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The COVID Observation Protocol: Evaluating a nurse practitioner implementation in an Emergency Department Observation Unit

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The COVID Observation Protocol: Evaluating a nurse practitioner implementation in an Emergency Department Observation Unit

DNP Scholarly Project Paper

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF NURSING PRACTICE

in Nursing Science

by

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2022

DEDICATION

This is dedicated to my beautiful Sweet Pea, Tex, who has been a constant source of unconditional love and encouragement. You inspire me to be a better person and someone you can be proud of.

To my brother, Joe, there is not a day that I do not think about you and wishing you were here to share all the ups and downs with me. I miss you, bro! “It’s a moo moo!”

To my mom, Diane, thank you for the long days of sitting at the dining room table with me and supporting me through this journey. Thank you for all the dinners and doing the dishes!

To my best friend, Sue, may our Ethel and Lucy days resume.

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for inspiration

“There is no such thing as failure, there’s just giving up too soon.”

Jonas Salk
Virologist and Medical Researcher

and for perseverance

“And will you succeed? Yes! You will, indeed!
(98 and 3/4 percent guaranteed.)
KID, YOU'LL MOVE MOUNTAINS!”

Dr. Seuss

Oh, the Places You'll Go!

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VITA

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FIELD OF STUDY

Doctor of Nursing Practice, Family Nurse Practitioner in Nursing Science

ABSTRACT OF THE DNP PROJECT FINAL PAPER

The COVID Observation Protocol: Lessons learned from nurse practitioner implementation in an Emergency Department Observation Unit

by

Dara Nunn

Doctor of Nursing Practice, Family Nurse Practitioner in Nursing Science

University of California, Irvine, 2022

Professor E. Alison Holman, Chair

Background: To optimize patient outcomes and conserve limited inpatient bedspace, the University of California, Irvine Medical Center Emergency Department (UCIMC ED) developed the COVID Observation Protocol, designed to decompress ED overcrowding, inpatient hospital admissions, and 30-day ED revisitations by discharging patients home on home-oxygen therapy. **Methods**: A retrospective program evaluation was conducted to assess whether the COVID Observation Protocol reduced 30-day ED readmissions and hospital admissions. Data from the electronic health record (EHR) compared patients presenting to the UCIMC ED pre-and post-implementation. Chi-square tests were utilized to compare inpatient hospitalizations, 30-day ED revisitations, and discharge home with home-oxygen therapy. A thematic analysis was conducted based upon an anonymous online survey to assess the role NPs played during the implementation process. **Results**: 4,049 patients presented to the ED, 48% before December 29, 2020, and 52% after. Thematic analysis yielded four themes: (1) significant issues with overcrowding in the ED; (2) lack of evidence-based research to support the newly implemented protocol; (3) a general lack of resources; and (4) needing coping skills to manage patients during a pandemic. Inpatient hospitalizations and 30-day ED revisitations were lower before implementation, and more patients were discharged home with home-oxygen therapy before protocol implementation. 30-day revisitations were lower among those discharged home on home-oxygen therapy after protocol implementation. **Discussion**: The goal of this protocol was to decrease and decompress inpatient admissions and reduce 30-day ED revisitations by discharging them home on home-oxygen therapy. While it was hypothesized that the protocol would reduce the number of inpatient hospitalizations after implementation, this project demonstrated the opposite; however, those patients who were discharged on home-oxygen therapy were significantly less likely to return to the ED within a 30-day timeframe. Analysis of the NP interviews demonstrated a stressful environment in which decisions had to be made to prioritize the sickest of patients with access to limited resources and a challenging practice environment in the mobile field hospital. **Conclusion**: While, on the surface, it appears that the protocol was not successful, a closer examination of the cohort discharged home on home-oxygen therapy after December 29, 2020, demonstrated a significant reduction in 30-day ED revisitations. Despite the number of confounding items, this scholarly project has demonstrated that the updated protocol was successful in reducing revisitation rates and warrants further analysis.

CHAPTER 1: INTRODUCTION

The COVID Observation Protocol: Lessons learned from nurse practitioner implementation in an Emergency Department Observation Unit

In March 2020, the United States entered a pandemic due to the spread of the novel Sars-CoV-2 coronavirus, the virus responsible for COVID-19. This highly infectious and contagious upper respiratory disease had severe and deleterious effects, including a high mortality rate (Centers for Disease Control and Prevention, 2021). In Southern California, hospitals were overwhelmed by inpatient admissions due to the influx of COVID-19 patients, leading to internal disaster management and planning initiation. While most hospitals had emergency or disaster response plans in place, they were primarily focused on localized scenarios, such as mass-casualty events, and not epidemic or pandemic-level events. As a result, health care systems were unable to transfer patients from one hospital to another laterally and had to develop new plans for managing patient overflow. This new patient burden additionally placed a strain on health care systems regarding exhaustion of resources (e.g., personal protective equipment, inpatient hospital beds, medical equipment) and increased staffing demands. This program evaluation examined the efficacy of a nurse practitioner-implemented intervention developed to alleviate the burden of the COVID-19 pandemic on the emergency department and inpatient hospital admissions at the University of California, Irvine Medical Center (UCIMC).

Background/Significance

In January 2020, hospitals in California began seeing an influx of patients presenting with symptoms that were later identified as consistent with Sars-CoV-2 coronavirus, resulting in an increase in hospitalizations and intensive care unit (ICU) admissions (Procter, 2021). On March 13, 2020, the president declared a nationwide emergency, and within a week of declaration, California went into lockdown (Centers for Disease Control and Prevention, 2021). Transmission of the disease was initially slowed by restrictive public health measures, such as mask mandates and social distancing measures, that

Governor Gavin Newsom implemented on June 18, 2020, (California Department of Public Health, 2020). While the initial rate of hospitalizations did not result in maximum capacity for ICUs, the overall ICU length of stay was longer for COVID patients than the typical average length of an ICU stay. Before the pandemic, the average ICU lengths of stay were 3.3 days (Hunter et al., 2014). During the early phase of the pandemic, the reported average ICU lengths of stay in California and Washington were 10.7 days for survivors and 13.7 days for non-survivors of patients with COVID-19 (Lewnard et al., 2020). Globally, the average ICU lengths of stay for patients with COVID-19 were approximately three weeks (Gilardino, 2020).

Over the summer of 2020, transmission rates flattened, and hospitalizations declined, although the mortality rate remained high for inpatients. On July 10, 2020, Orange County reported 60 cases per 100,000. As summer turned to fall, a false sense of normalcy returned, and people began to gather socially as the coronavirus positivity rate hit its lowest point in September 2020 (Procter, 2021). Thus, the second surge in California began on November 05, 2020, with four consecutive days of increased cases and an overall 14-day positivity rate (Procter, 2021). On November 10, 2020, hospitalizations throughout Southern California increased by 32%, and ICU admissions increased by 30% over two weeks (Procter, 2021).

As the winter holidays approached, people returned to normal activities such as holiday shopping and family gatherings, which led to the most significant surge of virus transmission and COVID-19 hospitalizations (California Open Data Portal, 2021). As a result of this winter surge, hospitals and emergency departments became overrun by moderate to severely ill patients with COVID-19 who required inpatient treatment, with limited and rapidly declining inpatient bed space. On December 25, 2020, Southern California reported 100% occupancy of licensed ICU beds as the surge continued (Procter, 2021). Orange County reported 160 cases per 100,000 on December 29, 2020, (OC Health Care Agency, 2021). This scenario led to the initiation of pandemic response measures for many emergency departments, including the use of mobile field hospitals to manage patients with moderate to severe COVID-19 disease needing continued treatment with oxygen.

In response to this surge, hospitals throughout California began to develop and initiate procedures and protocols to triage patients with COVID-19 and prioritize inpatient admission to those with a severe and life-threatening disease. To address this surge and ongoing issues of oversaturation of inpatient admissions and increased lengths of stay, hospitals began to develop protocols to discharge patients to their homes with home-oxygen therapy and home management of their disease. At the UCIMC, one such protocol was developed in the emergency department (ED) and implemented by nurse practitioners (NPs) in the emergency department observation unit (EDOU). Implementation of this protocol was to effectively discharge patients with COVID-19 to home on home-oxygen therapy to facilitate decompression of vitally needed inpatient bed space. In the UCIMC ED, NPs practice in the healthcare provider model by providing care to patients in the "fast track" or urgent care-like setting or in the EDOU, where the NPs provide direct care under the guidance of standardized protocols.

Nurse Practitioners in the Emergency Department Observation Units

Carter and Chochinov (2007) published a systematic review emphasizing NP-delivered care in the ED as a cost-effective alternative to hiring physicians resulting in increased quality of care, improved patient satisfaction, and decreased wait times and overcrowding. Their study also emphasized the benefits of increased NP utilization in EDs alongside fellow physicians as it improved quality of care and improved relationships with the emergency nursing staff. Additionally, it was pointed out that from 1993 to 2009, NPs in the ED were seeing at least one in seven patients as a national average (Brown et al., 2012). This study demonstrated the value of the NP role in the ED, both in human and fiscal terms.

The purpose of emergency department observation units is to provide designated bed space within the ED to decrease primary ED bed space occupancy. Historically, the ED held patients in primary bed space to undergo continued observation while awaiting necessary pending diagnostic testing required for discharge. The history of observation medicine dated to the early 1970s, when patients who had been seen in the ED were held in "observation" beds in anticipation of an available inpatient bed (Iv, 2017). Later, these single bed locations were combined to form observation units. The primary objective of these initial units was to provide observation for a short time to decrease the need for inpatient admissions. Admissions and discharges from the EDOU were straightforward, designed with the expectation that observation services were readily available and accessible. The UCIMC EDOU employs a combination of board-certified family and emergency NPs to disseminate care. They manage the care of patients in the EDOU, with typical patient stays generally less than 24 hours (Centers for Medicare & Medicaid Services, 2019). Patients are placed on specific NP implemented protocols specific to their diagnosis. From the EDOU, patients are either discharged home or admitted based on clinical decision-making by the NPs.

Problem Statement

Throughout the 2020 COVID-19 pandemic, health systems encountered significant capacity challenges. As the government mandated inpatient bed expansion through conversion of public spaces to makeshift field hospitals to increase capacity, these strategies did not alleviate the need for staffing, nor did they address medication and equipment shortages (Borgen et al., 2021). To address this issue, many health systems developed methods of triaging ambulatory COVID-19 patients in the emergency department to identify those patients eligible for discharge to home on home-oxygen therapy.

As a result of hospitals being overburdened with inpatient admissions and overcrowded EDs, longer inpatient length of stays, and decreased rates of patient discharges, patients were held in the EDOU beyond 24 hours, hoping that an inpatient hospital bed would become available. In response to this surge of patients, the COVID Observation Protocol was developed by ED physicians and NPs at UCIMC. The EDOU NPs then implemented this protocol to manage moderate to severely ill patients diagnosed with COVID-19 pneumonia on oxygen and monitor them in the EDOU for up to 23 hours with the expectation of discharging them home on home-oxygen therapy. To be eligible for the protocol, patients had to initially meet specific criteria such as a laboratory-confirmed diagnosis of COVID-19, oxygen saturation

(SpO_2) > 88% with ambulation, no evidence of tachypnea or hypotension, ability to self-prone, ability to ambulate with little to no assistance, a chest x-ray (CXR) without signs of severe bilateral pneumonia, and have a stable home to which they could be discharged with an oxygen concentrator (University of California, Irvine Medical Center Department of Emergency Medicine [UCIMC ED], 2020).

Due to the winter surge, a temporary mobile field hospital was erected at UCIMC on December 29, 2020, to house the EDOU and to create temporary inpatient bedspace for those patients with moderate to severe COVID-19 not immediately eligible for home-oxygen therapy and home management. Throughout the surge, the protocol's criteria had to be modified to account for the influx of higher acuity patients, resulting in increased clinical decision-making by the NPs to ensure that patients were stable for discharge to their homes.

PICO Question

To better understand the effectiveness of this NP-implemented protocol, we conducted a retrospective program evaluation and literature review addressing the following PICO question: did the implementation of the COVID Observation Protocol reduce the number of inpatient hospital admissions and 30-day ED revisitations for COVID-19 patients who presented to the UCIMC ED?

CHAPTER 2: Body of Evidence

Review of the Literature

At the height of the COVID-19 pandemic, innovative protocols were implemented to decompress overcrowded EDs and facilitate decreased inpatient admissions when inpatient bed space was at a premium. This literature review explores studies and perspectives designed to evaluate the outcomes of home-oxygen therapy. It is important to note that the following articles were written with a sense of urgency as authors set out to disseminate their real-time experiences with managing patients during a global pandemic.

Search Process

A systematic review of the literature was conducted to evaluate protocols designed to provide home-oxygen therapy to patients with moderate to severe COVID-19 disease who were either discharged from the ED, including the EDOU and those discharged to home from inpatient care. Two hundred thirty-three articles were collected from PubMed (37 articles), CINAHL (15 articles), Scopus (134 articles), and Web of Science (46 articles) (see Appendix C for the full criteria).

PubMed

Keywords and Boolean operators included: ("Oxygen Inhalation Therapy"[Majr] OR oxygen[ti]) AND ("Home Care Services"[Mesh] OR home OR home-based OR in-home) AND ("COVID-19"[Mesh] OR covid* OR coronavirus* OR pandemic) *and* "Oxygen Inhalation Therapy"[Mesh] AND ("Home Care Services"[Mesh] OR home OR home-based OR in-home) AND ("COVID-19"[Mesh] OR covid* OR coronavirus* OR pandemic) with filters from 2020 – 2021. Total articles obtained from search: 37.

After the 233 articles were entered into EndNote software, 61 duplicated articles were removed, leaving 172. These 172 articles were then screened individually by reading the title and abstracts of each article, and 164 were further excluded: 77 articles that were anecdotal/case reports; 27 articles that included home-based monitoring without oxygen therapy; 32 articles with emphasis on inpatient management; 11 articles describing healthcare systems issues concerning COVID; and 17 articles that discussed diagnostic tools (see PRISMA Flow Diagram in Appendix A). The remaining eight papers were assessed for eligibility, and it was determined that all eight articles were most pertinent to the project's PICO. These articles were all published in 2021. The Table of Evidence can be viewed in Appendix B.

