Distribution Statement

Distribution A: Public Release.

EXAMINATION OF SYNDROMIC SURVEILLANCE DATA AS A TRIGGER FOR ANALTERNATE CARE FACILITY IN AN EPIDEMIC/PANDEMIC

Bryan Hersch

Melanie Owes

Uniformed Services University

Daniel K. Inouye Graduate School of Nursing

Copyright Acknowledgement Statement

The author(s) hereby certify that the use of any original work by another author or copyrighted material used in the DNP project entitled: Examination of syndromic surveillance data as a trigger for an alternate care facility in an epidemic/pandemic is either appropriately cited within the manuscript or used with formal written permission of copyright release by the owner of the original work.

[redacted]

Bryan Hersch, MBA, BSN, RN, Maj., USAF
Family Nurse Practitioner Program
Daniel K. Inouye Graduate School of Nursing
Uniformed Services University
30 April 2021

[redacted]

Melanie Owes, BSN, RN, MAJ USA
Family Nurse Practitioner Program
Daniel K. Inouye Graduate School of Nursing
Uniformed Services University
30 April 2021

Author Acknowledgements

The success and outcome of this project required a lot of guidance and assistance from many people, and we are incredibly fortunate to have this level of support while completing this project. All that we have accomplished is due to the dedicated supervision and assistance, and we could not forget to say thank you.

Dr. Heather L. Johnson, DNP, FNP-BC, Senior Mentor, for giving us support and guidance in developing the project design, goals and advancing our draft into a finished project.

CDR Robert Kimberling, DNP, FNP-C, NMCCL Phase 2 Site Director, for compelling us to select a challenging topic, navigating our way as student practitioners, and accelerating through the learning curve of working in a joint environment in the middle of a pandemic.

Ms. Polly S. DeMonch, NMCCL Health Systems Specialist, for assistance with data mining and analyzing healthcare business metrics, and understanding the language or reimbursement.

Ms. Ashley R. Adams, NMCCL Clinical Protocol Developer, for assistance with statistical analysis and answering endless questions about the style and finesse of clinical investigations.

Table of Contents

Abstract

Background: The COVID19 pandemic exposed gaps in understanding of pandemic surveillance for novel respiratory syndromes. It also created opportunities to re-evaluate scalable patient care platforms. Pandemic exercises rarely incorporate planning for sustained operations during prolonged periods of increased demand.

Purpose: The purpose of this project was to evaluate syndromic surveillance data at the local and state level to identify an evidence-based moving epidemic threshold for operating an advanced practice provider-led alternate care facility.

Project Design: Syndromic surveillance metrics from MTF, local, state, and federal sources, along with billing and coding data for influenza, Group A streptococcus, and COVID-19 trends, were assessed for two three-month periods of *retrospective data*. A gap analysis of the data from ESSENCE and staff collected data identified areas for improvement in syndromic surveillance data collection.

Analysis of Results: A multiple regression analysis of the 7-day moving average at the onset of the pandemic (15 Mar to 15 Jun 20) of COVID19 testing results indicate a moderately strong relationship between the State of North Carolina and Naval Medical Center Camp Lejeune ($p<0.001$, $\beta\beta=0.399$(95%CI: 0.292, 0.505), $R2=0.358$). There is a weak but consistent relationship in the COVID incidence in the state of North Carolina and NMCCL ($p<0.024$, $\beta\beta=0.718$(95%CI: 0.096, 1.340), $R2=0.080$). There was a 976% increase in patient visits to the alternate care facility from the onset of the pandemic to the winter flu season. Additionally, a visit at the Acute Respiratory created significant savings in direct care costs ($205) when compared to the EmergencyDepartment ($533) and Family Medicine ($404).

Organizational Impact: Syndromic surveillance systems and command data identified similar trends in viral activity. Utilizing readily available data reduces redundancy in the collection, analysis, and reporting of trends. This DNP project identified syndromic surveillance trends for defined risk threshold. It established a blueprint for implementing an alternate care facility to improve safety, planning, and standardize patient care during pandemic outbreaks.

Keywords: syndromic surveillance, Advance practice provider led clinic, COVID

Preface

The Camp Lejeune student group developed a DNP Project topic separate and unique from the one undertaken. In March 2020, COVID19 was declared a national emergency in the United States. The team would have been unable to complete the original project as the medical treatment facility was unable to support the implementation of the original project in the COVID19 environment. The need to address the needs of patients in the COVID19 environment created opportunities for innovation and development of a new project upon arrival at Camp Lejeune.

Examination of Syndromic Surveillance Data as a Trigger for an Alternate Care Facility in an Epidemic/Pandemic

The novel COVID19 pandemic was declared a pandemic in the United States on 10 Mar 2020. Although influenza outbreaks worldwide are unusual, seasonal epidemics of influenza are not unique, as they typically peak in the winter and dissipate in the summer months (Edlund et al., 2009). Influenza undergoes molecular mutation, resulting in partial susceptibility to new viral variants (Edlund et al., 2009). Surveillance of influenza-like illnesses is essential to combat the transmission and burden of the disease. Historically, most influenza epidemics begin in rural, central China and rapidly spread worldwide via supply and transportation routes (Saunders-Hastings & Krewski, 2016). In December 2019, Chinese public health officials reported an outbreak of influenza-like illnesses (ILI) and subsequent pneumonia in Wuhan, Hubei Province. Less than six weeks later, this illness had spread to 21 countries and amassed 9976 cases (Holshue et al., 2020). By March of 2021, there were 1.27 million cases of COVID 19 in 219 countries with 2.7 million COVID-related deaths (World Health Organization, 2021). The pathogen was identified as SARS-CoV2 and rapidly became a global pandemic. In March 2020, the Department of Defense issued guidance instructing local commanders to adjust operations based on local activity. As a result of the pandemic, most military treatment facilities stopped all elective procedures, drastically reduced routine appointments, and limited ancillary services, essentially resulting in emergency medical care only (Department of Defense, 2020).

The Command Group at Naval Medical Center Camp Lejeune established an alternate care facility as a forward arm of the Department of Family Medicine to mitigate the risk of exposure of emergency department personnel and address the walk-in respiratory needs of beneficiaries Camp Lejeune. The Acute Respiratory Clinic (ARC) was open daily and primarily staffed by Nurse Practitioners and Physician Assistants to provide access to care for patients with respiratory symptoms who know or suspect they have been exposed to COVID 19. Any patient with respiratory symptoms (including symptoms of cough, congestion, shortness of breath, rhinorrhea, and sore throat) or symptoms that were concerning for COVID 19 respiratory symptoms, gastrointestinal distress, headache, fever was screened out of appointments in family medicine or pediatrics and redirected to the ARC for evaluation. The ARC at Camp Lejeune differs from COVID clinics at other MTFs as other locations primarily offer to screen for COVID. In contrast, the ARC offers complete medical evaluations, screening, and treatment, similar to what would be offered in an urgent care clinic. Although this Advanced Practice Provider (APP) led clinic has been critical in maintaining access to care for beneficiaries, there has been no analysis of the evidence to determine implementation thresholds specific to this Command. This DNP project was inspired by the need to analyze current utilization trends in the Camp Lejeune geographic area to maintain or create access to care during an unprecedented global pandemic of influenza-like illness. Current pandemic planning exercises rarely included contingencies for sustained operations and preservation of timely access to care during extended periods of increased demand. The military health system is uniquely tasked with ensuring active duty service members' medical readiness while meeting the healthcare needs of beneficiaries. The project team assessed existing public health surveillance and prediction tools and expanded ambulatory care initiatives needs at Naval Medical Center Camp Lejeune.

