyspnea and identified interventions that improved mobility and functional capacity. The project encouraged and supported nurses in the establishment of protocols and clinical guidelines for post-COVID patients with respiratory dysfunction to

improve patient outcomes. The project demonstrated the importance of improving care delivery, patient satisfaction, and patient outcomes in post-COVID patients with acute hypoxia and identifying those who may require further intervention. The project results showed that the use of bronchodilators as an intervention for post-COVID patients was transferrable for use in primary care, other outpatient facilities, and other organizations to evaluate cardiopulmonary function. This project's results were a contribution to nursing practice, an identification of ways to enhance preventive guidelines, assessment of risk factors, clinical management, and patient education (Martimbianco et al., 2021).

Summary

Globally, millions of individuals were impacted by COVID-19. Those with milder symptoms recovered without residual effects. However, others with moderate to severe illness continued with lingering respiratory dysfunction and activity intolerance (Soni & Nimbalkar, 2021). Many individuals tested positive for coronavirus and died during the pandemic due to respiratory issues resulting from the virus. The decreased oxygen and lung compliance lead to decreased physical activity due to breathlessness and fatigue. The practicum developed a QI initiative to evaluate post-COVID patients with respiratory dysfunction at least three weeks post-discharge or post-infection, according to a physician at the project site. In this project, I evaluated the existing data collected by the practicum from September 2020 to December 2020 of post-COVID patients with respiratory dysfunction who received respiratory treatments and the results of the 6MWT pre- and post-SpO_2 measurement to determine if an improvement in activity tolerance occurred.

The practice problem, the purpose, and the selected framework to guide the evaluation of the QI are discussed in Section 2.

Section 2: Background and Context

Introduction

The COVID-19 pandemic impacted millions of individuals throughout the world. Over the last 2 years, there were intermittent periods with surges and peaks and different variants of the virus. Some individuals infected with the virus continued with persistent symptoms referred to as long COVID. The practice problem was whether respiratory treatments were effective in post-COVID patients to improve 6MWT outcomes and activity tolerance as demonstrated in pre- and post-SpO_2. Some patients required supplemental oxygen to maintain SpO_2 of greater than or equal to 92%, resulting in decreased activity tolerance, while others did not have residuals. In the project, I evaluated and analyzed the archival data of the project site for those patients infected with COVID from September 2020 to December 2020 and determined whether respiratory treatments did improve patients' functional capacity, as demonstrated by the completion of the 6MWT and improvement in room air SpO_2 measurements. At the project site, respiratory treatments were initiated in post-COVID patients when PFTs demonstrate an obstructive component and were symptomatic, according to a nurse practitioner at the project site.

The DNP project demonstrated the effectiveness of respiratory treatments as an intervention to improve dyspnea in post-COVID patients by evaluating the pre- and post-SpO_2 measurements using the 6MWT evaluation. Using a Donabedian quality model, I analyzed the existing practicum data after IRB approval and provided stakeholders with the evaluation findings and potential recommendations for improvement in practice. I

utilized the Walden University Library and the highest level of research evidence available. This research evidence was evaluated using the Johns Hopkins Evidence-Based Practice Model. Walden University's *Quality Improvement Manual* was used to guide the development of the project.

I used the Donabedian quality model to evaluate the structure, process, and outcomes of the QI and intervention to demonstrate improvement in physical activity in post-COVID patients. The Donabedian quality model was a reliable framework used to evaluate QIs in healthcare. The framework evaluated the resources, the intervention implementation, and the outcomes. The coronavirus disrupted how nurses typically provide care and the interaction between nurses, patients, and their families. The implication of the project had relevance to nursing practice and identification of how nurses used evidence, past experiences, and patient experiences to influence practice changes. The project established new knowledge for nursing practice for replication and development of new research.

The pandemic had a crippling effect on the world, with millions of infected individuals. Subsequently, my role as the DNP student was to demonstrate leadership skills through effective interpersonal collaboration, appraising the evidence, and evaluating the project site's existing data from the QI. I was commissioned to translate the evidence for potential use in practice, understand the culture of the practice, and consider how change can impact the practice. Overall, this project addressed the physiological aspects of post-COVID and the impact of the intervention, the resources, and the outcomes. This section described the concepts, models, and theories used to guide

the development of this project. Additionally, this section explored the project's relevance to nursing practice, the local background and context, and my role as the DNP student.