Inclusion/Exclusion Criteria

Articles selected for this review had to meet all the following inclusion criteria:

1. Include COVID-19 patients sent home from an ED/EDOU on home-oxygen therapy,

2. Address ED and EDOU management of patients who do not warrant immediate inpatient hospitalization but continue to need close observation,
3. Address discharging COVID-19 patients from the ED and EDOU,
4. Address outpatient or home management of COVID-19 patients using home-oxygen therapy.

The following exclusion criteria were also applied during article selection:

1. Reports anecdotal case of patient management,
2. Addresses home monitoring of patients (pulse oximetry, telemedicine) without home-oxygen therapy,
3. Addresses inpatient management of COVID patients,
4. Addresses healthcare systems issues relating to home management of COVID patients,
5. Focuses on the development and utilization of diagnostic tools (radiographic imaging, ultrasonography, mobile apps) in the management of patients with COVID.

Appraisal of Evidence

All eight studies observed the effectiveness of home-oxygen therapy on COVID-19 patients in some way. Of the eight articles, one demonstrated Level I evidence as a randomized control trial where an inpatient intervention group received home-oxygen treatment upon discharge from the hospital while the control group remained hospitalized. Three articles were prospective observational studies with Level II evidence evaluating protocols designed to discharge patients to home from the ED on home-oxygen therapy. Three articles were retrospective observational studies with Level III evidence that compared the all-cause mortality rate, and 30-day readmission rate between COVID-19 patients admitted to the hospital and those who were discharged home on home-oxygen therapy. Finally, one article was a retrospective observational study with Level III evidence identifying potential risk factors linked to the escalation of oxygen requirements in COVID-19 patients.

Comprehensive Synthesis of Evidence

All eight studies included in this review provided specific analyses addressing the impact of implementing a protocol designed to transition patients with COVID-19 to home on home-oxygen therapy. The studies included in this synthesis utilized evidence-based practice to develop and implement their home-oxygen therapy protocols in an extensive healthcare delivery system at the height of a major pandemic. While most of the articles could be critiqued for confounding issues such as small sample size, low power, or lack of generalizability, it is essential to note that many of these studies were conducted over a brief period to provide an immediate knowledge base for methods to decrease inpatient hospitalizations during a pandemic as well as to effectively manage moderately to severely ill patients outside of the inpatient setting.

Adly et al. (2021) conducted a single-blinded randomized control trial in which home-oxygen therapy via bilevel positive airway pressure (BiPAP), a noninvasive form of ventilation, was compared to osteopathic manipulative respiratory and physical therapy. The interventions were applied to a convenience sample of patients (N = 60) with moderate to severe COVID-19 symptoms, which met eligibility criteria for potential home management via telemedicine. This study demonstrated the overall effectiveness of home-oxygen management for patients with COVID-19 as a method to reduce inpatient hospital admissions. One hundred percent of the BiPAP intervention group (30/30) remained at home in a stable condition. From the results of this study, the authors developed and implemented standardized protocols to reduce inpatient hospitalization during surge capacity in a pandemic with a home-based monitoring system of patients deemed stable for monitoring at home.

Borgen et al. (2021) conducted a quasi-experimental study evaluating the effectiveness of an intervention to optimize hospital bed capacity during a pandemic (N = 192). Patients were identified in the ED, held for observation in the EDOU, and discharged home on home-oxygen therapy. They analyzed the impact of this protocol on hospital readmission rates as well as a reduction in inpatient days and emergency department re-encounters. The results of this study demonstrated a feasible strategy for improving patient throughput in the ED and EDOU during the pandemic crisis. A limitation of this study was that it was a performance improvement project born out of necessity due to the pandemic crisis and not a formal research project. This study provided evidence to support the potential benefits of this type of protocol or program in the positive reduction of inpatient days and emergency department re-encounters.

Annunziata et al. (2021) conducted a prospective observational study evaluating moderate-to-severe respiratory failure in patients with COVID-19 (N = 18). This study was born out of necessity as these patients were identified as needing inpatient management due to the severity of their illness but refused hospitalization. Through remote monitoring, the authors evaluated the effects of home-oxygen therapy, in various forms of delivery, on decreasing the severity of illness and mortality. All 18 of the patients had favorable outcomes, and no deaths were reported. The results of this study concluded that the use of high-flow oxygen therapy for home management of COVID-19 patients with moderate lung failure was successful in preventing these patients from being hospitalized. The main limitations of this study were the highly selective patient population and small sample size. The use of this population reduces the ability to make generalizable statements toward more diverse patient populations undergoing treatment for COVID-19. However, the outcome of this study does support the benefits of home-oxygen therapy use in reducing inpatient hospitalizations for patients with moderate-to-severe COVID-19 illness.

Banerjee et al. (2021) evaluated the effectiveness of their home-oxygen therapy protocol by examining the all-cause mortality rate and the overall 30-day readmission rate using electronic medical record data from two large urban public hospitals in Los Angeles County. In this retrospective cohort study, COVID-19 patients were discharged home from either the emergency department or inpatient hospitalization with home-oxygen therapy (N = 621). Lower mortality rates and lower readmission rates within 30 days were demonstrated for those patients discharged home on home-oxygen therapy. While this study may provide a basis for the development of future protocols, it has limitations due to the convenience sample, retrospective observational study design, and the lack of generalizability to other health care systems. Los Angeles County had the unique ability to track patients throughout the county and were able to identify patients who presented to any ED within 30 days of discharge. They also had access to death records to calculate their mortality rates. While this study may lack generalizability, it does serve to direct focus on secondary data collected from the electronic health record and methods for quantitative analyses.

The remaining four articles focused on the home management of COVID-19 patients through various monitoring modalities. Gootenberg et al. (2021), a prospective observational study, evaluated the viability of an ED-based outpatient pulse-oximetry monitoring program with organized follow-up and ED return rates, hospitalization, and hypoxia among participants receiving home-oxygen therapy (N = 81). 28% (n = 23/81) of the patients returned to the ED at least once in the 30-day follow-up period and 12% (n = 10) were hospitalized within the 30-day follow-up period. The authors concluded that it was feasible to implement an outpatient pulse-oximetry monitoring protocol to monitor patients discharged from the ED with confirmed or suspected COVID-19. A limitation of this feasibility study was that it did not compare pre-and post-implementation strategies. Additionally, this was an observational study that did not provide generalizable outcome measures to the population of interest. This study assumed ease of use of home pulse-oximetry and that patients had access to phones for telephonic visits.

The three remaining articles were retrospective studies. Steel et al. (2021) measured the all-cause mortality rate by establishing a telemedicine program to monitor patients who were discharged from the emergency department either on room air or on home-oxygen therapy (N = 677). The authors developed a disaster care pathway to discharge patients from the ED who would have otherwise been admitted for COVID to free up inpatient bed space for the most severely ill patients. These patients were followed by virtual remote monitoring and home pulse oximetry. Of the 677 patients, the 30-day mortality rate was 13 patients (1.9%). The authors noted 5.3% loss to follow up and they speculated that it had to do with a patient's lack of access to telephonic or computer devices. One limitation of this study was the comparison of the 30-day mortality rate post-intervention to the mortality rate of New York during the same period. This study was more informational for identifying variables of interest and expanding on ways to provide home management of COVID-19 patients.

Through a retrospective observational study, Okauchi et al. (2021) identified potential risk factors linked with escalating oxygen requirements in COVID-19 patients to triage those patients who required inpatient management versus those who could be eligible for home management (N = 84). The authors identified a higher number of risk factors being associated with future oxygen requirements and found that those patients with more risk factors were already more likely to have poorer outcomes. They determined this to potentially be useful for triaging COVID-19 patients who may need oxygen either in the homes or as inpatients. There were two main limitations of this retrospective study, the lack of comparing pre-and post-intervention strategies, and a small sample size, which made the results less generalizable to a larger population.

Finally, Issa and Soderberg (2021) conducted a retrospective observational cohort study to evaluate the effects of supplemental oxygen in COVID patients to decrease inpatient/outpatient lengths of stay. They set out to measure the effects of the oxygen delivery method, high flow nasal oxygen (HFNO), for managing patients outside of the hospital (N = 41). COVID-19 patients, requiring supplemental oxygen, were placed in the infectious disease unit, described as comparable to an EDOU. While there, they were placed on HFNO in lieu of conventional oxygen therapy. They found that 55% of patients were discharged home from being on HFNO and 10% avoided the ICU completely. HFNO saved 229 days in the ICU, resulting in saving resources. HFNO treatment as feasible and efficient for patients with COVID-19. This study demonstrated the utilization of supplemental oxygen to facilitate faster recovery as well as shorter length of stay. The main limitations of this study included a lack of comparing pre-and post-implementation strategies; a small sample size, precluding generalizability to a larger population; and the study design. Observational studies tend to be less reliable as they are not reproducible.

These four studies identified methods to manage COVID-19 patients in an outpatient setting effectively. There were variations in the processes of monitoring as well as in the oxygen delivery method. Together, the measured outcomes were consistent in demonstrating the positive effects of patients receiving home-oxygen therapy on decreased mortality, decreased inpatient hospitalizations, and decreased readmission rates. In addition, these articles contributed information regarding risk factors associated with eligibility for home-oxygen therapy. The one prospective study conducted by Gootenberg et al. (2021) and the three retrospective studies conducted by Steel et al. (2021), Okauchi et al. (2021), and Issa and Soderberg (2021) help to establish criteria and methodology for conducting a retrospective program evaluation of the intervention described in this project.

Summary of Evidence

The eight articles included in this literature review demonstrated the significance of developing and implementing interventions during times of pandemic to effectively treat and manage patients with moderate to severe illness in the outpatient setting. Collectively, the studies demonstrated decreased severity of illness, decreased length of illness, and decreased mortality through the implementation of home-oxygen therapy in the outpatient setting, which resulted in reduced inpatient hospitalizations. In addition, some of the studies indicated that patients who were trialed on home-oxygen therapy and had certain risk factors and comorbidities, such as immunosuppression or end-stage renal disease, were at increased risk of readmission to the ED or inpatient hospitalization.

Although the articles described varying inclusion and exclusion criteria for patient participation, there were common themes across all studies that supported patient management at home. All study participants were adults 18 years and older. The articles defined patient inclusion/exclusion criteria by (a) the severity of the disease, oxygen saturation, the patient's ability to ambulate, access to a stable residence, and (b) their ability to follow instructions, use technology specific to the intervention, and have a method to communicate with the medical staff. Another key concept was the utilization of a structured follow-up with patients once the intervention was implemented. Exclusion criteria incorporated multiple comorbidities and severity of disease progression for patients who demonstrated a level of clinical instability that warranted inpatient care.

Most studies were conducted in the United States; two were conducted in countries that were more flexible with increased modes of oxygen delivery. In the United States, home-oxygen therapy was primarily limited to simple delivery via nasal cannula with a maximum of 4 liters per minute (LPM) of oxygen. The Adly et al. (2021) study evaluated the effects of utilizing BiPAP with oxygen supplementation as their mode of oxygen delivery. Two studies, one conducted in Italy and the other in Sweden described escalating home-oxygen delivery to high flow nasal oxygen (HFNO to deliver oxygen more effectively as a method to treat acute hypoxic failure. The findings were consistent in demonstrating effective use of oxygen therapy to reduce the severity of illness, and some even showed decreased mortality. These results effectively reduced inpatient hospitalizations. However, across these studies, there were differences in the methods used for oxygen delivery. Those studies that were able to escalate oxygen therapy beyond simple nasal cannula did demonstrate shorter disease course and progression. This would suggest the need to conduct further studies in the United States that evaluate the utilization of advanced oxygen delivery methods at home.

Gaps in the Literature

The articles in this review documented that home-based oxygen therapy was a successful approach to managing patients in their hospitals and health systems. However, the broader impact of the implementation of home-oxygen therapy on patient outcomes has not been evaluated in relation to pre-implementation outcomes. Two articles compared the intervention group to a non-intervention group, Steel et al. (2021) and Borgen et al. (2021), and Adly et al. (2021) compared two different home-based interventions. None of the studies reported pre-intervention data, such as resting and exertional oxygen saturation, respiratory rate, mortality rate, hospital admission rates, or readmission rates. This needs further exploration to ensure the efficacy of the intervention of home-based oxygen delivery in the management of COVID-19 patients during a pandemic or other natural disaster.

CHAPTER 3: PROJECT FRAMEWORK

Conceptual Framework

The Centers for Disease Control and Prevention (CDC) has conducted numerous studies and developed a program assessment framework that can be applied to this scholarly project. Their framework for program evaluation includes engaging stakeholders (i.e., UCIMC Emergency Department/EDOU and its providers UCIMC ED patients and their families); describing the program (i.e., the COVID Observation Protocol); focusing the evaluation design (i.e., pre-/post- protocol implementation); gathering credible evidence (i.e., EMR data); validating conclusions; assuring their use and dissemination; and identifying implications for future research and development (see Appendix C).

This framework set out to engage stakeholders or those most actively involved or impacted by the project (i.e., COVID patients, ED healthcare professionals, hospital personnel). Stakeholders were those who were the primary intended users of the program evaluation. Description of this framework included identifying the program's needs, expectations, activities, or resources to be evaluated. These descriptions were then included in a logic model for a graphic representation of the program evaluation. In focusing on the evaluation design, it was necessary to precisely describe the purpose of the program evaluation and its context.

Once the focus of the evaluation design was completed, the following steps included gathering evidence to support the program evaluation and justifying the conclusions of the program evaluation. Milstein and Wetterhall (2000) describe credible evidence as "raw material" necessary to conduct a program evaluation effectively. One of the challenges in justifying the conclusions of the program evaluation was to meet the expectations of all stakeholders and their specific questions relating to the program evaluation. Therefore, it was necessary to define parameters specific to the endeavors of this scholarly project while being mindful of the desired outcomes requested of the stakeholders and then set out to address more global requests later. Having explicit standards before conducting the program evaluation was central to this conceptual framework.