Significance of the Problem

Responding to a public health crisis is a process that involves coordination, preparation, and resource management. Through accurate forecasting, public health stakeholders can make informed decisions affecting those within the community they serve. However, preparing for and responding to a respiratory pandemic relies on accurate, timely, and reliable forecasting data (Biggerstaff et al., 2018). The COVID-19 pandemic has shown difficulty in developing and distributing critical resources as viral illness spreads among the population quickly through exposure to respiratory droplets (Centers for Disease Control, 2020). Forecasting provides a method for predicting epidemic characteristics vital for informing stakeholders on many levels, including public health officials and commanders, in when to take action appropriately and when to scale staffing requirements to accommodate increased healthcare demand. Crisis response can deplete resources, leading to shortfalls in therapeutics in the form of antivirals, assets such as ventilators, hospital inventory, and staff management (Biggerstaff et al., 2017). When hospitals, emergency departments, and clinics are overwhelmed by an influenza pandemic, syndromic surveillance provides a predictive means to signal stakeholders to activate emergency operations plans and manipulate resources to maintain access to care (Collins et al., 2006).

This project evaluated triggers for implementing an acute respiratory clinic to augment family medicine and emergency department operations in the interest of appropriate resource allocation. Surveillance metrics were used as evidence for informing stakeholders to adjust and respond appropriately. The methods and resources for establishing a non-traditional evaluation, testing, and treatment site in managing a disease outbreak were further evaluated in this project. The objective of this DNP project was to use syndromic surveillance data as an identifier for defined risk threshold and establish a blueprint for implementing an acute care respiratory clinic to improve safety planning, minimize exposure risk, protect staff and standardize patient care during disease outbreaks. COVID-19 transmission occurs through human to human contact and has been associated with relatively high morbidity and mortality rate (Burke et al., 2020). Primary care services play an essential role in treating and controlling the spread of these diseases within the local population, but increases the risk for direct contact with emerging diseases, yet direct contact between healthcare providers and the patients under their care is a significant risk factor for infection (Collins et al., 2006). A secondary outcome of this project was analysis of the feasibility and cost-effectiveness of an advanced-practice-led clinic in response to the pandemic.

In response to the emerging infectious disease outbreak of COVID-19 influenza, the Command directed opening an Advanced Practice Provider (APP)-led alternate care facility to limit unnecessary hospital staff and patient viral exposure within the Camp Lejeune Naval Hospital area of operations. A preliminary literature search suggested that alternate care facilities increase surge operations capacity. The Acute Respiratory Clinic (ARC) provided an alternative to home or telemedicine care for respiratory patients with COVID 19-like illness (CLI) symptoms. It sequestered them away from non-respiratory patients and staff. This type of service targeted walk-in patient's respiratory complaints but excluded patients requiring emergent respiratory interventions (Cinti et al., 2008).

Contribution to the Military Health System

The DNP project contributed to the military health system as a high-reliability organization by advancing the clinical practice guidelines for establishing and maintaining an ARC during a disease outbreak (Tomizuka, Kanatani & Kawahara, 2013). Syndromic surveillance systems, such as the Electronic Surveillance System for the Early Notification of Community Based Epidemics (ESSENCE) or U.S. Outpatient ILI Surveillance Network (ILINet), which report ILI, have been used widely as an indicator of influenza activity during non-pandemic epidemics. ILI reporting by sentinel general practice/family doctor (GPFD) clinics form the backbone of surveillance systems for influenza in many countries (Tomizuka et al., 2013). When performed in real-time during an epidemic, modeling provided insight to forecast when epidemic activity could peak and, in general, was a valuable tool in reducing the number and rate of hospitalizations. Such measures justify providing a stand-up acute respiratory clinic to minimize the risk of spreading the influenza virus to patients treated for other medical conditions (Edlund et al., 2011).

This project reduced costs and limited risk by maintaining emergency and family practice services to keep medical services open to patient care with little startup costs. The project supported medical readiness by preventing healthy patients from coming in contact with others reporting with flu-like illnesses or suspected COVID-19, which is essential for protecting service members from completing the mission. This DNP project demonstrated the importance of providing alternative care options to manage patient ILI concerns when resources, staffing, and care services are limited.

Relevance to Military Nursing

As a global force, a pandemic outbreak of respiratory illness threatened the health of service members and dependents worldwide. Public health surveillance or collection, analysis, and interpretation of data to advise leadership to become a critical function of military nurses. Military nurses function at the tip of the spear, collecting more syndromic data than is often reported through official public health surveillance methods such as chronic disease, sentinel, and syndromic surveillance. Through clinic dashboards and resource management data, military nurses are in a unique position to influence the MTF pandemic operations plan. Determinants of military nursing collection of influenza-like illness data is supported by command interest in real-time data updates that may not be available due to unavoidable lag.

Authorization of commanders to scale pandemic response based on local conditions has resulted in various pandemic response plans to mitigate a predicted surge. Military nurses are at every MTF planning level, preparing for influenza-like illness-mediated increases in visits. Developing a viable pandemic response not only requires a quality review of the evidence but a fair amount of abstraction of surge projections (Rhodes et al., 2020). Implementing a new process can be challenging in any setting. However, military nurses have a unique opportunity to participate in how the military treatment facility responds. Military nurses with experience in leadership, medical and military decision-making act quickly to detect changes in various operational settings across the MTF resulting in early warning critical in mitigating risk to the staff and managing community outbreaks.

U.S. military advanced practice registered nurses (APRN) and physician assistants (PA) are classified as advanced practice providers (APPs). They have been recognized as a solution to improve the balance of increasing demand for healthcare and decreasing supply of physicians (Newhouse et al., 2011). Inclusion and utilization of advanced practice providers to the full extent of their respective scopes of practice are critical in delivering healthcare to DoD beneficiaries. APPs have an opportunity to practice in all settings across the MTF as they are qualified and credentialed to assess, diagnose and implement treatments to impact positive patient outcomes. Staffing an alternate care facility with advanced practice providers is an innovative and cost-effective approach to the pandemic concept of operations during a respiratory pandemic. Expanded ambulatory and outpatient care capabilities provide a redistribution of access to care to manage patients that require minimal intervention (Lam et al., 2006).

Systems Question

How does syndromic surveillance (trends or modeling), compared with real-time COVID surveillance data and modeling, identify a moving epidemic threshold for an advanced practice provider-led alternate care facility at Camp Lejeune, NC?

Literature Review of Solutions

A detailed review of the literature was performed using the PowER digital catalog of Uniformed Services University. The electronic databases of the cumulative index of allied health literature (CINAHL), PubMed, and Embase were searched using two separate search strings to truncate the focus of the central themes in this evidence-based initiative. The strings included accuracy of syndromic surveillance/ESSENCE and influenza and advanced practice provider-led clinics. The searches were limited to full-text journal articles published in academic journals in English language, 2008 to present to limit the volume of records. The decision to include articles greater than five years of age was made to include a more robust literature review of the last major respiratory illness of H1N1 influenza.

The syndromic surveillance string included a manual and Boolean search that used the terms "syndromic surveillance," "influenza," and "electronic surveillance system for the early notification of community-based epidemics or essence," using various combinations yielding 525 records after applying common limitations. After the elimination of duplicates, 278 records were imported to COVIDENCE for screening. Approximately 268 articles were deemed irrelevant to the question after a review of abstracts. Ten articles were identified for full-text review, and five articles were excluded for wrong setting, study design, or intervention. The five remaining studies were included for evaluation (see Appendix A, Figure A1).