Concepts, Models, and Theories

The Donabedian quality model was a theoretical framework utilized for evaluating QIs in health care. The theoretical framework assessed a triad of structure, process, and outcome (Ameh et al., 2017). I selected the Donabedian quality model to evaluate the project's QI initiative; the impact of the structure, process, and outcome; and the setting, the intervention, and the results from the intervention. This approach allowed me to evaluate the effectiveness of the respiratory treatments initiated in post-COVID patients. The Donabedian model postulated that a good structure promotes a good process while producing good outcomes (Ameh et al., 2017).

The structure was the organization and the resources available to perform the 6WMT and document pre- and post-room air SpO_2 measurements. The process was identified as the intervention, or the respiratory treatments prescribed for post-COVID patients. At the same time, the outcomes were the desired results of the intervention to improve the patient's ability to tolerate activities. Ameh et al. (2017) explained that the Donabedian model is used to evaluate QIs, and the results validated the improvement in care delivery.

The Donabedian quality model also focuses on seven elements of quality care. These elements include efficacy, effectiveness, efficiency, equity, optimality, acceptability, and legitimacy. Efficacy is a measure of the care provided in an optimal

condition (Ameh et al., 2017). Effectiveness refers to the outcome of the intervention, whereas efficiency refers to the cost-effectiveness without compromising care (Ameh et al., 2017). Equity pertains to whether the care was fairly distributed to all individuals. Optimality has to do with the cost-benefit ratio of the intervention (Ameh et al., 2017). Acceptability relates to an assessment of the accessibility of the care and the patient-provider relationship (Ameh et al., 2017). Lastly, the legitimacy addressed whether the care was delivered socially acceptable manner.

Some of the terms used in the doctoral project were interchangeable. The terms for post-COVID patients are *long COVID patients* or *long haulers*. The CDC (2021) explained that *post-COVID* was an umbrella term used for patients' wide range of physical and mental consequences. Another term used interchangeably was *activity tolerance* as functional capacity and *exercise tolerance* as an outcome of the 6MWT. The classification of the disease in terms of severity and symptomatology varied in the evidence. According to Martimbianco et al. (2021), the frequency of long COVID ranged from 3 to 24 weeks after the acute phase or hospital discharge. Some of the evidence did not clearly define the severity. However, Cortés-Telles et al. (2021) reported COVID severity classifications as the following:

- mild – ambulatory without hypoxemia,
- moderate – ambulatory but requiring supplemental oxygen (O_2) of less than 5 L/min, and
- severe – hospitalized with O_2 greater than 5 L/min, prone position for at least 12 hours per day without mechanical ventilation.

The National Institute for Health and Care Excellence (NICE) coined the persistent symptoms as "post-COVID syndrome." It categorized the symptoms as acute post-COVID syndrome with symptoms persisting 3 weeks beyond the initial infection and chronic post-COVID syndrome with symptoms persisting beyond 12 weeks (Iqbal et al., 2021).

Relevance to Nursing Practice

The DNP project was embedded in relevance to nursing practice. The COVID pandemic impacted the way nurses typically provided care and used their clinical experience. In practice, nurses used their experience and knowledge to care for patients; however, with COVID being a novel virus, nurses were faced with unexpected patient outcomes, with some resulting in death. COVID affected patients' health-related quality of life (HRQoL) and the patients' ability to function normally as COVID-19 symptoms were reported to persist for months after the acute phase, which led to changes in lifestyle and normal function and poor HRQoL (Qu et al., 2021). Qu et al. (2021) reported 57.6% of the participants presented post discharge with prolonged fatigue, followed by 26.1% reporting shortness of breath after light physical activity. Post-pandemic, nurses were prepared to evaluate current processes, protocols, and clinical practice and the current evidence to identify QIs needed in practice. Moran et al. (2017) conducted a study which demonstrated how practicing scholarly nurses built new knowledge which was comparable to the affects of the DNP project. Camicia et al (2021) discussed some to the stressors nurses faced during the pandemic. This project advanced nursing knowledge on

the appropriate allocation of resources and PPE to prevent virus transmission and interventions to improve mobility in post-COVID patients.

The existing research revealed the impact of the pandemic on patient experience, which highly correlates with nursing care delivered (Sugg et al., 2021). In a mixed-method study, Sugg et al. (2017) surveyed nurses on their views and barriers to care related to the COVID-19 pandemic revealed barriers to care, with 57% being relational, 53% physical, and 26-53% psychosocial, while nurses highlighted relational communication difficulties. Fifty-three percent of nurses struggled with supporting patients' emotional well-being and mental health, and 26-53% of the nurses struggled with meeting patients' physical needs. PPE appeared to interfere with nonverbal communication, talking, and listening to patients, which further impacted the relationship and mental health of the patient and the nurse. The evidence showed that patients' immobility and social isolation were significant concerns for nursing, which were unexpected. The coronavirus affected each patient differently. Subsequently, the project data showed that the DNP project was relevant to guide nursing practice in establishing clinical practice protocols to address appropriate use of PPE. This helps ensure nurses feel protected in the work environment from transmission of diseases and that patients have expected outcomes and experiences.