The last phase of the conceptual framework involved disseminating information after completing the program evaluation. This phase evaluated the effectiveness of the intervention and served to provide standardized outcomes that could be implemented into practice. This stage's goal was to actively engage those stakeholders in taking the outcomes from the program evaluation, consolidating the results, and implementing the conclusions into actual practice. Utilizing the CDC approach to program evaluation, content specific to this project was inputted and displayed in Appendix C (Centers for Disease Control and Prevention: MMWR, 2012).

Logic Model

The W.K. Kellogg Foundation (2017) developed the Outcomes Approach Logic Model to demonstrate how planned activities are linked to expected outcomes. This model was utilized for this scholarly project as it focused planned project activities and expected project outcomes, while emphasizing project planning and implementation. This project focused on the potential positive impact (e.g., decreasing inpatient hospitalizations and reducing 30-day ED revisitation) of the COVID Observation Protocol has during the pandemic. The Outcomes Approach Logic Model emphasized the activities (e.g., reviewing and analyzing EHR data, compiling and analyzing NP interviews) and applying those activities to provide tangible benefits for the greater good (e.g., revising a necessary protocol for current and future pandemics or disasters). The integration of the CDC Framework for Program Evaluation and the Outcomes Approach Logic Model is displayed graphically in Appendices D and E.

CHAPTER 4: METHODS

Project Goals

The purpose of this scholarly project was to conduct a retrospective program evaluation of the nurse practitioner implemented COVID Observation Protocol through quantitative and qualitative analyses. The primary goal was to utilize a pre-and post-intervention implementation strategy to evaluate the effects of the protocol on decreasing or preventing inpatient hospitalizations and potentially decreasing the 30-day ED revisitation rate. To evaluate quantitative aspects of this project, data was collected from the four months prior to and four months following implementation of the intervention. This timeframe reflected a period when COVID cases started rising during the fall leading into the winter surge (Orange County Health Care Agency, 2021). For pre-intervention short-term outcomes, we expected to find increased rates of inpatient hospitalization admissions and increased 30-day ED revisitation rates for patients diagnosed with COVID-19. Conversely, decreased inpatient hospital admissions and 30-day ED revisitation rates are expected as post-intervention short-term outcomes for patients diagnosed with COVID-19. To evaluate qualitative aspects of this project, nurse practitioners were asked to provide anonymous responses in survey form to understand their role and experiences while implementing the protocol.

Project Description

Project Design

This Clinical Inquiry-Based Project was conducted as a retrospective chart review of de-identified data collected from the project site's EHR. No patient contact or observation occurred in the process of viewing the data retrospectively. This process preserved patient privacy and integrity.

The nurse practitioners in the ED and EDOU completed anonymous survey questions to provide a safe platform in which to respond. Their responses were kept in a de-identified file to ensure the privacy of the NPs. Patient privacy was preserved through the survey process as non-patient specific questions were addressed.

Implementation of the project began in January 2022 with the retrieval and analysis of de-identified data from the EHR. The data included patients presenting to the UCIMC ED with laboratory-confirmed COVID-19 and demonstrating moderate to severe illness from September 2020 through March 2021. Additionally, between January and March 2022, surveys were completed by the nurse practitioners. From March 2022 until May 2022, the collected data was analyzed, interpreted, and results were written for the final presentation.

Project Setting/Population

This single-center retrospective program evaluation was conducted at the University of California, Irvine Medical Center. The UCIMC is a level I trauma center and major teaching and research hospital that serves Orange County, California, with an average of 39,000 patient visits per year in the ER (UCI Health, 2021). The UCIMC is the largest health care organization in Orange County. The main project site was at the UCIMC; however, data collection was narrowed to those patients who presented to the UCIMC ED.

The primary project population included de-identified data from adult patients, 18 years and older, who presented to the UCIMC ED between September 2020 through March 2021 with moderate to severe symptoms associated with a diagnosis of COVID-19, some of whom were then transferred to the EDOU and placed on the COVID Observation Protocol. The significance of this timeframe included the three months before the December surge and three months after. During this period, UCIMC ED experienced a surge of patients presenting with symptoms associated with COVID-19 infection, ranging from mild to severe with varying degrees of hypoxia, while facing an inpatient bed shortage.

The secondary project population included de-identified responses of the ED NPs who participated in developing and implementing the COVID Observation Protocol.

Participants and Recruitment

This program evaluation included all adult patients, 18 years and older, who were diagnosed with COVID-19 and presented to the UCIMC ED between September 01, 2020, and March 31, 2021. Patients screened in the ED for possible discharge on home-oxygen therapy were then transferred to the EDOU for monitoring and trialed on oxygen therapy.

Inclusion criteria: patients with a laboratory-confirmed COVID-19 diagnosis; oxygen saturation > 88% with ambulation, if on oxygen supplementation via nasal cannula it cannot be more than 4 LPM; no significant tachypnea or hypotension; patients are eligible to walk and perform trials of ambulation; and they have a chest radiograph that demonstrates no signs of severe bilateral pneumonia with > 50% infiltrates; and have a home or residence in which the home-oxygen concentrator could be delivered.

Exclusion criteria: hypoxia < 88% for 15-30 seconds despite 3-4 vital capacity breaths after a trial of ambulation; requiring increased levels of supplemental oxygen > 4 LPM; the patient has a comorbidity that requires inpatient admission; the patient has unstable vital signs; a patient who needs a sitter for behavioral issues or are at high risk for elopement; are severely immunocompromised with multiple comorbidities, or they have end-stage renal disease requiring urgent dialysis.

During the study timeframe, there were eight full-time NPs and three who worked per diem. One full-time NP went out on maternity leave in June 2020, before the study timeframe, and a second went out on maternity leave in January 2021. Of the eight full-time NPs, one was no longer employed by UCIMC (S. Asturias ACNP-C (Lead Nurse Practitioner, UCIMC ED), personal communication, November 29, 2021).

Description of Intervention

Those patients who were initially seen in the ED and had positive COVID tests were triaged to determine the severity of illness and level of hypoxia, and those who demonstrated severe symptoms and severe hypoxemia were admitted to an inpatient bed or temporarily housed in the ED for close observation. In contrast, those with severe symptoms with mild hypoxemia were admitted to the EDOU to determine their eligibility to go home on home-oxygen therapy. In the EDOU, the intervention, the COVID Observation Protocol, a protocol developed to discharge patients on home-oxygen therapy, was implemented by the ED NPs. This intervention was designed to adapt to the needs of the patients within the context of the availability of resources.

The purpose of the COVID Observation Protocol was to provide patients with a trial of observation to determine whether they could maintain a stable oxygen saturation without supplemental oxygen or whether their oxygen saturation decreased, requiring new supplemental oxygen. During this observation period, the NPs continued to monitor COVID severity labs and followed up on diagnostic imaging studies.

Several components were included in this protocol beginning with the patient observation for a minimum of two hours to ensure the stability of oxygen saturation; patients in immediate need of oxygen supplementation were observed for at least four hours. When admitted to the EDOU, patients were instructed to self-prone to improve lung expansion (Taylor et al., 2021) and ambulate every hour with the assistance of EDOU registered nurses (RNs). Patients whose oxygen saturation was < 88% at the beginning of the ambulation trials were excluded from continuing to participate on the protocol. However, patients who were initially stable on room air but then demonstrated decreased oxygen saturation < 90% over time were then trialed on supplemental oxygen and observed for at least four hours. If a patient's lab work and diagnostic imaging were stable in addition to their ability to maintain their oxygen saturation at 90% with stable oxygen supplementation up to 4 liters per minute (LPM), they were then slated to meet with the case manager to discuss their eligibility to go home with a home oxygen concentrator. If oxygen saturation continued to drop despite supplemental oxygen, SpO_2 less than 90%, and the need for supplemental oxygen increases, then patients were slated for inpatient admission. See Appendix F to view the protocol and a graphic representation of the protocol.

Measures/Instruments

Admission to the EDOU. Admissions to the EDOU for moderate to severe COVID symptoms for patients admitted to the EDOU during the three months following the implementation of the protocol were assessed as a dichotomous (yes/no) variable for each ED admitted patient.

ED and EDOU length of stay. ED and EDOU lengths of stay were assessed as continuous variables calculated by subtracting the admission time from the discharge times for the ED and EDOU. The unit of measure was in hours.

Hospital inpatient admissions. The proportion of COVID patients admitted to UCIMC for COVID was assessed before implementing the protocol December 29, 2020, and again at the end of the three months following its implementation.

ED Revisitation. The proportion of COVID patients returning to the ED for COVID-related symptoms within 30 days of discharge from the ED was calculated for the three months before implementing the protocol and again at the end of the three months following its implementation. Revisitation to the ED was 1 for revisit and 0 for no revisit.

Medical comorbidity covariates. The presence or absence of several medical conditions was assessed as covariates in the analysis. These included body mass index (BMI), diabetes, hypertension, chronic obstructive pulmonary disease (COPD), asthma, obesity, end-stage renal disease (ESRD) without requiring urgent dialysis, dyslipidemia, cancer, immunodeficiency, and immunocompromise. (See Table 1 for coding of medical comorbidity covariates).

Demographic and other covariates. Characteristics of the patients included gender, race/ethnicity, financial class, level of education, severity of illness, and discharge disposition code was included in the EHR database as covariates for the analyses. (See Table 1 for coding of demographic covariates).

Table 1

Coding of Covariates

Gender	Race/Ethnicity	Comorbidities	Body Mass Index (BMI)	Education Level	Financial Class	Discharge Disposition
0 = Female	0 = Non-Hispanic Black/African American	0 = Diabetes	< 18.5 (underweight)	0 = Some High School	0 = Medicare	0 = Home
1 = Male	1 = Hispanic Black/African American	1 = Hypertension	1 = 18.5-24.9 (healthy weight)	1 = High School Graduate	1 = Medicaid	1 = Long-term Acute Care
2 = non-Binary	2= Non-Hispanic White	2 = COPD	2 = 25-29.9 (overweight)	2 = College Degree	2 = Commercial Insurance	2 = Skilled Nursing Facility
3 = Other	3 = Hispanic White	3 = Asthma	3 = 30 and above (obese)	3 = Graduate Degree	3 = Self Pay	3 = Shelter
	4 = Latin/Latina	4 = Obesity (BMI > 30)				
	5 = Asian	5 = End-Stage Renal Disease				
	6 = Native American	6 = Dyslipidemia				
	7 = Pacific Islander	7 = Cancer				
	8 = More than 1 Race/Ethnicity	8 = Immunodeficiency				
	9 = Other	9 = Immunocompromise				
	10 = Prefer Not to Say					

Data Collection Procedures

Data was collected at the project site from January 2022 through March 2022. De-identified retrospective data from the EHR was collected remotely, securely, and provided by the UCIMC Honest Broker to this investigator. To safeguard protected health information, access to the data was through the UCIMC remote desktop with restrictions limiting the ability to download or share the data. A database was created in an Excel spreadsheet to input and store EHR data in an electronic repository designated with a secure login for this investigator. Utilizing outcome variables, independent variables, and covariates collected from the EPIC chart review, the data was divided into two main categories to evaluate pre-and post-implementation of the COVID Observation Protocol before December 29, 2020, and after December 29, 2020.

An online anonymous survey, using Qualtrics survey software, was also utilized to assess the role played by NPs in the implementation process.

Data Analysis

To analyze the data acquired for this project, descriptive and inferential statistics were required utilizing STATA® statistical software. Chi-square tests of independence were conducted to examine the relationships between the intervention, inpatient hospitalizations, 30-day ED revisitations, and discharge home with home-oxygen therapy among the two populations (before and after December 29, 2020). In performing this analysis, the primary investigator wanted to determine if the EDOU served as somewhat of a "relief valve" in decreasing inpatient hospital admissions and 30-day ED revisitations at UCIMC.

A thematic analysis was conducted as a qualitative measure to evaluate responses from the nurse practitioner interviews. Thematic analysis is a technique for finding, analyzing, organizing, summarizing, and reporting themes in a data set (Elo & Kyngäs, 2008). One of the benefits of thematic analysis is that it is a valuable strategy for assessing different study participants' views, demonstrating parallels and differences, with the expectation of producing unexpected insights (Kallio et al., 2016). In addition, study participants' responses were compared to summarize collective experiences while implementing the COVID Observation Protocol in the EDOU. It was our hope that the thematic analyses helped contextualize the quantitative analyses included in this project.

Ethical Considerations

In accordance with the Health Insurance Portability and Accountability Act of 1996 (HIPAA), no protected health information (PHI) was viewable to the investigator. The data was de-identified prior to receiving it in a secure manner. This project was taken through the UCI Institutional Review Board (IRB) process. A non-human subjects research determination form was submitted to establish that this project does not constitute human subjects research.

Stakeholders/Barriers

The stakeholders of this project included the UCIMC Emergency Department/EDOU and its providers (including UCIMC advanced practice providers), UCI Sue & Bill Gross School of Nursing, UCIMC ED patients and their families, and the Orange County community.

There were two several essential facilitators at this project site. Dr. Jennifer Roh and Sheri Asturias, NP provided access to information regarding the protocol and other necessary information regarding the UCIMC ED. Dr. Soheil Saadat provided statistical support and analysis for this project. Dr.

Vasco Deon Kidd facilitated coordination of efforts on everyone's part at UCIMC. Access to the UCIMC Honest Broker provided the necessary EHR data for review and analysis and. Second, access to the ED NPs allowed for the completion of the qualitative arm of this project. Lastly, NP participation in the anonymous survey process explained their integral role in implementing the intervention.

Barriers included the data query and NP specific recall of events. The data query, at times, produced incomplete or inaccurate variables in the EHR or an inexact data retrieval. Not all fields were populated or populated accurately in the EHR and given the urgency and short staffing at the height of the pandemic, not all fields had data input. This project reflected on a point in time over a year ago, and not all the ED NPs who implemented the intervention were able to recall specific details relating to their involvement.

Formative Process Evaluation

Through formative evaluation of the data previously collected and analysis of the strengths and weaknesses of the intervention, suggested changes or modifications could be incorporated to improve the protocol and its implementation. Through formative evaluation of the data previously collected and analysis of the strengths and weaknesses of the intervention, suggested changes or modifications could be incorporated to improve the protocol and its implementation. Therefore, re-implementation of the newly adapted protocol should be considered to meet the demands of any future pandemic surge.