The Advanced Practice provider-led clinic string included a manual and Boolean search that used the terms "nurse practitioner," "physician assistant," "advanced practice provider," "nurse-managed," "nurse-led," "same day," "walk-in," "urgent care," "professional role," professional delegation and boundary" using various combinations yielding 277 records after applying common limitations. After the elimination of duplicates, 198 records were imported to COVIDENCE for screening. Approximately 175 articles were deemed irrelevant to the question after a review of abstracts. Twenty-three articles were identified for full-text review, and 12 were excluded for wrong setting, design, or comparator. The remaining 11 studies were included for evaluation (see Appendix A, Figure A2).

All 16 articles identified for review were evaluated using the Johns Hopkins Nursing Evidence-based Practice rating scale (Newhouse et al., 2005). The articles were graded based on strength (Level I-V, strong to weak) and quality (A-C, high to low). The articles consisted of various methodologies, including two systematic reviews and one meta-analysis (evidence/quality I A), four retrospective and prospective time analysis (evidence /quality VA), one cost analysis (evidence/quality VA), one case-control design (evidence/quality VB), five descriptive surveys (evidence/quality VB), one integrative review (evidence/quality VB) and one mixed methodology analysis (evidence/quality VB).

Synthesis of Solutions

In five studies, researchers support the utility in regular use of syndromic surveillance data to describe outbreaks in the local community (Chan et al., 2011; Gault et al., 2009; Lucero et al., 2011). These epidemiologic systems provide more sensitive detection and subsequent classification of viral outbreaks and other disease severity in a defined geographic location. The actual syndromic surveillance methodology and specific data points become more valuable when viewed as a collective. When aggregated and analyzed, the data demonstrate a peak up to four weeks before an elevation is detected in hospitalizations, personnel data, or billing data viewed separately (Chan et al., 2011; Lucero et al., 2011; Savage et al., 2012).

In four of the higher quality articles, researchers suggest the care provided by advanced practice providers and physicians is similar with no variance in perceived difference in care quality. Patients also reported higher satisfaction rates when care incorporates advanced practice providers (Carranza, Munoz & Nash, 2020; Desborough, Forrest &Parker, 2011; Swan et al., 2015). Methodologic heterogeneity among the studies prevents professional organizations from making sweeping recommendations. However, the care provided by advanced practice providers are safe and reliable in terms of clinical outcomes (Dols et al., 2018, Heale & Pilon, 2012; Barkauskas et al., 2011).

Evidence supports opening an alternate care facility to mitigate community outbreaks when the rate of disease progression outpaces existing appointment availability. Using syndromic surveillance to detect outbreaks in conjunction with APP-led clinics expands access to care and achieves better outcomes for beneficiaries (Brooks & Fulton, 2020; Desborough, Parker & Forrest, 2013; van den Wijngaard et al., 2010). When a patient considers the need for medical evaluation to be urgent, they will seek care at available and convenient locations (Desborough, Parker & Forrest, 2013). Scheduled appointments are not timely, and long wait times in emergency departments do not manage patient expectations. The alternate care facility provides a flexible patient-centered alternative when access to care is highly influenced by social pressure (Sturgeon, 2017).

Organizing Framework

The Camp Lejeune team used the Public Health Promotion Capacity (hereafter referred to as "Capacity") as a framework to employ public health emergency response capacity as a trigger to implement APP clinic resources. Pandemic influenza preparedness is an ongoing process and is the type of modeling most aligned with COVID-19 and respiratory pandemic response. Identifying a means for improving surge capacity provides stakeholders and public health officials a way to prioritize infectious disease response. The critical concept in capacity is to act as a fundamental guide for a specified location to set up functional components of a health response system that is tailored to local requirements. On a local level, emergency management systems may lack the infrastructure or the flexibility to respond efficiently during emergencies. The Capacity framework provided a guideline for less experienced stakeholders to assess current requirements, allocate assets, and efficiently budget allotted funding.

Assessing the emergency response capabilities begins with observations of the broader system. On level 1, the clinical practice guideline provided a framework for stakeholder responsibility to implement and design system requirements, monitoring and evaluating the data, coordinating throughput, and other related capacities at the systems level (Hu, Rao & Sun, 2005). At the organizational level 2, mission requirements described the strategies for implementing the process. This project described the roles, services, and communities served at the broader system level 1 and evaluated the method for measuring stakeholder mission success. The ability for organizations to change relies both on human resources and financial assets. Change depends on the efficient and effective use of resources by developing the Capacity to transform current processes for the best mission outcome. At the core, level 3 acted as a guide to prepare and train individuals. The DNP Project team outlined aspects for assessing individual Capacity, including job requirements for those working within the APP led clinic, training and retraining requirement, career progression, accessing information, performance and security, values and attitudes, teamwork interdependencies, redeployment, and professionalism (Hu, Rao & Sun, 2005). (See Appendix B, Figure B1).

Project Design

Evaluation and promotion of necessary health services are essential during a public health crisis (Allutis et al., 2014). The ARC at NMCCL was implemented to address the access-to-care issue and reduce risk to staff and patients who reported to the hospital for routine health care services. As this was a novel approach in a military treatment facility (MTF), it was essential to address the threshold for implementing future alternate care facilities and the cost-effectiveness of the endeavor. This project evaluated a process improvement implemented during the COVID19 pandemic.

The projected threshold for opening and closing the alternate care facility at Naval Medical Center Camp Lejeune was evaluated by examining syndromic surveillance metrics in influenza, Group A streptococcus, and COVID19 data from two periods of de-identified aggregate data at the early stages of the pandemic (15 Mar to 15 Jun 2020) and during historic influenza/respiratory illness months (15 Oct 2020 to 15 Jan 2021). Data collected by staff and the ESSENCE (electronic surveillance system for the early notification of community-based epidemics) syndromic surveillance system was compared to billing & coding data and state-wide surveillance trends. Clinic effectiveness of the ARC was evaluated using visit and billing trends compared to NMCCL and other local resources (see Appendix B, Figure B2).

Setting

The project setting was Naval Medical Center Camp Lejeune, North Carolina. The medical center provides inpatient and outpatient care and is the only DoD Level III Trauma Center in the Defense Health Agency enterprise. The facility serves 150,000 active duty service members, dependents, and retirees. One COVID-19 testing site on Camp Lejeune served the military troops, families, and outlining communities, and one testing site-specific for active duty COVID-19 testing only. Before implementing the ARC, care for patients with respiratory illness was provided in the Family Medicine Clinic or Emergency department, depending on the severity of symptoms. The ARC was designated to operate in space previously designated as the sleep clinic inside NH 200, an outlying building 250 yards in front of the main hospital at NMCCL. The space was unoccupied at the time of the pandemic. Initially, two APPs from family medicine were assigned as the designated provider staff due to family medicine physician graduate medical education commitments. Support staff (Registered Nurses and Corpsmen) were assigned from various locations within the hospital command. The Family Medicine clinic sustained the biggest impact on staffing and operations with the loss of two full-time providers and four Corpsmen. Other areas of the hospital continued operations with minimal interruption to daily operations.

Procedural Steps

In accordance with the project design, the following procedural steps were followed for completion of data collection and analysis:

Project Question

DNP project question developed by project team upon arrival at NMCCL.

Literature Review

A detailed literature review was completed at NMCCL following project question approval by USU faculty.

Proposal Approval

Project proposal for Phase 2 site at NMCCL submitted and approved by USU, approval number GSN61-11818 (Appendix C).

Project Plan

Upon arrival at Phase 2 site, the project team developed the project plan.