Local Background and Context

The coronavirus affected families, communities, and countries, and some individuals continued with residual health conditions. The virus was highly infectious and transmissible, paralyzed the economy, created social isolation and fear, and overwhelmed

healthcare. Due to the physiological effects of the virus, some individuals suffered prolonged respiratory symptoms and an inability to return to employment, which resulted in decreased personal income and economic decline. The evidence showed that long COVID symptoms persisted for weeks and even months.

There were multiple concerns within the practicum site on the best practice for managing post-COVID patients to improve respiratory dysfunction and activity tolerance. The practice guidelines changed frequently as the demographics of the practice was primarily patients with respiratory diseases. However, after the pandemic, a substantial number of patients required outpatient follow-up for resolution of hypoxia and immobility associated with coronavirus. In this project, I examined the effectiveness of respiratory treatments in post-COVID patients to improve activity. The 6MWT effectively measured the functional capacity of cardiopulmonary patients and is recommended by the ATS (Macchiavelli et al., 2021). The prolonged respiratory symptoms of post-COVID and identifying an appropriate intervention were relevant to improving physical, mental, and financial outcomes. The evidence showed that patients experience prolonged dyspnea for several weeks to months. Maniscalco et al. (2021) suggested that bronchodilator interventions did demonstrate functional improvement. The project site's QI initiative evaluated post-COVID patients with prolonged respiratory symptoms with various diagnostic testing. This project demonstrated the potential effectiveness of bronchodilator therapy in post-COVID patients. In some cases, patients required respiratory treatments based on spirometry results. The project involved

evaluating the project site's archival data to determine whether respiratory treatments improved the 6MWT results, as evidenced by pre- and post-SpO_2 results.

Since COVID was novel and the evidence was constantly evolving, the practice followed the most current evidence-based practice (EBP). The changes in practice protocol were based on the recommendations from the most recent EBP and the CDC. Healthcare practices were encouraged to develop various strategies to evaluate and care for post-COVID patients by creating patient-centered approaches which optimized the patient's quality of life and function (Chevinsky et al., 2021). Nationally, it was suggested obtaining objective laboratory testing and imaging findings not to measure the patient's well-being but as a correlation. Health care providers and patients were encouraged to set achievable goals through shared decision-making to approach treatment by focusing on symptom management with a comprehensive plan focusing on physical, mental, and social well-being (CDC, 2021a).

Role of the DNP Student

The professional relationship with the practice site was developed over 14 years ago when I was employed as an acute care nurse practitioner (ACNP). Although, I am no longer employed at the project site, my current role as an ACNP with a hospital medicine team for a local hospital allowed me to witness patients' responses to the coronavirus and the impact of improving patient care by providing supportive care with oxygen and respiratory treatments. In some cases, a patient without radiographic abnormalities but who was symptomatic with shortness of breath, dyspnea, cough, and chest tightness showed improvement with supportive care of supplemental oxygen and bronchodilators,

which alleviated symptoms and improved SpO_2. Due to the patient's acute onset of hypoxia related to the virus, baseline 6MWT measurements were not assessed before the implementation of an intervention. Based on the evidence, bronchodilators potentially improved post-COVID patients' functional capacity (Maniscalo et al., 2021). The patients' discharge included scheduling follow-up appointments with pulmonary medicine to reassess their functional capacity and hypoxia.

A holistic approach is imperative in nursing practice. Patients are lost to follow-up after hospitalization, which was one of the reasons that motivated me to explore what works and what does not work for post-COVID patients. Respiratory treatments showed induction of functional capacity in those patients infected with the virus. The use of long-acting bronchodilators, both long-acting beta 2 agonists (LABAs) or long-acting muscarinic antagonists (LAMAs), improved lung function and HRQoL, prevented exacerbations and increased exercise endurance by reducing hyperinflation and dyspnea (Rodrigo et al., 2017). However, in my previous pulmonary experience with patients and obstructive and restrictive airway disease, respiratory treatments were the most effective intervention. My previous experience was considered a bias since I had witnessed firsthand improvement in care and outcomes.