CHAPTER 5: RESULTS AND CONCLUSIONS

Results

Quantitative Data Results

De-identified patient data was extracted from the EHR with a total of 4,049 patients presenting to the UCIMC ED between September 2020 and April 2021. Of those 4049 patients, 1,951 patients (48%) presented before December 29, 2020, and 2098 patients (52%) presented after December 29, 2020, when the COVID Observation Protocol was first implemented. The characteristics of the patients are presented in the appendices: race (Table 2, Graph 2), comorbidities (Table 3, Graph 3), and financial class (Table 4, Graph 4). The median age was 53-years, 47% were female, and 53% were male (See Appendix J, Table 1, Graph 1).

Of those patients who arrived at the ED ***prior*** to December 29, 2020, 45.3% (n = 883/1951) were hospitalized, the 30-day ED revisitation rate was 20.71% (n = 404/1951), and 31.83% (n = 621/1951) were discharged home with oxygen. Of those who arrived at the ED ***after*** December 29, 2020, 46.5% (n = 976/2098) were hospitalized, the 30-day ED revisitation rate was 26.55% (n = 557/2098), and 28.32% (n = 572/2020) were discharged home with oxygen.

A chi-square test of independence was performed to examine the relation of hospital admissions pre-and post-implementation of the COVID Observation Protocol. The relation between these variables was not significant, X^2 (df 1, N = 4049) = 0.648, $p = 0.43$. A chi-square test of independence was performed to examine the relation of 30-day ED revisitations pre-and post-implementation of the COVID Observation Protocol. The relation between these variables was significant, X^2 (df 1, N = 4049) = 19.0589, $p < .001$. A chi-square test of independence was performed to examine the relation of patients discharged home with home-oxygen pre-and post-implementation of the COVID Observation Protocol. The relation between these variables was significant, X^2 (1, N = 3971) = 5.8276, $p < .05$. (See Appendix L, Tables 5-7). A chi-square test of independence was performed to examine the relation of 30-day ED revisitations among those patients who arrived ***after*** December 29, 2020, and were either discharged home on home-oxygen therapy or were discharged without. The relation between these variables was statistically significant, X^2(df 1, N = 2098) = 15.2864, $p = 0.000$.

Qualitative Data Results

A total of eleven nurse practitioners participated in the anonymous survey to ascertain their role and perspectives of protocol implementation. All eleven NPs worked in the ED between September 2020 and April 2021. Of the eleven NPs, two (18%) participated in the development of the COVID

Observation Protocol and its implementation while the remaining nine NPs took part exclusively in its implementation. Following manual qualitative analysis, four primary themes emerged from this survey: (1) significant issues with overcrowding in the ED; (2) lack of evidence-based research to support the newly implemented protocol; (3) a general lack of resources; and (4) needing coping skills to manage patients during a pandemic.

When asked to reflect on the state of affairs of the ED and EDOU prior to implementation of the protocol, all of the NPs identified overcrowding as a major problem, resulting from increased patient volume, staffing shortages, and boarding of patients in the ED/EDOU. These factors all contributed to poor patient flow in and out of the ED. After the protocol was implemented, there were issues with patients meeting protocol criteria, which led to a change in the protocol. There was little to no evidence to support the implementation of this type of protocol, rolling modifications of criteria. Collectively, the NPs reported a change to the oxygen saturation requirements to enable more patients to meet the inclusion criteria. "This change helped facilitate decompression of the ED and EDOU by sending more patients home with home oxygen, resulting in "better" patient flow". One (9%) of the NPs felt that patients were frequently discharged prematurely and 27% (n = 3/11) NPs felt that patients were sometimes discharged prematurely. Two NPs (18%) reported that the protocol made things worse for patients "because clearly they needed monitoring and support but were sent home to self-monitor".

All the NPs reported issues with the lack of resources such as: bedspace shortages in the ED, EDOU, and inpatient settings; housing of the EDOU in a mobile field hospital with sometimes difficult working conditions; extended stays in the EDOU after implementation of the protocol; a lack of bedside staff to care for patients; a lack of case managers to facilitate discharge on home oxygen; a lack of insurance approval of home oxygen; and a lack of home oxygen concentrators to discharge patients home on home oxygen.

The NPs reported utilizing coping skills such as discussions with colleagues and fellow NPs. More than half (n = 6/11) of the NPs reported that they avoided watching the news to protect their mental health from the onslaught of information and misinformation surrounding the pandemic.

Summative Evaluation

This DNP scholarly project was a retrospective program evaluation of a pre-and post-implementation strategy to assess the impact of the COVID Observation Protocol designed to facilitate improved patient flow in the UCIMC ED during the COVID-19 surge between September 2020 and April 2021. There was no recruitment process for the purposes of the quantitative portion of this scholarly project; however, there were several email conversations with the Honest Broker to discuss specifics of the data request made at the beginning of the quarter. The Honest Broker provided the data in an Excel format, which was only viewable through the UCI Health remote desktop. During Winter Quarter 2022, UCIMC was hit with another surge of COVID-19 patients and the stakeholders were overburdened with the patient care load. This posed some delays in getting email responses from the project mentors in aiding with statistical analyses. However, after meeting with Dr. Kidd, Dr. Roh, and Dr. Saadat, statistical analysis was expedited and completed.

For the qualitative portion of this scholarly project, eleven NPs at the UCIMC ED were recruited by email to participate in an interview process, via zoom, to evaluate their experience in the implementation process of the COVID Observation Protocol. After speaking with the lead NP, feedback was provided that the ED NPs would prefer to complete an anonymous survey. The interview process was redesigned to include an anonymous survey that was created in Qualtrics. The interview questions were modified into multiple choice and essay responses. The recruitment process was challenging as many of the NPs were working extra because of the winter COVID-19 surge. After sending several reminders about the survey and incentive to complete the survey, eleven NPs ultimately responded. The data from the anonymous surveys was easily exported to Excel and was organized to facilitate qualitative analysis.

Other than changing the method of surveying the NPs and learning to use Qualtrics effectively, no other major issues were incurred as primary investigator.

Overall, this project was very successful given the short timeline in which data extracted, collected, and analyzed. The project team members and stakeholders were instrumental in the success of this project and performed their roles to the best of their abilities. Seeking clarification early on regarding the data query might have improved the timeline in which data was extracted from the EHR and asking the method in which the NPs preferred to be interviewed would have saved time in performing the qualitative portion of this project.

Discussion

Implications

This project documented fewer inpatient hospitalizations ~45% (n = 883/1951) and 30-day ED revisitations ~21% (n = 404/1951) *before* implementation of the COVID Observation Protocol, and more inpatient hospitalizations ~47% (n = 976/2098) and 30-day ED revisitations ~27% (n = 557/1541) *after* implementation of the protocol. While the comparison of inpatient hospitalizations among patients before and after implementation was not statistically significant, the comparison of 30-day ED revisitations was statistically significant. One could speculate that the increase in both hospitalizations and 30-day ED revisitations after December 29, 2020, was due to peaking of the winter surge, requiring more patients to be admitted as well as patients presenting with other viral illnesses, such as influenza, that exacerbated COVID-19 symptoms. The typical flu season is between December and February (CDC, 2022).

Another rationale for the difference in hospitalizations and 30-day ED revisitations after protocol implementation might be that those patients who presented after December 29, 2020, had more comorbidities and were generally sicker than patients who presented before protocol implementation. When comparing comorbidities, such as, T2DM, hypertension, COPD, asthma, and chronic kidney disease, 46% (n = 292/634) of patients before implementation had these comorbidities while 54% (n = 342/634) of the patients after implementation had these comorbidities. When comparing insurance types pre-and post-implementation, more patients with Medicaid and Medicare presented to the ED after December 29, 2020, which may also account for the higher rate of comorbidities. Capturing an accurate 30-day ED revisitation rate may have posed a challenge due to the inability to determine whether those patients who first presented to the UCIMC ED had subsequent visits at the UCIMC ED or other hospitals throughout the county. See Graph 3.

When comparing those patients discharged on home-oxygen therapy before and after protocol implementation, the results were only marginally significant with ~32% (n = 621/1951) being discharged with oxygen before implementation and 28% (n = 572/2020) after implementation. It should be noted that there were patients discharged home on home-oxygen therapy before December 29, 2020, and, from the data query, it is unclear as to whether they were discharged from the inpatient or outpatient setting. One explanation for the increase after implementation was that sicker patients, who would have been otherwise hospitalized, were discharged home based on the protocol and returned to the ED within 30 days due to exacerbation of symptoms. This speculation correlates with some of the NP responses regarding their concerns of prematurely discharging patients too soon on home oxygen therapy.

When comparing 30-day ED revisitations of patients discharged on home-oxygen therapy to those who were not *after* protocol implementation, patients who were sent home on home-oxygen therapy were significantly less likely to return to the ED within a 30-day timeframe. This would indicate that the protocol was successful in reducing the number of 30-day revisitations among patients who were sent home on oxygen. It should be noted, however, that the UCIMC did not have access to Orange County data to assess whether these patients could have presented to other hospitals throughout the county within the 30-day timeframe. There was also no way of knowing if members of this patient population could have died within the 30-day timeframe as well.

In providing the NPs a safe space to discuss their experiences in implementing the COVID Observation Protocol, we were able to capture facilitators and barriers to the protocol's success. Their experiences with implementation can improve this protocol and positively affect practice changes during a pandemic or other form of natural disaster. Some NPs expressed concern regarding ethical considerations in their dissemination of care in relation to prematurely discharging patients. These concerns may have been mitigated by increased participation in developing and modifying the protocol, implementing the protocol in a systematic way, and enhanced coordination of care with interdisciplinary teams such as the case managers and care coordinators. Most reported not having participated in the development process of the protocol, therefore, it is recommended that NP participation is increased in protocol development and future modifications.

Limitations

There were several limitations of this project, the first being the EHR. During the first data extraction, there was only one patient listed as having been discharged home with home oxygen-therapy; it took some time and several conversations with the Honest Broker to determine the right questions to ask to obtain the necessary data to complete this project. This project had non-exempt status through the IRB, which meant that viewing of specific dates of patient visits was not allowed as this was deemed identifiable data. The compromise was having the Honest Broker present the data as before and after December 29, 2020. Another issue was the way in which data was coded as the data was not coded as "0/1" or "Yes/No", which posed challenges in trying to view the data for analysis.

Moreover, the COVID Observation Protocol, in its original form, was not preserved with track changes throughout the early pandemic. This created some limitations in understanding how and why criteria was changed. Due to the nature of this project focusing exclusively on the UCIMC ED patient population there are limits to generalizability to greater populations.

Sustainability

The long-term sustainability of this project will depend on the efforts of the faculty of the UCIMC ED to continue to analyze the data. Upon initial data analysis, this project revealed some interesting results that need to be further explored as well as some unanswered questions. We need to look further into the EMR data to make sure we are getting quality data to analyze as it was unclear how accurately the data was kept. There were also some issues in capturing data because charting was pared down due to the influx of patients during the pandemic. In continuing to analyze the data and the implications, it will further support the use of these types of protocols and how they are implemented.

Conclusion

In summary, we examined 4049 patients who presented to the UCIMC ED between September 2020 and March 2021, that demonstrated similar characteristics before and after protocol implementation. In comparing the two data sets, they were very similar across gender, race, and financial class. Before December 29, 2020, 48% presented to the ED, 45% were hospitalized, and 21% revisited the ED within 30 days. After December 29, 2020, 52% presented to the ED, 47% were hospitalized, and 27% revisited the ED within 30 days. It was initially hypothesized that the protocol would reduce the number of inpatient hospitalizations and 30-day ED revisitations after implementation. While, on the surface, it appears that the protocol was not successful, a closer examination of the cohort discharged home on home-oxygen therapy after December 29, 2020, demonstrated a significant reduction in 30-day ED revisitations. Despite the number of confounding items, I think this scholarly project has demonstrated that the updated protocol was successful in reducing revisitation rates and warrants further analysis.

The design of this program evaluation was developed to retrospectively evaluate an intervention in a major health care organization during a pandemic. The relevant findings and outcome measures of this project may be utilized to facilitate practice changes and revise protocol development and implementation for nurse practitioners who practice within this health care organization as well as during a pandemic or other natural disaster.

It was the goal of this protocol to decrease and decompress inpatient admissions through ambulatory management of patients to discharge them to home on home-oxygen therapy. While it was hypothesized that the protocol would reduce the number of inpatient hospitalizations and 30-day ED revisitations after implementation, the results of this project somewhat demonstrated the opposite. While some of the results were statistically significant, there were many confounders that were possibly overlooked, such as concomitant viral illnesses during flu season and other comorbidities. Data analyses may also have proven different had we excluded patients with the most salient comorbidities. Analysis of the NP responses demonstrated a stressful environment in which decisions had to be made to prioritize the sickest of patients with access to limited resources and a challenging practice environment in the mobile field hospital.

It is, therefore, necessary to consider ways to further improve the retrospective analysis of this project. It would be beneficial to submit an IRB request to access specific dates of patient encounters in understanding patient disposition. In doing this, understanding the 30-day ED revisitation rate may improve. It would also be helpful to collect retrospective data throughout Orange County hospitals to identify those patients who presented to non-UCIMC EDs within 30 days after being seen at the UCIMC ED for treatment. Another possible question to explore is how financial class, such as type of insurance, facilitated or hindered access to home-oxygen therapy as most patients in this project had Medicaid or Medicare (see Table 5 for breakdown of financial class). Lastly, it is recommended to expand the data query to include such variables as diagnostic results that include viral panels (e.g., influenza, parainfluenza, metapneumovirus, etc.) and pulse oximetry results throughout the ED/EDOU stay.

Utilizing facets of the DNP Essentials to complete this scholarly project has led me to become a competent DNP prepared scholar. This has been accomplished through integration of scholarship and research into application while focusing on improving clinical aspects of advanced practice through retrospective evaluation of protocol implementation. This scholarly project incorporated the DNP essentials by learning to critically appraise literature and evidence-based research, through extraction and collection of data from systems/databases, by using relevant results to suggest possible improvements toward clinical practice, and through collaboration to develop and implement future practice models.