Institutional Review Board (IRB) Determination

The project team submitted the project proposal to the Naval Medical Center Camp Lejeune Institutional Review Board and was deemed a Performance Improvement Project and not in need of IRB oversight. (Appendix D).

Focus Areas

1. **Examine syndromic surveillance data to predict opening of an alternate care facility.**

Syndromic surveillance is the continuous monitoring and dissemination of real-time health data to identify potential public health outbreaks. The data from ESSENCE and the NMCCL Military Health System were used to determine the comparative tools for predicting the timing and spread of infectious disease. Establishing a method for predicting disease incidence could provide valuable information when interventions to limit infectious diseases are to be implemented. The predictor would justify setting up the acute respiratory clinic (ARC) and implementing protective measures for an appropriate response.

2. **Evaluate implementation of an Advanced Practice Provider-led Acute Respiratory Clinic.**

Alternative care facilities provided a high benefit by addressing clinical care safety needs and best patient care outcomes. The ARC managed patients with risk of exposure or complications from respiratory illness, including the surveillance, screening, and diagnosis, and treatment of respiratory infections. Primary care services continued in the hospital while minimizing the risk of spreading infection in clinical practice. The ARC guidelines and protocols were based on best practices from the evidence in the literature and the essential planning elements for infection control procedures, patient movement, and strategies for maintaining reliable and efficient patient care access.

3. Perform a program evaluation.

A review of the selected data and regression modeling compared to current surveillance data with the antecedent influenza prediction aided in scaling the command response. Analysis of ARC utilization data described utilization, cost, and quality of care delivered to drive continued access. A comprehensive evaluation of the ARC at mid flu season provided objective data to recommend the Command to continue operations based on patient access to care, decreased morbidity, sustained staffing, and cost-effectiveness for optimal patient outcomes.

General Approach

This DNP project used a mixed-method design involving retrospective data reviews, cost-benefit and statistical analysis. The authors identified the top International Classification of Disease (ICD-10) codes assigned by providers in the acute respiratory clinic from March 15 through June 15, 2020 and October 15, 2020 through January 15, 2021. Then data for all locations in the geographic Command area was retrieved from the Military Health System, encompassing inpatient and outpatient electronic medical records. The next step was to identify the epidemiologic curves for the number of cases diagnosed with Group A Streptococcus, influenza A/B and SARS Coronavirus 19. In addition to diagnostic data, the reimbursement rates for the same ICD 10 codes were retrieved and graphed to show trends in overall cost to the hospital command stakeholders. The trends in diagnosis were analyzed using multiple regression of the 7-day moving averages to warrant making "walk-in" respiratory evaluation separate from the emergency department available to NMCCL beneficiaries. Reimbursement data was compared to direct care costs to evaluate potential savings for the command.

The looming arrival of viral infection coupled with Health Protection Condition elevation, "Do Not Travel" orders, and suspension of elective procedures all influenced the opening of the Acute Respiratory Clinic on March 17, 2020 (Department of Defense, 2020). A variety of different types of screening facilities and options were implemented at facilities across the Department of Defense, making enterprise-wide analysis of financial benefit a challenge. Tricare covered out-of-network evaluation of COVID-like illnesses in local facilities. However, conversations with leaders at NMCCL revealed concerns about the sensitivity and specificity of the COVID-19 test being offered in Onslow county. Additionally, visits with a provider were reimbursed at a different rate based on skill type and location. When evaluating reimbursement costs by MEPRS code, overhead costs (facility, utilities, diagnostics/pharmacy) were included in the cost per visit estimation. Civilian network providers who participate in Tricare insurance agree to accept flat-rate reimbursement, independent of the actual cost to provide the service. A complete financial analysis of all COVID-like illness visits was beyond the scope not included as a part of this project.

Mitigating Potential Barriers to Implementation

Patient non-compliance with redirection or sequestration to ARC

For various reasons (including, but not limited to, education, health literacy, economic status, personal belief or relationship with Primary Care Manager), patients may resist redirection to the acute respiratory clinic. This issue was addressed by implementing a controlled access plan with entry screening according to CDC recommended surveillance measures for the MTF and the ARC.

Patients afraid to seek care because of exposure risk

Public Affairs was engaged for a targeted digital media campaign (social media, television & inclusion in local public health announcements) that provided details on the new access plan, appointment processes, and safety procedures. A COVID hotline was established for patients to call with direct questions.

High risk of ARC staff infection due to repeat exposure

Iterative training with proper live demonstrations of donning and doffing of PPE was conducted for staff. Additionally, strict screening and sanitation protocols were implemented to optimize the early detection of concerning symptoms. A screening questionnaire was initiated as the patient arrived by car for COVID-like symptoms, including fever, cough, loss of taste or smell, and length of time symptoms began.

Risk of missed diagnosis due to limited services within ARC and overreliance on patient-reported history

The ARC planning team coordinated access plans for patients to access radiology and pharmacy, in addition to urgent/immediate referral procedures to the emergency department for ARC patients who exhibited high acuity or concerning symptoms. Initial vital signs were completed with a temperature check, heart rate, blood pressure, and SpO^2 level. For patients whose vital signs or symptoms were out of normal range, or if the patient was symptomatic for heart issues, arrangements were established to quickly sequester and transfer the patient to a higher level of care.

Potential to overwhelm ARC capacity

Provider scheduling was optimized so that more providers were available during peak flow times. An on-call personnel roster was developed and maintained for sustained high-capacity operations in unexpected patient surges.

Sustainment and Dissemination Plan

Opening an alternate care facility required an updated command instruction, subordinate unit guidance, and clinic standard operating procedure for influenza-like illness pandemic response and the alternate care facility (ARC). Personnel were identified for quick reaction staffing and logistics needs. Hospital instructions, train-the-trainer educational products, and ARC internal standard operating procedures were developed and published. A published command instruction provided a measurable and objective intervention when the threat of pandemic illness was identified. The ancillary support response (pharmacy, radiology, logistics) was scaled according to the patient's presenting symptoms. This plan was used as an operational model for demographically similar facilities in the civilian and military healthcare sectors to provide continued care and decrease military health expenditures. Ultimately this project will increase readiness, improve access to care, and sustain efficiency in hospital operations.

HIPAA Concerns

This project used data generated through public health open data sources and de-identified aggregate data. No individually identifiable patient data was collected or used during this project. No data about reportable information or events occurred within the scope of the EBP project. This project utilized previously approved technological means to communicate information that is readily available through published public health data and data generated through ICD-10 codes that did not identify a patient's personal information.

Project Results

The DNP project team analyzed data from the ESSENCE portal, aggregated data from NMCCL for respiratory illnesses, ARC data on clinic utilization and access to care, ICD-10 coded data and TRICARE reimbursement information. This data was reviewed and evaluated to provide recommendations for monitoring pandemic data and optimal timing to open and down-regulate the ARC. In addition, a post hoc analysis of clinic performance was completed to update the Command on the effectiveness and efficiency of resources used for this process improvement.

ESSENCE

The team requested assistance from the NMCCL public health team with obtaining access to the ESSENCE portal. After reviewing the data and comparing influenza, Group A Streptococcus, and COVID-19 positive cases from ESSENCE from 15 March-15 June 2020 to positives collected by the ARC champion team and positives from the command data, there were significant lab report incongruencies in the ESSENCE-generated data. Days with one or more known positives of COVID 19, influenza, and Group A strep tests at the ARC and command laboratory were reported as negatives, in ESSENCE, thus creating artificially low positives and rates of testing.