As a DNP student, my role in the project was multifactorial. It included the demonstration of leadership skills, interprofessional collaboration with stakeholders, conducting a scholarly review of the highest level of evidence, and an evaluation of the practice data to determine if the intervention improved outcomes. I evaluated the existing data of the patients infected with coronavirus from September 2020 to December 2020

and determine that those patients who received respiratory treatment had better outcomes as evidenced by improved activity tolerance. I plan to disseminate the project's results in a poster presentation to the practice site.

Summary

In n this DNP project, I evaluated the practice site's archival data from September 2020 to December 2020 of patients previously infected with coronavirus and the initiation of respiratory treatments to improve functional capacity by using the 6MWT as evaluation performance. The ATS recommended the 6MWT as a tool to evaluate functional capacity in cardiopulmonary patients. The Donabedian quality model was selected to guide the evaluation of the project, which included the process, the structure, and the outcomes. Some of the terms that described post-COVID patients' symptoms were interchangeable, and the terms were delineated. The project had significant relevance for nursing in helping with the recognition of those patients who required additional intervention, and the development of new clinical practice guidelines and protocols to improve patient outcomes. The project was conducted by me, a DNP student, who performed rigorous research on the highest level of evidence on the impact of COVID on the pulmonary system, the diagnostics used to evaluate the patients, and the interventions. The evidence showed that bronchodilators were essential in improving functional capacity in post-COVID patients. The sources of evidence used to address the practice-focused question, and the analysis and synthesis of the data is addressed in Section 3.

Section 3: Collection and Analysis of Evidence

Introduction

The COVID-19 pandemic had a global impact on millions. It was a highly transmissible virus that was spread through droplets, with the lungs being one of the primary organs affected by the virus. The project problem focused on whether respiratory treatment in post-COVID patients with persistent respiratory dysfunction did improve the SpO_2 measurements. At the project site, the 6MWT was used to determine functional capacity by measuring SpO_2. Subsequently, I evaluated the SpO_2 measurements pre- and post to examine the effectiveness of the respiratory treatments to improve activity tolerance. I evaluated the project site's archival data from the QI initiative implemented during the COVID pandemic. The COVID patients' visits were coded "post-COVID" during the pandemic, utilizing the International Classification of Diseases, Tenth Revision (ICD-10). The project site's archival data from September 2020 to December 2020 were evaluated, organized, and analyzed to determine if the intervention improved patients' outcomes. The coronavirus was novel, and the evidence suggested various diagnostics to evaluate improvement or resolution. However, there was limited evidence on interventions in the ambulatory care setting. The evidence showed that the 6MWT and PFT was initiated to help identify functional capacity and lung function. In clinical practice, bronchodilator reversibility testing has been used to predict the usefulness of a bronchodilator treatment (Maniscalco et al., 2021).

The Donabedian quality model was selected to guide the evaluation of the QI. The Donabedian framework includes three elements: structure, the process, and the outcome.

Through this project, I examined the practicum's structure, including the resources available to perform the pre-and post-6MWT. For the process, I examined the bronchodilators, the frequency, and the dosage. The outcomes I evaluated were whether the respiratory treatments precipitated the desired results, as the goal of the intervention was to improve patient outcomes.

The physiological effect of prolonged illness disrupts emotional stability, lifestyle, and normal functioning, which leads to poor HRQoL (Qu et al., 2021). Evaluation of the relevance of bronchodilator therapy in the post-COVID patient was essential to returning patients to a more normal lifestyle, including employment. During the pandemic, unemployment rates soared while personal income plummeted, creating food scarcity among communities (USA Facts, 2022, "About the COVID-19 Impact and Recovery Hub" section). The implications of the DNP project outcomes were a guide for stakeholders to developing clinical practice guidelines and treatment plans and the identification of the most cost-effectiveness of the intervention to improve care delivery and patient outcomes. COVID remains a novel virus with research constantly evolving on best practices; hence, this project presented insight into the effectiveness of bronchodilator therapy in post-COVID patients to improve functional capacity, which leads to improved HRQoL.