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Appendices

Appendix A

UCI University of California, Irvine

Letter of Cooperation with Outside Organization for UCI DNP Project

Date: 11/29/2021

Dear: (name of DNP Student): Dara Nunn

This letter confirms that I, as an authorized representative of
allow the above-named Doctor of Nursing Practice student access to conduct a leadership, policy, quality improvement, or evidence-based practice project activities at the listed site(s) as discussed with the DNP student and outlined below. These activities may commence after the DNP student has consulted with UCI IRB about the proposed project.

- **Project site(s):** (list specific site name and address for all sites within which the organization is providing student access to conduct the project)

  University of California, Irvine Medical Center Emergency Department

- **Project purpose:** (briefly summarize the project purpose, plan and expected outcomes)

  To evaluate the effectiveness of the nurse practitioner-implemented COVID Observation Protocol in the EDOU. This retrospective program evaluation will use de-identified data to assess the impact of the intervention in reducing inpatient hospitalizations and 30-day readmissions

- **Project activities**: (briefly summarize the activities that will commence at the site, including any baseline data collected, educational interventions, PDSA cycle proposed…)

  Through quantitative analysis, de-identified data of patients presenting to the UCIMC ED between September 2020 and March 2021 will be used to compare inpatient admission rates and 30-day readmission rates to the ED pre- and post-intervention. Through qualitative analysis, interviews of

- **Target population**: (identify the population upon whom the project will focus)

  Patients who presented to the UCIMC ED, with laboratory confirmed COVID-19 and moderate to severe illness, between September 2020 and March 2021.

- **Site(s) support:** (briefly describe the support the project site(s) agree to provide to support the project, such as space to conduct project activities, data retrieval from electronic records, facilitation of educational activities….)

  Data retrieval from electronic records will be provided by the UCIMC data broker. Assistance with statistical analysis will be provided by the statistician for the UCIMC ED.

Sue & Bill Gross School of Nursing
268 Berk Hall
Irvine, CA, 92697-3959
(949) 824-3650
www.nursing.uci.edu

UCI University of California, Irvine

- **Data management plan**: (briefly describe the plan for management of data such as what data will be collected, whether it will be identified/de-identified, what protections will be in place for data protection...)

  For quantitative analysis, de-identified data will be extracted from the EHR by the data broker and provided in a secure Excel document. The document will be password protected. No patient contact or observation will occur, which will preserve patient privacy. For qualitative analysis, responses from the nurse

- **Other agreements**: (briefly describe any additional agreements that have been made to support the project, if applicable)

- **Anticipated end date**: (indicate the anticipated date that the project will be concluded at the site)

  May 2022

It is understood that all DNP Scholarly Project related activities must cease if directed by UCI IRB. It is also understood that any activities that involve Personal Private Information or Protected Health Information must comply with HIPAA Laws and institutional policy.

Our organization agrees to the terms and conditions stated above. If there are any concerns related to this project, we will contact the DNP student named above and their DNP Scholarly Project Chair. For concerns regarding IRB policy or human subject welfare, we may also contact our own institutional IRB.

UCI IRB: https://www.research.uci.edu/compliance/human-research-protections/researchers/irb-faqs.html

With regards,

[signature]	Assistant Professor of Emer
(Signature of Project site-authorized representative)	(Job title of authorized representative)

12/06/2021

(Date signed)

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Appendix B

Kuali Approval Email

From: **Kuali Notifications** no-reply@kuali.co
Subject: Confirmation of Activities that DO NOT Constitute Human Subjects Research
Date: October 21, 2021 at 09:41
To: dnunn@uci.edu

KN

Dear Dara Nunn,

The University of California, Irvine (UCI) Human Research Protections (HRP) Program complies with all review requirements defined in 45 CFR Part 46 and 21 CFR 50.3.

Based on the responses provided in Non Human Subjects Research (NHSR): #388 - "The Nurse Practitioner implemented COVID-19 Observation Protocol: Lessons learned on discharging patients from the Emergency Department Observation Unit on home-based oxygen therapy", and per the definitions cited below, the activities do not constitute human subject research or a clinical investigation, as applicable. Therefore, *UCI IRB review is not required and will not be provided.*

45 CFR 46.102(l) defines research as "a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge; and 45 CFR 46.102(e)(1) defines a human subject as "a living individual about whom an investigator conducting research obtains (i) Obtains information or biospecimens through intervention or interaction with the individual, and uses, studies, or analyzes the information or biospecimens; or (ii) Obtains, uses, studies, analyzes, or generates identifiable private information or identifiable biospecimens."

21 CFR 50.3(c) defines a clinical investigation as "any experiment that involves a test article and one or more human subjects and that either is subject to requirements for prior submission to the Food and Drug Administration under section 505(i) or 520(g) of the act, or is not subject to requirements for prior submission to the Food and Drug Administration under these sections of the act, but the results of which are intended to be submitted later to, or held for inspection by, the Food and Drug Administration as part of an application for a research or marketing permit."

To view the determination for your submission, click here: uci.kuali.co/protocols/protocols/616e15e56682d9003684c1bd

Please DO NOT REPLY to this email as this mailbox is unmonitored. If your project changes in ways that may affect this determination, please contact the HRP staff for additional guidance: irb@uci.edu.

Appendix C

Keywords and Boolean Search Terms

PubMed

Keywords and Boolean operators included: ("Oxygen Inhalation Therapy"[Majr] OR oxygen[ti]) AND ("Home Care Services"[Mesh] OR home OR home-based OR in-home) AND ("COVID-19"[Mesh] OR covid* OR coronavirus* OR pandemic) *and* "Oxygen Inhalation Therapy"[Mesh] AND ("Home Care Services"[Mesh] OR home OR home-based OR in-home) AND ("COVID-19"[Mesh] OR covid* OR coronavirus* OR pandemic) with filters from 2020 – 2021. Total articles obtained from search: 37.

CINAHL

Keywords and Boolean operators included: (MH "Home Oxygen Therapy") AND

(MH "COVID-19") OR covid* OR coronavirus* OR pandemic *and* (MH "Home Oxygen Therapy") OR ((MH "Home Health Care") OR (MH "Home Rehabilitation") OR (MH "Home Respiratory Care")) AND ((MH "Oxygen") OR (MH "Oxygen Therapy Care (Saba CCC)") OR (MH "Oxygen Therapy") OR (MH "Oxygen Therapy (Iowa NIC)") OR oxygen))

AND (MH "COVID-19") OR covid* OR coronavirus* OR pandemic. Total articles obtained from search: 15.

Scopus

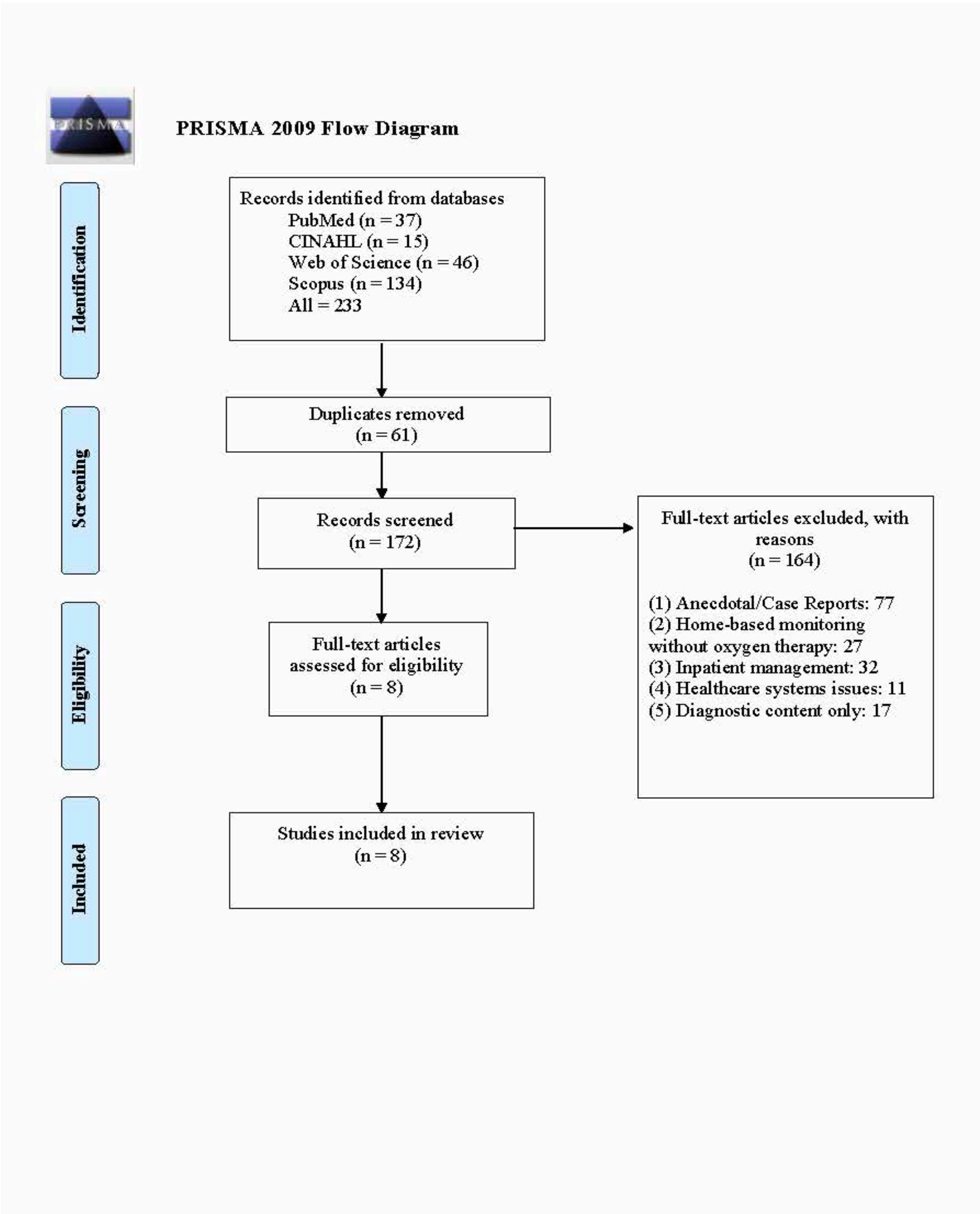
Keywords and Boolean operators included: Oxygen* AND home OR home-based OR in-home AND covid* OR coronavirus* OR pandemic AND ER OR emergency. Total articles obtained from search: 134.

Web of Science

Keywords and Boolean operators included: Oxygen* AND home OR home-based OR in-home AND covid* OR coronavirus* OR pandemic AND ER OR emergency. Total articles obtained from search: 46.

Appendix D

PRISMA FLOW DIAGRAM



Appendix E

Table of Evidence

	SOURCE (AUTHOR, DATE)	TOPIC/ MAIN IDEA	POPULATION OF STUDY	Independent/ Dependent Variable (*Primary Outcome)	RESULTS/ CONCLUSIONS	LIMITATIONS	CONNECTION TO OTHER STUDIES	RELATION TO PICO Question	NOS SCORE
SOURCE 1	Banerjee et al. (2021) Mortality and readmission rates among patients with COVID-19 after discharge from acute care setting with supplemental oxygen	Assessing the all-cause mortality rate of patients with COVID-19 pneumonia who were discharged home from emergency or inpatient care on home oxygen.	Retrospective observational cohort study of 621 adult patients with COVID-19 pneumonia diagnosis, discharged from 2 large urban public hospitals. Took place over 5 months.	Independent: Patients on oxygen who are discharged from emergency or inpatient encounters with home oxygen equipment, educational resources, and nursing telephone follow-up. Dependent: Patients with COVID-19 pneumonia stable without other indication for inpatient care.	All-cause mortality rate was 1.3% and the 30-day return hospital admission rate was 8.5%. No deaths occurred in the ambulatory setting. Patients with COVID-19 pneumonia who were discharged on HOT had low mortality and return admission within 30 days of discharge. This study did not compare pre- and post-intervention.	This is an observational study that does not provide generalizable outcome measures. The low mortality rate is below the range reported in large surveillance studies of outpatients with COVID-19. This study also does not have a control group for comparison.	Assessing mortality rates among patients with COVID-19.	This study provides a basis for collecting secondary data for the purposes of my study.	9/10
SOURCE 2	Steel et al. (2021) Telehealth follow up in emergency department patients discharged with COVID-like illness and exertional hypoxia	Development of a disaster care pathway to discharge patients from the ED, who would have otherwise been admitted for COVID, to free up inpatient bed space for the most severely ill patients. Assessing 30-day mortality rate.	Retrospective observational cohort study following 677 patients with COVID-like illness were enrolled in the program and were monitored post-discharge via virtual follow up visits. Patients with exertional hypoxia were given oxygen set a 2 LPM via nasal cannula and sent home with a home oxygen concentrator. **Took place over 4 months.**	Independent: Oxygen saturation > 94% and/or maintenance of oxygen saturation between 90% and 94% with exertional hypoxia. Dependent: Patients with COVID-like illness (CLI).	Overall, 30-day mortality rate was 13 patients (1.9%). **It does not compare pre- and post-intervention in the same population. They are comparing the outpatient cohort to the inpatient cohort.**	This article compares the 30-day mortality rate post-intervention in comparison to the mortality rate of New York during the same time period.	Assessing mortality rates among patients with COVID-19.	Patients are placed on HOT for exertional hypoxia from ED discharge and monitored at home. Provides detailed information on specific data variables to seek for my study.	9/10
SOURCE 3	Adly et al. (2021) Telemanagement of home-isolated COVID-19 patients using oxygen therapy with noninvasive positive	Compare two nonpharmacological respiratory treatment methods for home-	Single-blinded randomized clinical trial of 60 patients with stage 1 COVID pneumonia who were randomized to receive either oxygen therapy via BiPAP or to receive	Independent: BiPAP or osteopathic manipulative respiratory and physical therapy. Dependent: Patients with stage 1 COVID pneumonia.	Home-based oxygen therapy via BiPAP was more a effective prophylactic treatment than treatment with osteopathic manipulative respiratory and physical therapy	Small sample size.	Demonstrated the overall effectiveness of home-oxygen management for patients with stage 1 COVID pneumonia as a method to reduce inpatient hospital admissions.	Utilization of HOT to maintain patients at home with telemanagement support.	10/10