Respiratory Illness Rate

The DNP project team analyzed data for COVID 19, influenza A/B and Group A streptococcus aggregated in the NMCCL command laboratory data files from the ARC and primary hospital clinics and inpatient wards. From 15 Mar to 15 Jun 2020, there were 1269

COVID 19 tests with 44 positives (3.5%), 1019 influenza tests with 257 (25%) positives, and 592 Group A Streptococcus Rapid Tests with 203(34%) positives from the primary hospital clinics analyzed at the NMCCL central laboratory (see Appendix E, Figure E1). From 15 Oct 2020 to 15 Jan 2021, there were 2538 COVID 19 tests with 344 positives, 391 influenza tests with 43 positives, and 534 Group A Streptococcus Rapid Tests 144 positives from primary hospital clinics analyzed at the NMCCL central laboratory (see Appendix E, Figure E2)

At the beginning of the pandemic, supplies were limited, such as COVID screening tests, which was also confirmed at NMCCL. The DNP project team was aware that this might have resulted in lower COVID-19 screenings and a higher number of screenings for influenza.

Utilization and Access to Care

The Military Health System Management and Analysis Reporting Tool (M2) was searched for the number of daily visits in the ARC, Emergency Department, and Family Medicine clinics (blue, red, white & gold) for 15 Mar to 15 Jun 20 and 15 Oct 20-15 Jan 21. The overall number of visits for the Emergency Department and Family Medicine clinics decreased from the previous year's data for the Oct 15 -15 January time frame, without a concomitant reduction in the number of MTF beneficiaries. The number of face-to-face family medicine clinic visits was reduced by 50%. In-house office appointments were reduced, and maximum use of telehealth capabilities was encouraged.

Although the ARC opened as a part of the MTF Commander's pandemic response plan on March 17, 2020, a MEPRS (medical expense performance reporting system) code was not assigned until April 6, 2020, making tracking encounter data difficult. Encounters that occurred before adopting the new MEPRS code were populated according to the clinic the clinician was previously assigned to from across the Command. From April 6 -15 June 2020, 1413 patients were evaluated in the Acute Respiratory Clinic. From 15 Oct 20-15 Jan 2021, the Acute Respiratory Clinic accrued 11,927 total encounters, the Emergency Department accrued 7,672 total encounters, and Family Medicine accrued 19,687 total encounters. Refer to Appendix E, Table E1 for outpatient visits in the ARC, Family Medicine, and Emergency Department.

COVID-like Illness Costs

The North Carolina Disease Event Tracking and Epidemiologic Collection Tool *(NC DETECT)* is the state-wide syndromic surveillance system designed to identify public health events using secondary data sources (NC HHS, n.d.). The system funnels ICD-10 codes into diagnosis silos to assist state and local authorities in identifying patterns in patient exposure, behaviors, or clinical symptoms. In optimizing a syndromic surveillance grouping for respiratory illness as closely as possible, the ICD-10 criteria were reviewed from *NC DETECT* dashboard (NC HHS, n.d.) and used to search the Military Health System. The cost per encounter for the acute respiratory clinic was calculated using the average from the identified ICD-10 codes (J02.0 Strep pharyngitis; J06.9 acute respiratory infection; J09.X1 influenza due to identified novel influenza A virus with pneumonia; J09.X2 influenza due to identified novel influenza A virus with other respiratory manifestations; J09.X3 influenza due to identified novel influenza A virus with gastrointestinal manifestations; J09.X9 Influenza due to identified novel influenza A virus with other manifestations; Z11.59 encounter for screening for other viral diseases; Z03.818 encounter for observation for suspected exposure to other biological agents; Z20.828 contact with and (suspected) exposure to other viral communicable diseases; R05 cough; B34.9 viral infection, unspecified, and U071 2019-nCoV acute respiratory disease) to produce a similar output to what is expected from ESSENCE (ICD10 Data, n.d.). These ICD-10 codes encompass the most common respiratory illnesses and viral infections associated with acute respiratory illness encounters (see Appendix E, Table E1). There is an increase in the reimbursement data that reflects reimbursement and testing increases implemented by the Centers for Medicare and Medicaid Services effective 14 Apr 2020 (Center for Medicare and Medicaid Services, 2020).

Data Analysis

The team requested assistance from the NMCCL Clinical Investigations team for the final statistical analysis of the data. SPSS® 25.0 (IBM Corp) was used for the analysis. The proportion of North Carolina COVID 19 tests was calculated using the number of tests reported from the NC HHS dashboard divided by the 2019 population (10.5 million). The proportion of NMCCL COVID 19 tests was calculated using the number of tests reported from the command lab data report divided by the number of enrolled beneficiaries (56,000). To adjust for the 7-day cyclical nature of each timed series in the two identified periods (15 Mar to 15 Jun 20 and 15 Oct 20 to 15 Jan 21), the moving 7-day average was calculated adding the date to a regression analysis allowed comparison between the State of North Carolina and NMCCL rates adjusted for time trends.

A multiple regression analysis was performed for each period after calculating the 7-day moving average (7-dma). The test rates and positive rates of NMCCL was the assigned dependent variable, and the date and 7-dma for North Carolina (including test rates and positive rates) were assigned independent variables. Data falling within the regression were included in a stepwise fashion, entering the model if they were significant with $p<0.05$ and leaving the model if $p \geq 0.10$. Using the 7-day moving averages and adding the date to the regression model allowed the analysis to compare the rate of testing and COVID diagnosis between North Carolina and Naval Medical Center Camp Lejeune, while adjusting for potential trends due to time.

Relationship Between NMCCL and North Carolina COVID Rates

In the initial onset of the pandemic (15 March-15 June 2020), there was a moderately strong relationship between the rate of testing for COVID of North Carolina and NMCCL ($p<0.001$, $\beta\beta$=0.399(95%CI: 0.292,0.505), R2=0.358) (see Appendix E, Figure E3). However, as the community and state-wide concerns and testing for COVID increased, the relationship dissipated during the winter "flu season" (see Appendix E, Figure E4) This progressively divergent relationship could be attributed to several factors, but the lack of identifiable information in both data sets makes for a difficult hypothesis.

For all time periods analyzed by this project, there is a weak but consistent relationship in the COVID incidence in the state of North Carolina and NMCCL (Appendix E, Figures E5 and Figure E6). This analysis suggests that the Command could use current data from the state for ongoing, rapid assessment to enact pandemic plans when local data is unavailable or unclear.

In analyzing patient contacts from the early pandemic to the winter flu season, there was a 976% increase in patient contacts at the ARC. Specifically, there were 1413 contacts from 15 March to 15 Jun 2020 and 11,927 contacts from 15 Oct- 15 Jan 2021. With the most contacts occurring on Monday (see Appendix E, Figure E7).

Cost Per Encounter Estimates

The team performed a cost per encounter comparative analysis, which included the data source encounter ICD-10 codes previously discussed. The average direct care cost (cost to the facility) for a COVID-like illness (CLI) in the ARC averaged half the cost of a visit for the same diagnosis in the Emergency Department or Family Medicine. Such cost differences represented a significant saving to the Command.

When the ARC first opened in the time period from 15 Mar-15 Jun 2020, there were 953 out of 1,413 total patient ARC encounters (67%) identified with the ICD 10 codes in the syndromic surveillance aggregation. The Tricare reimbursement estimates, which included the identified diagnostic codes, was $40, with a direct care cost per encounter in the MTF of $193. During the second data collection between 15 Oct 20 -15 Jan 21, 8700 of the 11,927 patient encounters (73%) were identified in the syndromic surveillance aggregation with a Tricare reimbursement rate of $38 per encounter (see Appendix E, Table E2).