Practice-Focused Question

One of the most significant health issues of patients infected with COVID-19 has been persistent respiratory issues. The practice-focused question was, in post-COVID patients who received respiratory treatments, does the pre- and post-results of the 6MWT

demonstrate improvement in activity tolerance as evidenced by the room air SpO_2 measurements? The project site's QI initiative was designed to evaluate post-COVID and help the providers identify obstructive or restrictive patterns to determine the appropriate intervention, according to a physician at the project site. The DNP project evaluated the archival data of the pre- and post-SpO_2 measurements from the 6MWT of post-COVID patients with an obstructive pattern on spirometry, suggested a component of chronic obstructive airway disease (COPD) or asthma and the effect of respiratory treatment in improved activity tolerance. The project identified which respiratory treatments were utilized at the project site such as inhaled corticosteroids (ICS) and LABA, termed single inhaler therapy or single maintenance and reliever therapy (SMART) and showed quick relief in the management of asthma (Sobieraj et al., 2018). In COPD patients, LABAs and LAMAs were used for symptom management, improved lung function, HRQoL, and increased exercise endurance (Rodrigo et al., 2017). The DNP project involved analyzing the outcomes of the 6MWTs to determine whether the implementation of respiratory treatments improves functional capacity in post-COVID patients. Overall, the key aspects of the DNP are the evaluation of the effectiveness of respiratory treatments in helping post-COVID patients improve their physical activity and advancing nursing practice in development of establishing clinical practice guidelines for PPE and protected work environment.

Sources of Evidence

The sources of evidence to address the practice-focused question were obtained from the Walden Library and peer-reviewed articles searched in Boolean and CINAHL

databases. Systematic reviews and meta-analysis were the highest quality of evidence use to support the support the practice focused problem and avoid biases and errors to address respiratory function and frequency of signs and symptoms in post-COVID patients. Torres-Castro et al. (2020) conducted a systematic review of five databases which included 380 patients infected with COVID-19. The study revealed the lungs as the organs most affected by COVID-19, patients infected with COVID-19 showed impaired lung function, and PFTs showed diffusion lung capacity. Martimbianco et al.'s (2021) study confirmed the use of supplemental oxygen in the acute phase was significant due to dyspnea. Other studies included observational retrospective, which suggested treatments with bronchodilator should be considered in post-COVID patients to improve physical activity (Maniscalco et al.,2021). The project aimed to evaluate the project site's archival data to determine the effectiveness of respiratory treatment on improving the outcomes of the 6MWT as evidenced by SpO_2 measurements. The evidence collection and analysis supported respiratory dysfunction among COVID-19 was one of the most prevalent symptoms, patients required supplemental oxygen, and respiratory treatments did improve physical activity. In summary, the evidence utilized supported the use of respiratory treatments in post-COVID patients to improve physical activity.

Archival and Operational Data

The secondary data evaluated for the DNP project contributed to the providers' and nursing staff's training on performing PFTs, 6MWTs, and the administration of respiratory treatments. Permission was gained to review the electronic medical records by the administrative chief executive officer (CEO) and practice manager to ensure access to

clean data to analyze. I signed the Health Insurance Portability and Accountability Act (HIPAA) and privacy documents. The nature of the data was the history and physical (H&P), progress notes, PFT interpretations documented by the providers trained to interpret the test, and the nurses' documentation. The PFT numeric and curvatons were recorded on a calibrated device. PFTs have commonly been used for functional respiratory evaluations, including spirometry, diffusion capacity, and lung volumes (Torres-Castro et al., 2020). The ATS recommended the 6MWT for evaluating ambulation endurance and functional capacity (Macchiavelli et al., 2021). Respiratory treatments were evaluated pre- and post-SpO_2 via pulse oximetry during the 6MWT.

The project site data were initially collected by trained medical assistants (MAs) and the providers and documented in the electronic medical records. The vital signs, including blood pressure, respiratory rate, heart rate, and SpO_2 measurements, were collected as a part of the initial assessment before the provider's face-to-face with the patient. The initial 6MWT was performed on room air while being monitored by the MAs for desaturation. If the patient's SpO_2 dropped below 92%, the time and the SpO_2 were documented, and the patient was placed on oxygen via nasal cannula. PFTs were a part of the evaluation, which was performed by trained personnel. The PFT machine was calibrated daily before use as directed by the manufacturer.

I conducted the QI evaluation through a retrospective chart review. The CEO administrator was solicited to assist with obtaining the data from the electronic medical records. The parameters, dates, and goals of the DNP project were evaluated and corroborated by the preceptor and the CEO administrator. The DNP project was not

initiated until after the organization and Walden University IRB approval (08-30-22-0472842) was obtained. The manager of Billing, Compliance Reporting generated a report of all the providers in the practice of those patients with ICD-10 coded as "COVID" between the September 2020 to December 2020. The archival data, collected from the medical records, consisted of demographics, age, body mass index (BMI; if available), PFT results (obstructive or restrictive airway pattern), pre- and post-SpO_2 measurements via pulse oximetry from the 6MWT, and the respiratory intervention. The collected data were stored on a password-protected computer owned and accessed solely by me. A unique de-identifier was assigned and stored in an electronic file that is also password protected. I handled all data and medical information confidentially following HIPAA compliance; no patient names or other demographic information to conclude the difference between the sample of individuals who received respiratory versus those individuals who did not receive treatment linked or traced back to the patients was utilized.