	pressure ventilation and physical therapy techniques: Randomized clinical trial.	isolated COVID-19 patients using a newly developed telemanagement health care system.	osteopathic manipulative respiratory and physical therapy. **Intervention duration: 14 days**		for patients with early-stage COVID-19 pneumonia. **Compares two interventions with pre- and post-intervention observation of chest CTs.**				
SOURCE 4	Gootenberg et al. (2021) Developing a pulse oximetry home monitoring protocol for patients suspected with COVID-19 after emergency department discharge.	Assess feasibility of a protocol for ED-based outpatient pulse-oximetry monitoring with structured follow up and determine ED rates of return, hospitalization, and hypoxia among participants.	Prospective observational study of 81 patients suspected of having COVID-19, presenting to a single research site. Patients were observed for 28 days over the study period.	Independent: Resting SpO2 > 92%, ambulatory SpO2 > 90%, heart rate < 110 bpm, ability to use home pulse-oximetry. Dependent: Patients with suspected COVID-19.	23/81 patients returned to the ED at least once and 10 of those who returned were admitted. 76/81 patients were successfully contacted at least once for follow up. It is feasible to implement an outpatient pulse-oximetry monitoring protocol to monitor patients discharged from the ED with confirmed or suspected COVID-19. **This was a feasibility study that did not compare pre- and post-intervention strategies.**	This an observational study that does not provide generalizable outcome measures to the population of interest. This study assumes ease of use of home pulse-oximetry and that patients have access to phones for telephonic visits.	Feasibility of discharging and monitoring patients from the ED while at home.	Looking at methods of monitoring patients at home who are discharged from the ED with COVID-19.	10/10
SOURCE 5	Okauchi et al. (2021) Obesity, glucose tolerance, advanced age, and lymphocytopenia are independent risk factors for oxygen requirement in Japanese patients with Coronavirus disease 2019 (COVID-19).	Identify risk factors associated with the progression to oxygen requirements in COVID-19 patients.	Retrospective observational study of 84 (after exclusion criteria) patients with lab-confirmed COVID-19 who were admitted to the hospital. **Took place over 7 months.**	Independent: Patients who required oxygen and those who did not. Dependent: Lab-confirmed COVID-19.	A higher number of risk factors is associated with future oxygen requirements. This can be useful for triaging COVID-19 patients who may need oxygen either in the home or as inpatients. **No pre- and post-intervention comparisons.**	A retrospective study of patients who have already been triaged for admission based on other factors such as age, fever, hypoxia, or pre-existing diseases. Those patients were already more likely to have poorer outcomes. This was also a small sample size which makes it more difficult to for application to a general population.	This study provides groundwork for identifying patients at greatest risk for inpatient hospitalization vs those who could be potentially discharged home with HOT.	Will facilitate determination of variables and comorbidities for my retrospective program evaluation.	9/10
SOURCE 6	Issa & Soderberg (2021) High-flow nasal oxygen (HFNO) for	HFNO in COVID patients with moderate to severe	Retrospective observational cohort study comparing 41 patients with HFNO either as	Independent: HFNO as primary intervention or as secondary intervention after transition from ICU	55% of patients were discharged home from being on HFNO and 10% avoided the ICU completely.	An observational study that utilized a small sample size in attempt to	Retrospective observational cohort study evaluating the effects of supplemental	Demonstrates the utilization of supplemental oxygen as a means to	8/10

	patients with COVID-19 outside intensive care units	ARDS in attempt to avoid ICU admissio n.	primary treatment or as step-down from ICU treatment.	step-down unit, duration of HFNO in a non-ICU unit. Dependent: COVID patients requiring supplemental oxygen.	HFNO saved 229 days in the ICU, resulting in saving resources. HFNO treatment is feasible and efficient for patients with COVID-19. **No pre- and post-intervention comparisons.**	decrease ICU admissions. While this study shows the benefits of HFNO in decreasing severity of disease and improving inpatient discharge, it does not provide generalizable information to a larger population.	oxygen in COVID patients as a means to decrease inpatient/outpati ent lengths of stay.	facilitate faster recovery as well as shorter length of stay. **The infection unit is comparable to the EDOU.**	
SOURCE 7	Annunziata et al. (2021) Home management of patients with moderate or severe respiratory failure secondary to COVID-19, using remote monitoring and oxygen with or without HFNC	Italian study evaluatin g HOT in managing moderate -to- severe COVID-19 patients at home with communi ty support	Prospective observational cohort study involving 18 patients with moderate-to-severe respiratory failure secondary to COVID-19. **Observation period: 2 months**	Independent: Oxygen saturation, temperature, and lung performance. Dependent: Patients with moderate-to-severe respiratory failure secondary to COVID-19, oxygen requirements.	All 18 patients had favorable outcomes and no deaths were reported. **No pre- and post-intervention comparisons.**	Small population size. Not generalizable as there was no control group.	HOT use to decrease overburdened health care systems.	Utilization of HOT (nasal cannula/HF NC) to maintain patients at home with community support.	9/10
SOURCE 8	Borgen et al. (2021) From hospital to home: an intensive transitional care management intervention for patients with COVID-19	Interventi onal study evaluatin g the effective ness of an interventi on to optimize hospital bed capacity during a pandemic at the 4 largest inpatient facilities of a health system in New Jersey.	Prospective interventional or experimental study of 192 patients who were evaluated in the ED, monitored in the EDOU or admitted to the hospital, with mild-to-moderate COVID-19 infection. **Took place over 21 days.**	Intervention: Intensive Transitional Care Management (ITCM). Dependent variables: hospital bed capacity, patients with COVID-19.	Significant reduction in hospital patient days during surge capacity in a pandemic due to the ITCM intervention. **No pre- and post-intervention comparisons.** They compared two groups, one that received the intervention, to an inpatient population.	This is an observational study that does not provide generalizable outcome measures to smaller health systems. This study also does not have a control group for comparison.	Utilizing a standardized protocol to reduce inpatient hospitalization during surge capacity in a pandemic with a home-based monitoring system of patients stable for monitoring at home.	An EBP based standardized protocol for transitioning stable patients (meeting specific criteria) from the EDOU or inpatient stay to home on oxygen with continued monitoring.	10/10

Appendix F

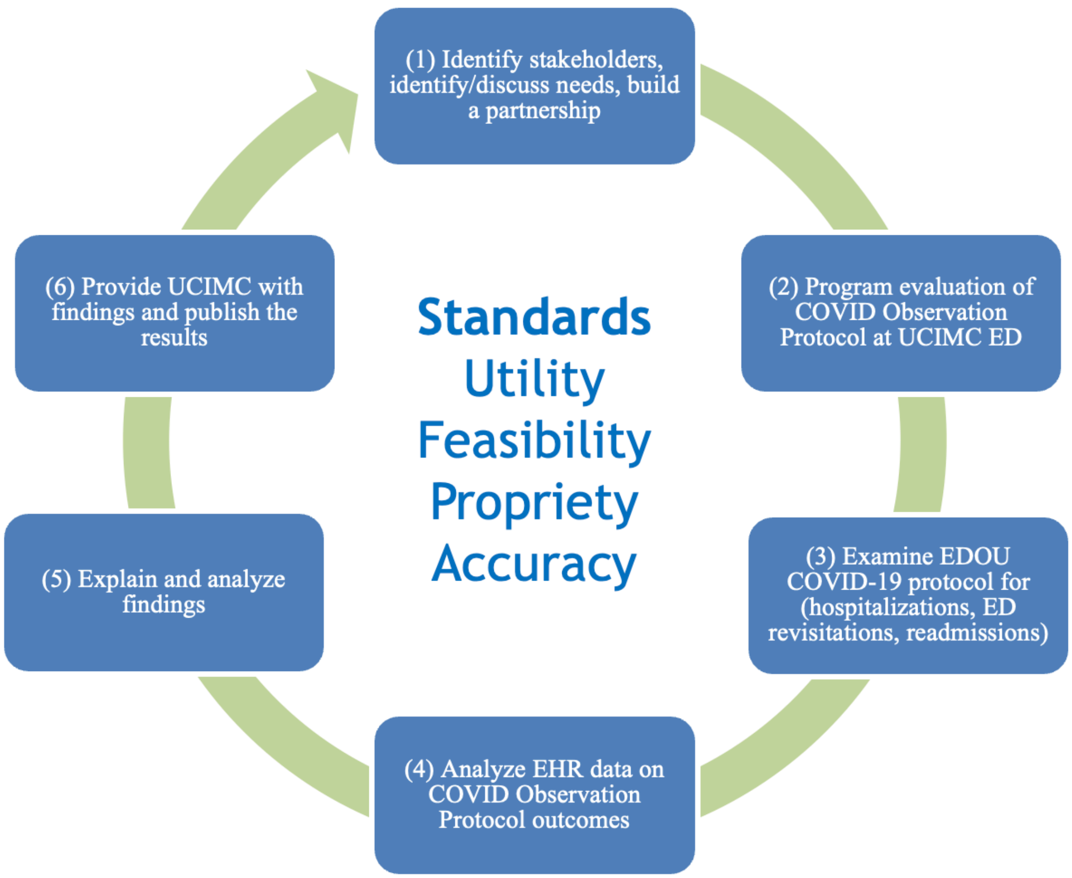
Conceptual Framework Model: A Framework for Program Evaluation

Centers for Disease Control and Prevention. Framework for program evaluation in public health. MMWR 1999;48 (No. RR-11)

Appendix G

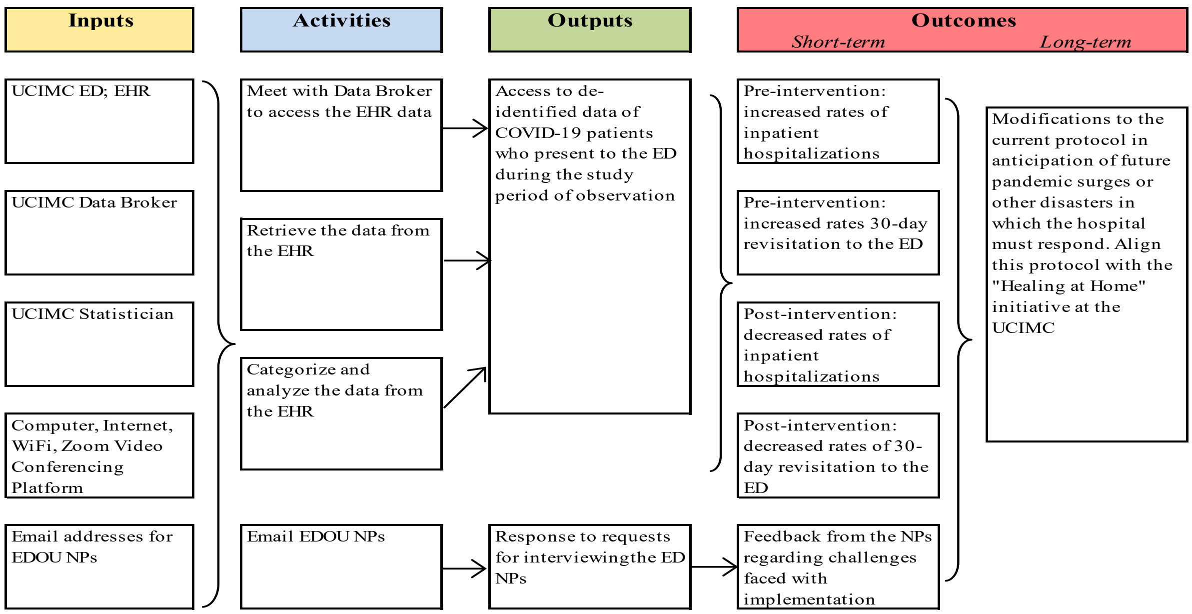
Adapted Conceptual Framework Model*

Derived from the Centers for Disease Control and Prevention Framework for Evaluation in Public Health



Appendix H

Outcomes Approach Logic Model



External Influences: inability to access the necessary de-identified data from the UCIMC EHR effectively. The risks exist of the failure to retrieve all the required data points or the inability to open the secure data transmission. Another influence would be the lack of sample size, as this could potentially reduce the power of this analysis and increase the margin of error. Lastly, a lack of response by the nurse practitioners to participate in the interview process may pose a severe negative influence to conduct a thematic analysis.

Appendix I

COVID Observation Protocol (Depicted as Provided by UCIMC ED)

COVID Observation Protocol

Background: There are some COVID+ who have risk factors associated with severe covid or and/or mildly hypoxic, but not at a level that requires admission.

Purpose of this protocol:
1. To give patients a trial of observation to help determine if the patient's oxygen saturation remains stable, or decreases, requiring new supplemental O2 and admission.
2. Arrange Home O2 for applicable patients
3. Infusion of Monoclonal Antibodies, Bamlanivimab for applicable patients

Inclusion Criteria

1. Patients who are confirmed COVID +
2. O2 is >88% with ambulation (if on O2 NC -- max of 4L)
3. No significant tachypnea or hypotension
4. Able to walk and perform trials of ambulation
5. CXR without signs of severe bilateral pneumonia (ie. >50% infiltrates)

Exclusion Criteria

1. Hypoxia of <88% for > 15-30 seconds despite 3-4 vital capacity breaths after a trial of ambulation (pt can be up to 4L NC)
2. Requiring increasing levels of supplemental O2
3. Has another medical condition that requires admission
4. Unstable vitals
5. Patients who require a sitter (ie. behavioral issues or are high risk for elopement)
6. Immunocompromised
7. ESRD requiring urgent dialysis

Interventions

1. Observe Patient for a minimum of 2 hours (ie. Ensure O2 stability for at least 2 hours. If patient has a new O2 requirement during ED Obs stay, please observe for at least an additional 4 hours --If O2 requirements increase --> Admit)
2. Perform a trial of ambulation every hour and prior to Discharge
3. Follow up on COVID severity labs
4. Follow up on imaging (ie. CTA chest if indicated)
5. If a patient being observed on RA demonstrates a trial ambulation O2 saturation that falls below 90% --> can trial NC (*patient needs to demonstrate stable O2 settings on NC for at least 4 hours)
    a) If patient requires a stable amount of O2 --> contact CM to arrange home O2
    b) If O2 requirements increase (after the initial trial of NC)--> Admit
6. **Home O2:**
    a) Patient must demonstrate stable O2 saturation NC up to maximum rate of 4L.
    b) Call Case Management to arrange Home O2 (if not already in process)
    c) Place Gen IP DME order for home O2 (or ask ED physician to place of NP cannot order)
7. ***Bamlanivumab (Monoclonal Antibodies):** The ED physician must have already received approval from ID for monoclonal antibodies. Please observe patient for 1 hour after completion

for infusion. There is a very small risk for allergic reaction and anaphylaxis. If patient develops any itching, shortness of breath, nausea/vomiting, facial swelling, hypotension etc. give IM epipen, IV Benadryl, IVF and call the ED physician.