Data from the Emergency Department and Family Medicine was similarly reviewed to correlate cost difference effects over time. From 15 Oct 20- 15 Jan 21, 6% of Emergency Department encounters met syndromic surveillance aggregation parameters, whereas the previous year the encounters reflected upwards of 13% of the same encounter types. Tricare reimbursement costs averaged $168 in 15 Oct-15 Jan in fiscal years (FY) 2018 and 2019, but then increased to $277 in the same, most recent time period. This cost represented an increase of 39% from FY18 to FY20 (See Appendix E, Table E1).

The Family Medicine reimbursements experienced modest cost changes, where Tricare reimbursement decreased from an average of $84 in FY18 and FY19 to $76 in FY20. Consequently, there was a cost increase in direct patient care average costs per encounter from $313 to $404 US from FY 18 and FY19 to FY20. However, 3% of patients seen in Family Medicine had ICD-10 diagnoses in the respiratory surveillance aggregate in FY18 and FY19. Patients in the respiratory surveillance aggregate decreased to 1% of patient visits in Oct 2020. (See Appendix E, Table E1).

The team performed an inventory of costs for opening the ARC from 15 Oct 2020 to 15 Jan 2021 by comparing the number of encounters with the identified diagnostic codes with the direct care costs per patient evaluated at the Emergency Room and Family Medicine. The Emergency Department experienced 434 encounters with a direct care cost per encounter of

$533, for a total direct care cost of $231,322. Family Medicine had 110 patients with a direct care cost per encounter of $404, for a total direct care cost of $44,440. The ARC had 8,700 encounters with a direct care cost of $205, for a total direct care cost of $1,783,500. When considering the patients would have been seen in the absence of the ARC at either the Emergency Department, Family Medicine, the cost savings potential may be difficult to determine. However, the cost per encounter at the ARC was approximately half the direct care cost at either the Emergency Room or Family Medicine visit when seen for the same diagnostic codes (See Appendix E, Table E2).

Organizational Impact/Implications for Practice and Policy

Findings of this project reinforce the need for military treatment facilities participating in DHA and state-level syndromic surveillance reporting to maximize early identification and warning of emerging illnesses in the community. There was a problem with data collation and mining from ESSENCE and inconsistency in coding to influence healthcare business analysis. However, syndromic surveillance from the local and state data reflects disease trends consistent with NMCCL. It is sufficient for local commanders to take specific action in force protection measures and ARC implementation.

ESSENCE

During data analysis, the project team discovered gaps in the accuracy of NMCCL syndromic surveillance data in ESSENCE. A mismatch in the numbers of positive cases for COVID 19, along with multiple days of unreported numbers from laboratory data, made the ESSENCE system less reliable for short-term prediction and review. Additional ESSENCE programming support would increase simplicity in data mining and analysis.

Inconsistencies in Clinical Coding for COVID-19

When reviewing the ICD-10 codes, there was evidence of coding inconsistencies, which made data aggregation according to ICD-10 codes from M2 difficult. Healthcare providers were responsible for identifying specific symptoms for diagnosing and assigning ICD-10 diagnostic codes for each patient encounter. There were subtle variations between providers and clinics in ICD 10 code assignments, creating a challenge for surveillance systems to track illness. For example, a provider should use Z11.52 for an encounter for screening for COVID-19 (Moore, 2020). In practice, providers used different codes such as Z11.59 screening for viral disease and Z13 need for screening for other diseases (Moore, 2020; ICD10 Data, n.d.). Such issues are common and not unique to NMCCL. The efficiency of tracking protocols relies on effectively identifying the most pertinent codes for effective surveillance. Education and follow-up on accurate coding is vital if ICD-10 data will be used for pandemic surveillance.

Pandemic Planning

It is critical for military leaders and treatment facilities to prepare for staffing and operations well in advance of a pandemic/epidemic outbreak. Issues arise when stakeholders fail to plan for pandemic events, and Emergency Departments become "a safety net for the safety net" after primary care systems fail (Patel, Phillips, Pearce, Kljakovic, Dugdale & Glasgow, 2008). When facilities and resources to manage disaster events are undersupplied and understaffed, overcrowding in Emergency Departments suggests that there is likely insufficient surge capacity to manage the demand that would develop early in an influenza pandemic (Collins et al., 2006).

An alternate care facility streamlined care delivery and provided the Command with a centralized location to conduct surveillance, monitor staff health, and funnel resources. The remaining outpatient clinics remained open by opening the ARC, preserving existing access to care while limiting exposure to the pathogen. Safety protocols and training were effective, as there were zero diagnoses of COVID19 among the staff assigned to the Acute Respiratory Clinic from its inception through 1 Apr 2021. Within NMCCL, the ability to consolidate the laboratory data and track electronically generated medical diagnostic codes with timeliness during an ILI pandemic was streamlined by establishing localized control with centralized dissemination.

"Integrated planning" is a process that involves communication between ancillary services at all levels, including the Emergency Department, for patients requiring higher-level care, screening guidance for patients needing lab work-up, as well as radiology services. Communication outside the local hospital is a process that enables public health services to monitor the spread of illness. Therefore, staff requires continued training for continuity of care, screening guidance, and maintaining infection control measures.

Recommendations

1. In the absence of a definitive local analysis, it may be feasible to use state-level data as an indicator of local disease burden as it trends similarly to NMCCL.
2. After calculating the 7-day moving averages in the identified observation period, the first peak in a syndromic surveillance diagnostic group is a target point to activate a pandemic/epidemic response plan; an alternate care facility should be considered. This suggestion is consistent with existing literature that evaluates syndromic surveillance systems.
3. Financial impact should not be the sole determinant in deciding to open an alternate care facility. A comprehensive program assessment with the historical analysis of direct care costs, community diagnostic rates and public health implications should be performed before value-based care can be determined.

4. An alternate care facility aligns with the principles of the MHS Quadruple Aim, creating better access to efficient, quality care while sustaining readiness at NMCCL.

Future Directions and Sustainability

Future evidence-based projects may be used to identify best practices in coding to increase providers' reimbursement and optimize data collection. Syndromic surveillance relies on rapidly detecting disease within a community. Healthcare providers act as first-line defense by looking for patterns of symptoms when making a diagnosis. Providers who take an active part in reporting key parameters in coding and detecting illness trends preemptively enable the enactment of early warning systems to protect frontline workers and address patient safety. Healthcare data linked to syndromic surveillance measures to track disease in a population plays an essential role in detecting illness patterns and guides the implementation of initiatives to augment the spread and containment of disease.

Reporting Data

The collection and collation of ICD-10 codes and disease tracking may not fall under one particular Command section, or state/local authority, or other surveillance centers. Leadership within the Command, public health authorities, and governmental entities with oversight of collecting and reporting data need centralized direction. Representatives from each Command section need to agree to the streamlining of data collection processes and provide effective informatics systems to populate the data and distribute the data where it can be analyzed for future reference. In the military, areas of responsibility may fall on a local region, such as the case of Camp Lejeune in Onslow County. The data collected at Camp Lejeune must be robust and sufficient to detect illness, be stored in a system that is accessible electronically, and remain available to leadership for future opportunities to source trends in the data.

Evaluation of clinic level performance compared with utilization at the hospital and active-duty screening site could determine best practices for staffing ratios and clinic locations and type of screening required to implement resources for detecting outbreaks of illness. At the onset of the COVID-19 pandemic, the Emergency Department and Acute Respiratory Clinic were the only two areas on Camp Lejeune open at total capacity for patient healthcare access. Collating ICD-10 codes with patient chief complaints in the triage process was instrumental in obtaining real-time data collection. Billing codes also act as early indicators to monitor for cases that appear to be similar. The classification of data in the form of ICD-10 codes and as clusters of disease symptoms demonstrated the importance of developing data groups specifically for implementing syndromic surveillance measures.