Analysis and Synthesis

Initially, the proposed project plan evaluated the data of the patients coded as "post-COVID" however, the partner organization's Manager of Billing, Compliance Reporting, revealed the official use of the ICD-10 "post-COVID" was not implemented for medical billing until January 2021. Subsequently, the medical records before January 2021 were coded with a diagnosis of "COVID-19" and these were the medical records provided by the practice CEO for patients seen from September 2020 to December 2020. There were multiple variables collected, which I recorded in a Microsoft Excel

spreadsheet and then uploaded into IBM SPSS software. The statistical analysis of continuous variables of pre-and post-6MWT SpO_2, respiratory rate, heart rate, blood pressure, and BMI was conducted using multivariate statistics. Data were analyzed using the one-way analysis of variance (ANOVA) to compare multiple groups who received respiratory treatments. Initially, codes were assigned to each variable to ensure its integrity and eliminate outliers. Any missing data were assigned a code to manage outliers. All other data were coded appropriately and entered into SPSS, and then the data analysis compared variation between and within the groups using the independent variable (respiratory treatments) and the dependent variable (improved SpO_2 measurements).

Summary

In this DNP project, I sought to answer the project practice-focused question, in post-COVID patients who received respiratory treatments, did the pre- and post-results of the 6MWT demonstrate improvement in activity tolerance as evidenced by the room air SpO_2 measurements? No human participants or direct patient contact was involved in the project, and the project was not initiated until after IRB approval. I used the Walden University Library, Boolean search operators, and nursing databases and systematically reviewed the evidence surrounding post-COVID patients and interventions to improve functional capacity. After IRB approval, I began collecting data from the practice site electronic medical records of approximately 30 patients coded with ICD-10 for "COVID". The data collected included demographic, BMI, PFT results, 6MWT results, and SpO_2 results. The data were stored in a password-protected device, and a de-

identifier was used. SPSS was used to analyze the data; codes were assigned to each variable, and multivariate statistical analysis was used. The independent variable (respiratory treatments) and the dependent variable (SpO_2 measurements) were evaluated, and a descriptive analysis was used to describe the outcomes. The key points of the DNP project were as follows:

- Post-COVID patients with persistent respiratory dysfunction did benefit from respiratory treatments (independent variable) which improved activity tolerance, as evidenced by improved SpO_2 measurements (dependent variable).
- Bronchodilators improved activity tolerance in post-COVID patients.
- The 6MWT was an effective evaluation method for measuring improvement in functional capacity.

Subsequently, the data collection and statistical analysis attempted to confirm the key points of the project, which I address in Section 4.

Section 4: Findings and Recommendations

Introduction

Patients infected with COVID-19 have often encountered persist respiratory symptoms for a prolonged period requiring respiratory treatments and constant medical follow-up. The practice-focused question is, in post-COVID patients who received respiratory treatments, did the pre- and post-results of the 6MWT demonstrate improvement in activity tolerance as evidenced by the room air SpO_2 measurements? The purpose of this DNP project was to determine whether respiratory treatments improved physical activity in post-COVID patients, as evidenced by pre-and post-6MWT SpO_2 measurements. Using IBM SPSS, the dataset was coded and labeled to ensure data were clean and no outliers were present. During the coding and labeling process, various respiratory treatments were identified in the management of post-COVID patients. Albuterol and LABAs were identified as the most frequently used and were subsequently coded as Groups 1 and 2, respectively. Less frequently used were ICS and LAMAs which were labeled as others and coded as Group 3. The data were analyzed in IBM SPSS using one-way AVOVA to determine any statistically significant differences within the groups with respiratory treatments as the independent variable and SpO_2 saturation as the dependent variable.

Findings and Recommendations

As noted above, the data were analyzed using IBM SPSS Statistics (Version 28.0.0) using ANOVA to compare the three treatment groups and the responses. The assumptions for using ANOVA, according to Polit (2010), are as follows:

- The groups compared were randomly selected.
- Respiratory treatments (independent variable) were assumed to be normally distributed across the population.
- The groups were assumed to have equal variances.
- The tests did not meet homogeneity variances.
- The participants in the group were not the same individual or matched with individuals in other groups.