Disposition

1. Discharge: if the patient remains clinically stable

Patients should be considered stable for discharge if meet all ED Criteria determined by ED physician, and have:
1) Respiratory rate <20
and
2) maintain O_2 Sat 92-90% sat on Room Air or stable flow of nasal cannula (NC) O_2, or decreasing amount of NC O_2 not greater than 4l/min (flows above 1L/min should be humidified).

2. Admission:
   a) If patient's clinical presentation deteriorates to the threshold that admission is indicated
   b) If O2 sats drop <90%
   c) If the patient develops tachypnea (RR >20) and/or
   d) If pt develops hypotension and/or significant tachycardia not responsive to antipyretics
   e) Admit if a CTA chest was ordered and is positive for PE or significant pneumonia/sepsis

Bamlanivimab Protocol

From Dr. Chandwani's Email 12/4/2020
We can offer monoclonal antibody infusions of **bamlanivimab** to select covid patients.

1. **How do you identify the right ED patient for this?**

Inclusion Criteria

COVID-19 test positive with symptom onset up to 7 days with mild or moderate COVID-19 disease (essentially high risk patients that don't require admission at this point in time)

Exclusion criteria:

- Patients hospitalized **due to** COVID-19.
- Patients who require oxygen therapy due to COVID-19
- Patients who require an increase in baseline oxygen flow rate due to COVID-19 in those on chronic oxygen therapy due to underlying non-COVID-19 related comorbidity
- Weight < 40 kg

2. **Who benefits the most? (elderly benefits the most)**

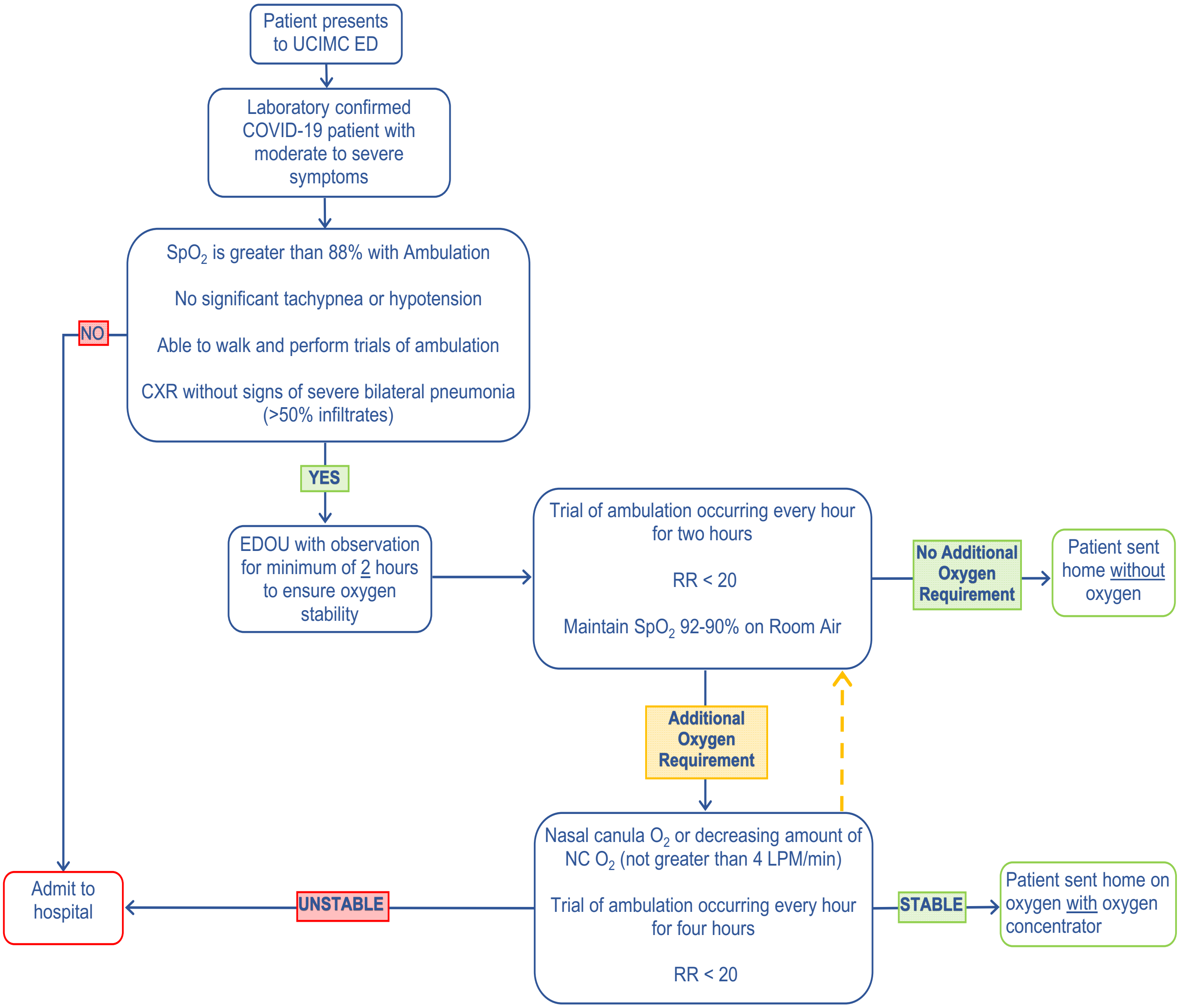
   Priority criteria (if/when supplies are limited, priority to be given to patients with more points)

   - Age ≥80 years (4 points)
   - Age 65-79 years (2 points)

- Age ≥50 years (1 point)
- Solid organ transplant (3 points)
- Body mass index (BMI) ≥35 (2 points)
- Hematologic cancer (2 points)
- Male sex (1 point)
- Ethnicity non-white (1 point)
- Chronic kidney disease (1 point)
- Cirrhosis (1 point)
- COPD (1 point)
- Hypertension (1 point)
- Heart disease (1 point)
- Diabetes (1 point)
- Recent (within 1 year) non-hematologic cancer (1 point)
- Currently receiving immunosuppressive treatment (1 point)
- Pregnancy (1 point)
- Symptoms < 4 days (1 point)

3. **What is the process to order bamlanivimab? (CURRENTLY ONLY AVAILABLE 7a- 7p)**
   a. Identify COVID + patient that is going home who meets one or more of the priority criteria
   b. PAGE Dr. Steven Park (ID) for approval
      i. If you cannot reach Dr. Park, page the ID fellow on call
      ii. Approval is subject to supply/risk/severity of illness – it will be **VARIABLE**
   c. Review the patient fact sheet (ATTACHED).
      i. You must click the box in epic order that says you have reviewed this fact sheet with patient
      ii. The sheet should be accessible via the epic order, but if not there will be paper copies (see attached)
      iii. I will have these printed a stored in ED – location TBD today
   d. Order bamlanivimab infusion (See Epic order set under same name)
      i. Infusion takes 1 hr
      ii. MONITOR for 1 hr after infusion (anaphylaxis very rare, 5% develop itching)
      iii. The epic order set includes prn meds for tylenol, Benadryl, epi, and Zofran
      iv. If any adverse reaction occurs (not just itching), contact via tiger text Helen Lee (these are reportable at this time)
   e. After 1 hour monitoring session, ok to DC home
      i. We are working to ensure all patients can get a covid follow up

COVID Observation Protocol



Appendix J

Nurse Practitioner Anonymous Survey Questions

(1) Were you practicing as a nurse practitioner in the UCIMC ED/EDOU during any part of the period between September 30, 2020, to April 30, 2021?

(2) If you answered yes to question 1, did you play a role in the development of the COVID Observation Protocol? (Yes/No)

(3) If you answered yes to playing a role in the development of the COVID Observation Protocol, could you please describe your role in that process?

(4) Thinking back to before the protocol was launched, what was the state of affairs in the ED/EDOU like right before the protocol was implemented (e.g., patient overcrowding in the ED/EDOU)?

(5) Did the response in question 4 contribute to the statement that "we need a protocol"?

(6) In thinking back to when you first implemented the COVID Observation Protocol, what were some of the facilitators and barriers to implementing it (e.g., lack of evidence-based research to support home oxygen therapy?

(7) It is my understanding that the protocol had to be revised over the course of the surge that began in November 2020 and continued through Spring 2021, possibly to decompress the burden of inpatient admissions. Can you tell me what criteria warranted revision (e.g., oxygen saturation, length of stay in the EDOU)?

(8) What were your thoughts about the criteria changes?

(9) Did the changes noted in question 8 make things better or worse?

(10) When the criteria of the COVID Observation Protocol was modified (e.g., oxygen saturation, length of stay in the EDOU), how concerned were you that you were potentially prematurely discharging patients?

(11) What coping strategies did you utilize to address the stress of caring for patients during a pandemic when, so little was known about SARS-CoV-2?

(12) Is there anything that I did not ask that you would like to share?

Appendix K

Data Calculations

Table 5. Chi-Square Analysis Comparing Inpatient Admissions Pre-and Post-Implementation

ED Arrival Date	Inpatient Hospitalization Yes	No	Total
Before 12/29/2020	883	1068	1951
Row Percentage	45.3	54.7	100.00
After 12/29/2020	976	1122	2098
Row Percentage	46.5	53.5	100.00
Total	1859	2190	4049
	45.9	54.1	100.00

Pearson chi2(1)	=	0.648	Pr =	0.421
Fisher's exact	=			0.430
1-sided Fisher's exact	=			0.220

Table 6. Chi-Square Analysis Comparing 30-day ED Revisitation Pre-and Post-Implementation

ED Arrival Date	30-day ED Revisitation Yes	No	Total
Before 12/29/2020	404	1547	1951
Row Percentage	20.71	79.29	100.00
After 12/29/2020	557	1541	2098
Row Percentage	26.55	73.45	100.00
Total	961	3088	4049
	23.73	76.27	100.00

Pearson chi2(1)	=	19.0589	Pr =	0.000
Fisher's exact	=			0.000
1-sided Fisher's exact	=			0.000

Table 7. Chi-Square Analysis Comparing Discharge with Home Oxygen Pre-and Post-Implementation

ED Arrival Date	Discharge with Home Oxygen Yes	No	Total
Before 12/29/2020	621	1330	1951
Row Percentage	31.83	68.17	100.00
After 12/29/2020	572	1448	2020
Row Percentage	28.32	71.68	100.00
Total	1193	2778	3971
	30.04	69.96	100.00

Pearson chi2(1)	=	5.8276	Pr =	0.016
Fisher's exact	=			0.017
1-sided Fisher's exact	=			0.009

Table 8. Chi-Square Analysis Comparing Discharge with Home Oxygen Post-Implementation

Discharge with Home Oxygen	30-day ED Revisitation Yes	No	Total
Yes	136	514	650
Row Percentage	20.92	79.08	100.00
No	421	1027	1448
Row Percentage	29.07	70.93	100.00
Total	557	1541	2098
	26.55	73.45	100.00

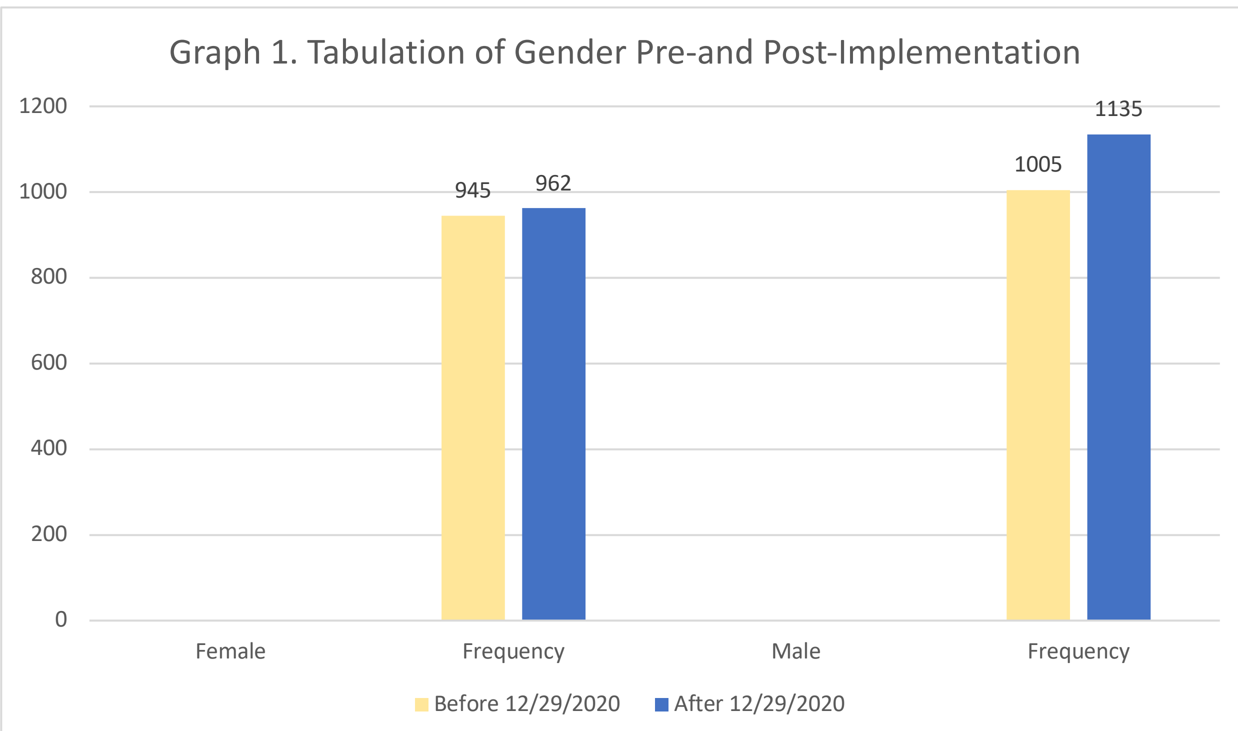
Pearson chi2(1)	=	15.2864	Pr =	0.000
Fisher's exact	=			0.000
1-sided Fisher's exact	=			0.000