Patients who are offered the option to seek care at the ARC otherwise would not have received timely care for chronic medical conditions or provided delayed access or continued access and continuity of care. Redistribution of staff to cover an alternate care facility should be from Family Medicine, Emergency Medicine, Pediatrics, and Internal Medicine staff. To continue timely care, the expediency in which data reporting and collection occurred was directly impacted by surveillance detection measures. The DNP Project team utilized data sourced from the ARC, data acquired from the NMCCL laboratory testing center, and administratively through ICD-10 codes to evaluate how each process provided the most pertinent surveillance information. The fourth option for ILI surveillance would include data generated from CHCS, where pharmaceutical medications are ordered and distributed to patients who exhibited ILI symptoms. These medications include antiviral medications such as oseltamivir and symptomatic care medications like acetaminophen, ibuprofen or pseudoephedrine or. However, we recognized that using the CHCS system as a data collection point had limitations due to tracking issues, healthcare provider ordering preferences, and medications that may also be prescribed similarly for illness other than ILI symptoms. Consequently, our team focused ILI data collection on three areas of interest from the lab, ARC, and ICD-10 codes generated from each patient encounter.

Forecasting does not directly predict future disease burden. However, forecasting does facilitate accurate Command and public health decisions and acquisition of resources as a part of a pandemic response plan. Using available ILI models with the diagnostic data as a historical data set or control to assess CLI predictor models' predictive value and development could benefit strategic planners.

The next iteration of this project should include review of protected health data to evaluate further the patient population being served. Generating data on age-specific results will impact the MTF's justification of staffing authorizations, facility funding, and capital improvement.

Limitations

The limitations in this project include the team's ability to data-mine using ESSENCE and reliance on the clinic and laboratory staff that conducted daily data collection to aggregate data for resource management not related to syndromic surveillance. The scope of the data analysis was adjusted to fit the academic timeline of the project team. Additionally, future analysis should include all testing and results from the NMCCL Laboratory to make a broader statement about the incident of infection at the Command. This project did not include facilities under administrative control by the United States Marine Corps.

Conclusion

The American Association of Nurse Practitioners and the American Association of Physician Assistants promote statutory autonomy among providers, and there is a dedicated body of literature to support APP-led clinics. However, not many programs include healthcare business or principles of public health in their curriculums. Through leadership experience gained as military officers, the team understands and applies basic health care operations and business practices. However, specific provider education about the ways that coding, reimbursement, staffing, and resources are tied together need to be discussed as a part of the clinic orientation process and continuing education. The health of the population dramatically depends on their access to quality healthcare. Providing an alternate care facility during a global pandemic created forward access as a viable option for continued access to quality healthcare. The acute respiratory clinic offers beneficiaries the ability to be evaluated for specific conditions related to disease outbreaks and stabilize the in-house hospital clinic workload.

References

Aluttis, C., van den Broucke, S., Chiotan, C., Costongs, C., Michelsen, K., & Brand, H. (2014). Public health and health promotion capacity at national and regional level: A review of conceptual frameworks. *Journal of Public Health Research,3*(1). https://doi.org/10.4081/jphr.2014.199

Barkauskas, V.H., Pohl, J.M., Tanner, C., Onifade, T.J.M., & Pilon, B. (2011). Quality of care in nurse-managed health centers. *Nursing Administration Quarterly*, *35*(1), 34-43. https://doi.org/10.1097/NAQ.0b013e3182032165

Biggerstaff, M., Johansson, M., Alper, D., Brooks, L.C., Chakraborty, P., Farrow, D.C., Hyun, S., Kandula, S., Mcgowan, C., Ramakrishnan, N., Rosenfeld, R., Shaman, J., Tibshirani, R., Vespignani, A., Yang, W., Ahang, Q., & Reed, C. (2018). Results from the second year of a collaborative effort to forecast influenza seasons in the United States. *Epidemics,24*, 26-33. https://doi.org/10.1016/j.epidem.2018.02.003

Brooks, P.B., & Fulton, M.E. (2020). Driving high-functioning clinical teams: An advanced practice registered nurse and PA optimization initiative. *Journal of th American Academy of Physician Assistants*, *33*(6), 1-12. https://doi.org/10.1097/01.JAA.0000662400.04961.45

Burke, R. M., Killerby, M. E., Newton, S., Ashworth, C. E., Berns, A. L., Brennan, S., Bressler, J. M., Bye, E., Crawford, R., Harduar Morano, L., Lewis, N. M., Markus, T. M., Read, J. S., Rissman, T., Taylor, J., Tate, J. E., Midgley, C. M., & Case Investigation Form Working Group (2020). Symptom profiles of a convenience sample of patients with COVID-19 - United States, January-April 2020. *MMWR:Morbidity and Mortality Weekly Report*, *69*(28), 904–908. https://doi.org/10.15585/mmwr.mm6928a2

Carranza, A.N., Munoz, P.J., & Nash, A.J. (2020). Comparing quality of care in medical specialties between nurse practitioners and physicians. *Journal of the American Association of Nurse Practitioners*,*33*(3), 184-193. https://doi.org/10.1097/jxx.0000000000000394

Centers for Disease Control and Prevention. (2020, October 5). *Science Brief: SARS CoV2 and Potential Airborne Transmission.* https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/scientific-brief-sars-cov-2.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fmore%2Fscientific-brief-sars-cov-2.html

Chan, E.H., Tamblyn, R., Charland, K.M., & Buckeridge, D.L. (2011). Outpatient physician billing data for age and setting specific syndromic surveillance of influenza-like illnesses. *Journal of Biomedical Informatics*,*44*(2), 221-228. https://doi.org/10.1016/j.jbi.2010.10.001

Cinti, S.K., Wilkerson, W., Holmes, J.G., Shlafer, J., Kim, C., Collins, C., Bandy, K., Krupansky, F., Lozon, M., Bradin, S.A., Wright, C., Goldberg, J., Wagner, D., Rodgers, P., Atas, J., Cadwallender, B. (2008). Pandemic influenza and acute care centers: Taking care of sick patients in a non-hospital setting. *Biosecurity and Bioterrorism*, *6*(4), 335-344.https://doi.org/10.1089/bsp.2008.0030

Collins, N., Litt, J., Moore, M., Winzenberg, T., & Shaw, K. (2006). General practice: Professional preparation for a pandemic. *Medical Journal of Australia*,*185*, (S10). https://doi.org/10.5694/j.1326-5377.2006.tb00711.x

Desborough, J., Forrest, L., & Parker, R. (2011). Nurse-led primary healthcare walk-in centres: An integrative literature review. *Journal of Advanced Nursing,68*(2), 248-263. https://doi.org/10.1111/j.1365-2648.2011.05798.x

Desborough, J., Parker, R., & Forrest, L. (2013). Development and implementation of a nurse-led walk-in centre: Evidence lost in translation? *Journal of Health Services Research & Policy, 18*(3), 174-178. https://doi.org/10.1177/1355819613488574

Dols, J.D., Beckman-Mendez, D., DiLeo, H.A., Weis, K.L. & Medina-Calvo, M. (2018). Nurse managed health centers: Measures of excellence. *The Journal for Nurse Practitioners, 14*(8), 613-619. https://doi.org/10.1016/j.nurpra.2018.06.008

Donovan, M.P. (2020, February 25). *Force health protection (Supplement 2)- Department of Defense guidance for military installation commanders' risk-based measured responses to the Novel Coronavirus outbreak* [Memorandum]. Department of Defense. https://media.defense.gov/2020/Feb/26/2002255006/-1/-1/1/FORCE-HEALTH-PROTECTION-SUPPLEMENT-2.PDF