As shown in Appendix A, the total sample size for pre-O_2 saturation measurement and respiratory treatments was 20 patients with only three patients with post-O_2 saturations after treatment. The 30 patients were randomly selected from a report generated by the manager of Billing, Compliance Reporting. Every other patient was selected from the generated report until data were collected for 30 patients. However, 10 patients had to be excluded due to no documented respiratory treatments during September 2020 to December 2020. In the sample of those who received treatment, seven had albuterol, six had LABA, and seven had other treatments, such as ICS or short-acting beta agonist (SABA). The mean pre-SpO_2 measurement for each group was 95, 98, and 93 respectively with a group mean of 95. The 95% confidence interval (CI) for albuterol showed a range of 92 to 99, LABA showed a range of 95 to 100, and others showed a range of 86 to 99.

The table in Appendix B shows that the mean post O_2 saturation for the albuterol group was 95 with no significant variability. There was no post SpO_2 for the LABA group, and 94.5 for the other group. The data collection revealed that only three in the

sample had post 6MWTs performed with only one patient who received albuterol and no patients who received LABA, which was an unanticipated finding, and two patients who received other treatments. As shown in Appendix B, there was no post-saturation 95% CI for albuterol and LABA and a wide range for the other group. Levene's Statistics are insignificant and there were not enough data to evaluate.

As shown in the table in Appendix C, this sample does not give sufficient evidence that another treatment has a significant effect on pre-O_2, $F(2, 17) = 1.83$, $p = .191$. Also, the findings do not yield sufficient evidence that the post SpO_2 albuterol and LABA groups were significant $F(1,1) = .013$, $p = .927$.

The results of the analysis of the data revealed that post-COVID patients were prescribed respiratory treatments as an intervention for the respiratory dysfunction. The LABA and albuterol groups showed SpO_2 measurements within normal range and congruent with the evidence. Sobieraj et al. (2018) discussed the effectiveness of ICS and LABA in quickly improving respiratory dysfunction. The evidence suggests the use of LABA improves lung function and reduces hyperinflation and dyspnea (Rodrigo et al., 2017). The unanticipated outcomes were the number of patients who did not have post-intervention assessments and no documented record of the post-intervention SpO_2 measurements. These findings impacted the validity of the results. The implication of the findings is that LABA and albuterol are effective interventions and patients who received either treatment had normal range SpO_2 suggesting that the implementation of respiratory treatments in patients with dyspnea can improve breathing. In conclusion, the use of

respiratory treatment in post-COVID patient could essentially be effective to improve breathing and improve patient outcomes.

Recommendations

The goal of the project was to determine whether respiratory treatments in post-COVID patients demonstrate improvement in pre-and post- $Sp0_2$ measurements. The results did not show sufficient evidence that the ICS or SABA group had a significant effect on pre- $Sp0_2$ measurements. The post-SpO_2 had insufficient data to evaluate significance. Despite the findings not being significant, this DNP project established the foundation for additional research with a larger sample size to evaluate the effectiveness of respiratory treatments. The LABA and albuterol treatment groups showed consistency in maintaining normal SpO_2 measurements. Subsequently, I recommended more data collection with a larger sample, appropriate labeling and coding of those groups and additional data analysis to determine their impact of respiratory treatment on pre-and post SpO_2 saturations. This DNP project did not address other variables which could be essential to identifying patterns to improve patient care and outcomes.

Strengths and Limitations of the Project

The strength of the project was that the mean pre- and post-SpO_2 measurements for the albuterol groups remain stable. Although a small sample, it suggested that the participants possibly had a mild case of COVID and were able to “ambulate without hypoxemia” (Cortés-Telles et al., 2021). Despite the albuterol and LABA treatment groups showing normal oxygenation, the data were not significant to determine that those respiratory treatments improved physical activity. On the other hand, the limitations of

the project were the sample size and the lack of 6MWT results post-intervention as anticipated to determine improvement in ambulation without dyspnea. The DNP project data were evaluated less than 12 months after the pandemic started suggesting an analysis of the data over a longer period could yield more significant results. It should be noted that a lack of post-intervention 6MWT results was likely associated with recommendations to continue social distancing and isolation to avoid the spread of COVID-19. It is recommended that future research of post-COVID patients include a longer timeframe and a larger sample that is more representative of the population which could yield more valid results on the impact of respiratory treatments to demonstrate improvement in physical activity.