Appendix L

Frequency of Gender Pre-and Post-Implementation

Table 1. Tabulation of Gender Pre-and Post-Implementation

Gender	Before 12/29/2020	After 12/29/2020	Total
Female			
Frequency	945	962	1907
Percentage	45.85	48.44	47.10
Male			
Frequency	1005	1135	2140
Percentage	54.10	51.51	52.85

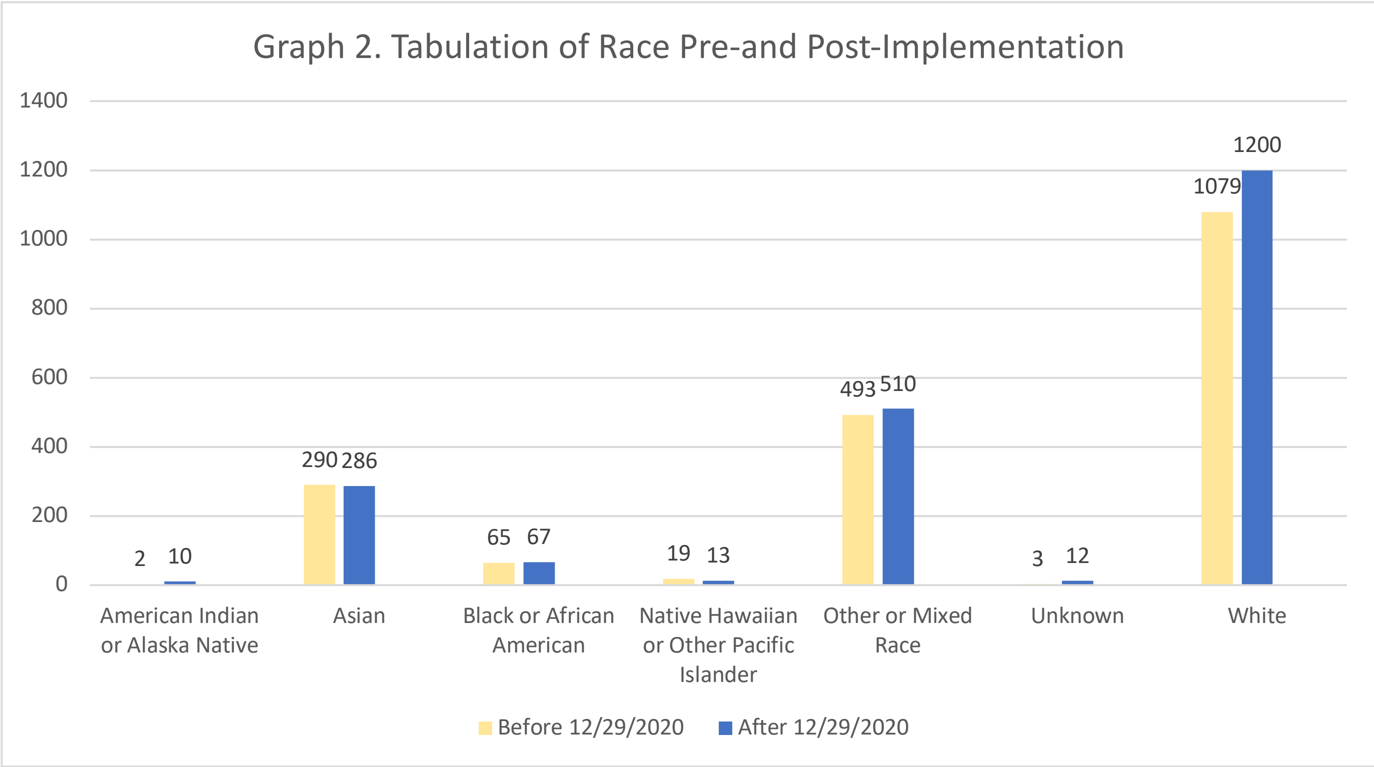


Appendix M

Frequency of Race Pre-and Post-Implementation

Table 2. Tabulation of Race Pre-and Post-Implementation

Race	Before 12/29/2020	After 12/29/2020	Total
American Indian or Alaska Native			
Frequency	2	10	12
Percentage	0.10	0.48	0.30
Asian			
Frequency	290	286	576
Percentage	14.86	13.63	14.23
Black or African American			
Frequency	65	67	132
Percentage	3.33	3.19	3.26
Native Hawaiian or Other Pacific Islander			
Frequency	19	13	32
Percentage	0.97	0.62	0.79
Other or Mixed Race			
Frequency	493	510	1003
Percentage	25.27	24.31	24.77
Unknown			
Frequency	3	12	15
Percentage	0.15	0.57	0.37
White			
Frequency	1079	1200	2279
Percentage	55.30	57.20	56.29

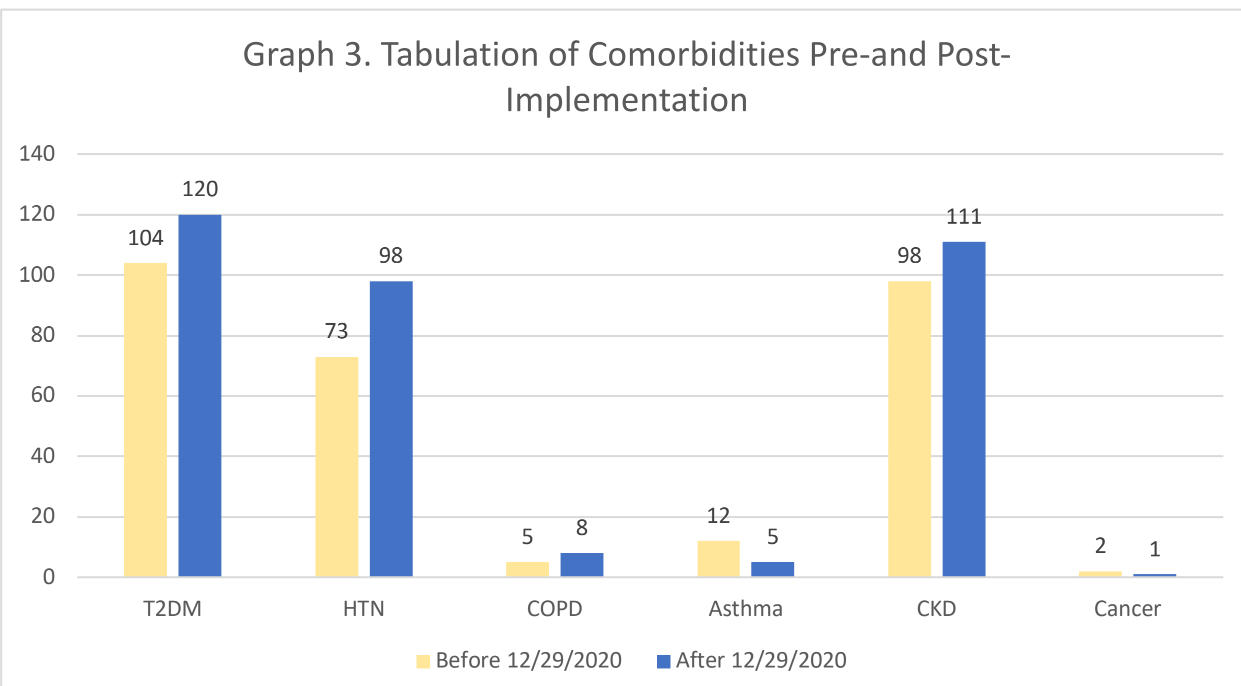

Graph 2. Tabulation of Race Pre-and Post-Implementation
1400
1200
1000
800
600
400
200
0
2
10
290
286
65
67
19
13
493
510
3
12
1079
1200
American Indian or Alaska Native
Asian
Black or African American
Native Hawaiian or Other Pacific Islander
Other or Mixed Race
Unknown
White
Before 12/29/2020
After 12/29/2020

Appendix N

Frequency of Comorbidities Pre-and Post-Implementation

Table 3. Tabulation of Comorbidities Pre-and Post-Implementation

Comorbidity	Before 12/29/2020	After 12/29/2020	Total
Type 2 Diabetes			
Frequency	104	120	224
Percentage	5.33	5.72	5.53
Hypertension			
Frequency	73	98	171
Percentage	3.74	4.67	4.22
COPD			
Frequency	5	8	13
Percentage	0.26	0.38	0.32
Asthma			
Frequency	12	5	17
Percentage	0.62	0.24	0.42
Chronic Kidney Disease			
Frequency	98	111	209
Percentage	5.02	5.29	5.16
Cancer			
Frequency	2	1	3
Percentage	0.10	0.05	0.07

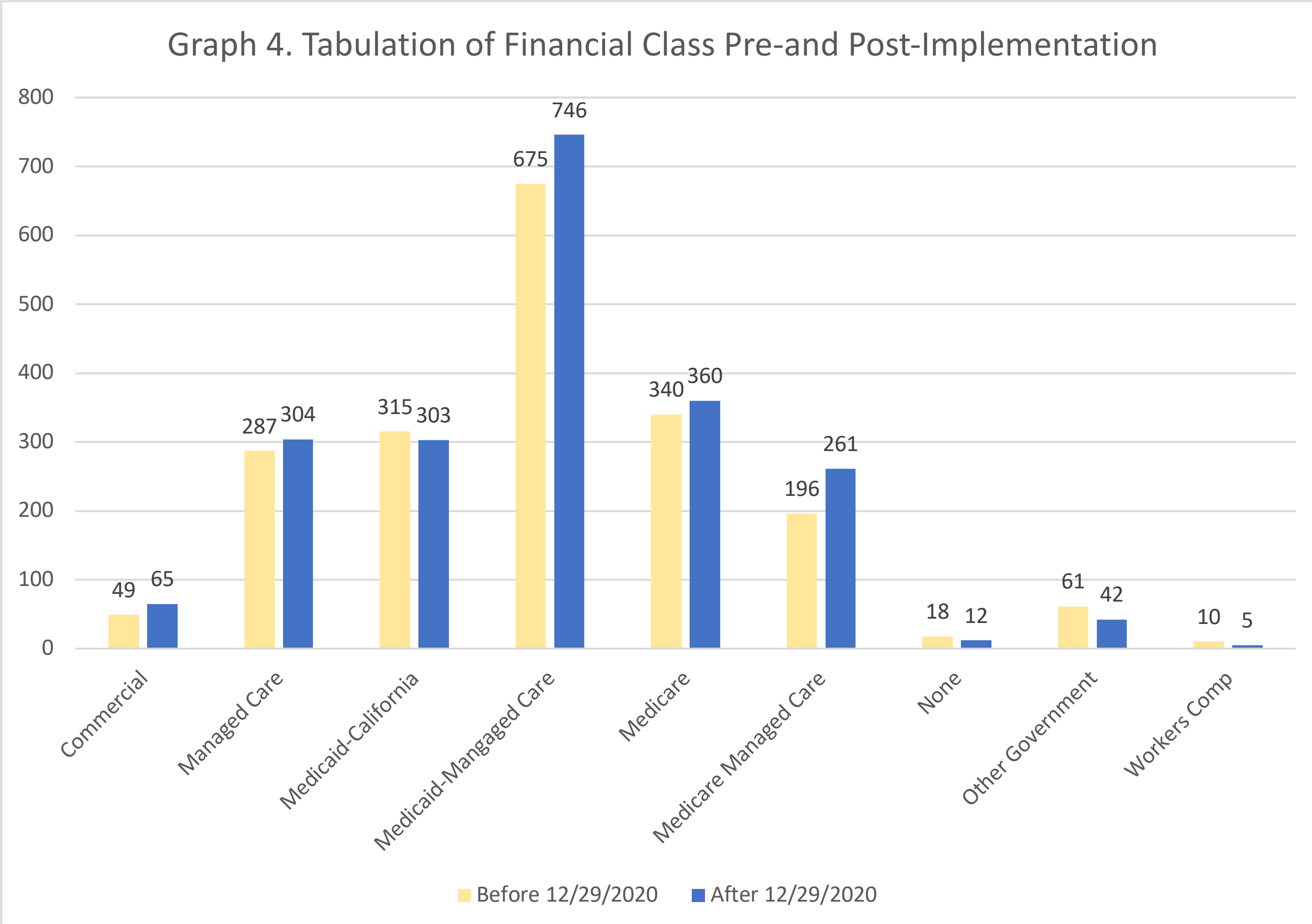


Appendix O

Frequency of Financial Class Pre-and Post-Implementation

Table 4. Tabulation of Financial Class Pre-and Post-Implementation

Financial Class	Before 12/29/2020	After 12/29/2020	Total
Commercial			
Frequency	49	65	114
Percentage	2.51	3.10	2.82
Managed Care			
Frequency	287	304	591
Percentage	14.71	14.49	14.60
Medicaid-California			
Frequency	315	303	618
Percentage	16.15	14.44	15.26
Medicaid-Managed Care			
Frequency	675	746	1421
Percentage	34.60	35.56	35.10
Medicare			
Frequency	340	360	700
Percentage	17.43	17.16	17.29
Medicare Managed Care			
Frequency	196	261	457
Percentage	10.05	12.44	11.29
None			
Frequency	18	12	30
Percentage	0.92	0.57	0.74
Other Government			
Frequency	61	42	103
Percentage	3.13	2.00	2.54
Workers Compensation			
Frequency	10	5	15
Percentage	0.51	0.24	0.37


Graph 4. Tabulation of Financial Class Pre-and Post-Implementation
800
700
600
500
400
300
200
100
0
49
65
287
304
315
303
675
746
340
360
196
261
18
12
61
42
10
5
Commercial
Managed Care
Medicaid-California
Medicaid-Mangaged Care
Medicare
Medicare Managed Care
None
Other Government
Workers Comp
Before 12/29/2020
After 12/29/2020