Section 5: Dissemination Plan

Dissemination Plan

I will disseminate the results of the DNP project to the practice CEO and the providers at the facility through a PowerPoint poster presentation. The goal of the dissemination is to illustrate the importance of further retrospective research on the impact of respiratory treatments in post-COVID patients with a larger sample and to encourage additional evaluation of QIs implemented in the practice. As the results revealed that all post-COVID patients in the sample were prescribed respiratory treatment, identification of those patients with asthma or COPD is imperative. The project results will also be disseminated to advanced practice providers at professional nursing conferences via a poster presentation and with future plans for publication in a professional nursing journal. Although the project did not yield the results anticipated, the project establishes a foundation for future research and recommendations to improve data analysis with more valid results.

Analysis of Self

The DNP project increased my knowledge on effectively implementing practice changes. Although the DNP journey has been challenging and tedious, it allowed me to improve leadership skills, enhance interprofessional collaboration, and utilize technology and statistical analysis in a professional manner to gain the confidence of supporters and stakeholders. I learned the importance of identifying gaps in practice, systematically reviewing the evidence, appropriately interpreting the evidence, and establishing and sustaining long-term professional relationships to help improve processes and patient

outcomes. This project has increased my ability to under statistical analysis of the data and how to interpret the results. Overall, the DNP project granted me the opportunity for professional development to further my nursing career and encouraged lifelong learning.

Summary

In summary, the coronavirus pandemic was novel and affected millions globally. Healthcare providers and nursing were astounded and overwhelmed with how the virus affected everyone differently. Some patients developed acute respiratory failure while others had prolonged symptoms of SARS. Individuals with SARS often continued with prolonged respiratory symptoms causing functional dysfunction. With limited evidence available on patient management, various QIs were developed in the acute care and outpatient settings. Within the partner organization, the QI to evaluate these patients included 6MWTs, radiographs, and PFTs. Based on the results of the PFTs, respiratory treatments could be initiated. The DNP project was designed to evaluate the practice's QI to determine in post-COVID patients if respiratory treatments demonstrate improvement in activity tolerance as evidenced by pre-and post SpO_2 measurements.

The DNP project has significant relevance to nursing as the pandemic impacted patient care, exposed nurses to a highly transmissible virus with concerns for adequate PPE, and created emotional stressors. The project has the potential to identify roadblocks to patient flow and processes, establish nursing protocols on mobility and increase education on coronavirus. Flow and processes can provide data to establish nursing protocols on mobility and improve the use of PPE.

The results of the DNP project did not show respiratory treatments were significant in improving physical activity due to the sample size. However, the project has laid the foundation for future research to be performed. The project data were collected less than a year after the pandemic started, and social distancing and mask-wearing were being enforced. Subsequently, the lack of data could be related to these factors, and new research could identify patients with long-term symptoms of COVID and ways to improve patient care management.

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Appendix A: Descriptive Statistics

Group	*n*	Min.	Max.	*M*	*SD*	*SE*	95% CI Lower	95% CI Upper
				Pre Sats				
Albuterol	7	88	99	95.4	3.77	1.43	91.9	98.9
LABA	6	93	100	98.0	2.77	1.12	95.1	100.9
Other	7	82	99	92.7	7.04	2.66	86.2	99.2
Total	20	82	100	95.0	5.19	1.16	92.8l	97.7
				Post O2				
Albuterol	1	95	95	95.0	-	-	-	-
LABA	0	-	-	-	-	-	--	-
Other	2	97	97	94.5	3.53	2.50	62.7	126.2
Total	3	97	97	94.7	2.51	1.45	88.4	100.9

Note. Pre Sats = pre-SpO2 measurements; Post O_2 = post SpO_2 measurements; LABA = long-acting beta agonist; Other = inhaled corticosteroids and short acting beta agonist; - = missing data.

Appendix B: Tests of Homogeneity of Variances

Pre sats [a]	Levene statistics	dt1	dt2	Sig.
Based on mean	5.82	2	17	.012
Based on median	1.37	2	17	.281
Based on median with adjusted dt	1.37	2	9.4	.300

[a] Levene's Test of Equality of Error Variances was not computed for post sats because there are fewer than two nonempty groups.

Appendix C: ANOVA

	SS	Dt	*MS*	*F*	Sig.
		Pre sats			
Between groups	90.7	2	45.3	1.83	.191
Within groups	421.1	17	24.8	-	-
Total	511.8	19	-	-	-
		Post O_2			
Between groups	.167	1	.167	.013	.927
Within groups	12.5	1	12.5	-	-
Total	12.7	2	-	-	-

*$p < .05$