Edlund, S., Kaufman, J., Lessler, J., Douglas, J., Bromberg, M., Kaufman, Z., Bassal, R., Chodick, G., Marom, R., Shalev, V., Mesika, Y., Ram, R. & Leventhal, A. (2011). Comparing three basic models for seasonal influenza. *Epidemics*, *3*, 135-142. https://doi.org/10.1016/j.epidem.2011.04.002

Gault, G., Larrieu, S., Durand, C., Josseran, L., Jouves, B., Filleul, L. (2009). Performance of a syndromic system for influenza based on the activity of general practitioners. *Journal of Public Health*, 31(2), 286–292. https://doi.org/10.1093/pubmed/fdp020

Hargraves, J. & Frost, A. (2018). Trends in primary care visits. *Healthcare Cost Institute*. https://healthcostinstitute.org/hcci-research/trends-in-primary-care-visits

Heale, R., & Pilon, R. (2012). An exploration of patient satisfaction in a nurse practitioner–led clinic. *Nursing Leadership,25*(3), 43-55. https://doi.org/10.12927/cjnl.2012.23056

Holshue, M.L., DeBolt, C., Lindquist, S., Lofy, K.H., Wiesman, J., Bruce, H., Spitters, C., Ericson, K., Wilkerson, S., Tural, A., Diaz, G., Cohn, A., Fox, L., Patel, A., Gerber, S.., Kim, L., Tong, S., Lu, X., Lindstrom, S., Pallansch, M.A., Weldon, W.C., Biggs, H.M., Uyeki, T.M., & Pillai, S.K. (2020). First Case of 2019 Novel Coronavirus in the United States. *The New England Journal of Medicine*, *382*(10), 929–936. https://doi.org/10.1056/NEJMoa2001191

Ho, V., Metcalfe, L., Dark, C., Vu, L., Weber, E., Shelton, G. & Underwood, H. (2017). Comparing utilization and costs of care in freestanding emergency departments, hospital emergency departments and urgent care centers. *Annals of Emergency Medicine*, *70*(6), 846-857. https://doi.org/10.1016/j.annemergmed.2016.12.006

Hu, G., Rao, K., & Sun, Z. (2005). A preliminary framework to measure public health emergency response capacity. *Journal of Public Health,14*(1), 43-47. https://doi.org/10.1007/s10389-005-0008-2

ICD-10 Data. (n.d.). *Encounter for screening for other diseases and disorders z13*. https://www.icd10data.com/ICD10CM/Codes/Z00-Z99/Z00-Z13/Z13-

Lam, C., Waldhorn, R., Toner, E., Inglesby, T.V. & O'Toole, T. (2006). The prospect of using alternative medical care facilities in an influenza pandemic. *Biosecurity and Bioterrorism*, *4*(4), 384-390. https://doi.org/10.1089/bsp.2006.4.384

Lucero, C.A., Oda, G., Cox, K., Maldonado, F., Lombardo, J., Wojcik, R., & Holodniy, M. (2011). Enhanced health event detection and influenza surveillance using a joint Veterans

Affairs and Department of Defense biosurveillance application. *BMC Medical Informatics and Decision Making,11*(1). https://doi.org/10.1186/1472-6947-11-56

Mandl, K.D., Overhage, J.M., Wagner, M.M., Lober, W.B., Sebastiani, P., Mostashari, F.U., Pavlin, J.A., Gesteland, P.H., Treadwell, T.U., Koski, E.U., Hutwagner, L.U., Buckeridge, D.L., Aller, R.D., & Grannis, S.U. (2004). Implementing syndromic surveillance: A practical guide informed by the early experience. *Journal of the American Medical Informatics Association,11*(2), 141-150. https://doi.org/10.1197/jamia.m1356

Moore, K. (2020, December 21). *COVID19: New ICD-10 codes for the new year.* AAFP Getting Paid. https://www.aafp.org/journals/fpm/blogs/gettingpaid/entry/2021_covid_codes.html

North Carolina Department of Health and Human Services. (n.d.) *NC DETECT Home*. https://ncdetect.org/

North Carolina Department of Health and Human Services. (2020, August 4). https://covid19.ncdhhs.gov/dashboard/testing

Patel, M.S., Phillips, C.B., Pearce, C., Kljakovic, M., Dugdale, P. & Glasgow, N. (2008). General practice and pandemic influenza planning and comparison of plans in five countries. *PLOSOne, 3*(5), e2269. https://doi.org/10.1371/journal.pone.0002269.

Reich, N.G., Brooks, L.C., Fox, S.J., Kandula, S., McGowan, C.J., Moore, E., Osthus, D., Ray, E.L., Tushar, A., Yamana, T.K., Biggerstaff, M., Johansson, Rosenfeld, R. & Shaman, J. (2019). A collaborative multiyear, multimodel assessment of seasonal influenza forecasting in the United States. *Proceedings of the National Academy of Sciences of the United States of America*, *119*(8), 3146-3154. https://doi.org/10.1073/pnas.1812594116

Saunders-Hastings, P.R., & Krewski, D. (2016). Reviewing the history of pandemic influenza: Understanding patterns of emergence and transmission. *Pathogens*, 5(4), 66. https://doi.org/10.3390/pathogens5040066

Savage, R., Chu, A., Rosella, L.C., Crowcroft, N.S., Varia, M., Policarpio, M.E., Vinson, N., Winter, A., Davies, R., Gemmill, I., Willison, D. & Johnson, I. (2011). Perceived usefulness of syndromic surveillance in Ontario during the H1N1 pandemic. *Journal of Public Health,34*(2), 195-202. https://doi.org/10.1093/pubmed/fdr088

Sofer, D. (2018). AMA resolution opposes independent practice by APRNs. *American Journal of Nursing,118*(3),12. https://doi.org/10.1097/01.naj.0000530922.33715.46

Sturgeon, D. (2017). Convenience, quality and choice: Patient and service provider perspectives for treating primary care complaints in urgent care settings. *International Emergency Nursing*, *35*, 43-50. https://doi.org/10.1016/j.enj.2017.06.005

Swain, M., Ferguson, S., Chang, A., Larson, E. & Smaldone, A. (2015). Quality of primary care by advanced practice nurses: A systematic review. *International Journal for Quality in Health Care, 27*(5), 396-404. https://doi.org/10.1093/intqhc/mzv054

Tomizuka, T., Kanatani, Y. & Kawahara, K. (2013). Insufficient preparedness of primary care practices for pandemic influenza and the effect of a preparedness plan in Japan: a prefecture wide cross sectional study. *BioMed Central, 14,* 174. https://doi.org/10.1186/1471-2296-14-174.

Tong, S., Amand, C., Kieffer, A. & Kyaw, M.H. (2018). Trends in healthcare utilization and costs associated with pneumonia in the United States during 2008–2014. BMC Health Services Research, 18, 715. https://doi.org/10.1186/s12913-018-3529-4 van den Wijngaard, C. C., Asten, L. V., Pelt, W. V., Doornbos, G., Nagelkerke, N. J., Donker, G. A., Hoek, W., Koopmans, M. P. (2010). Syndromic surveillance for local outbreaks of lower-respiratory infections: Would it work? *PLoS ONE,5*(4). https://doi.org/10.1371/journal.pone.0010406

World Health Organization. (2021, March 29). WHO Coronavirus (COVID19) Dashboard. https://covid19.who.int/

Appendix A: PRISMA

Figure A1

Syndromic Surveillance

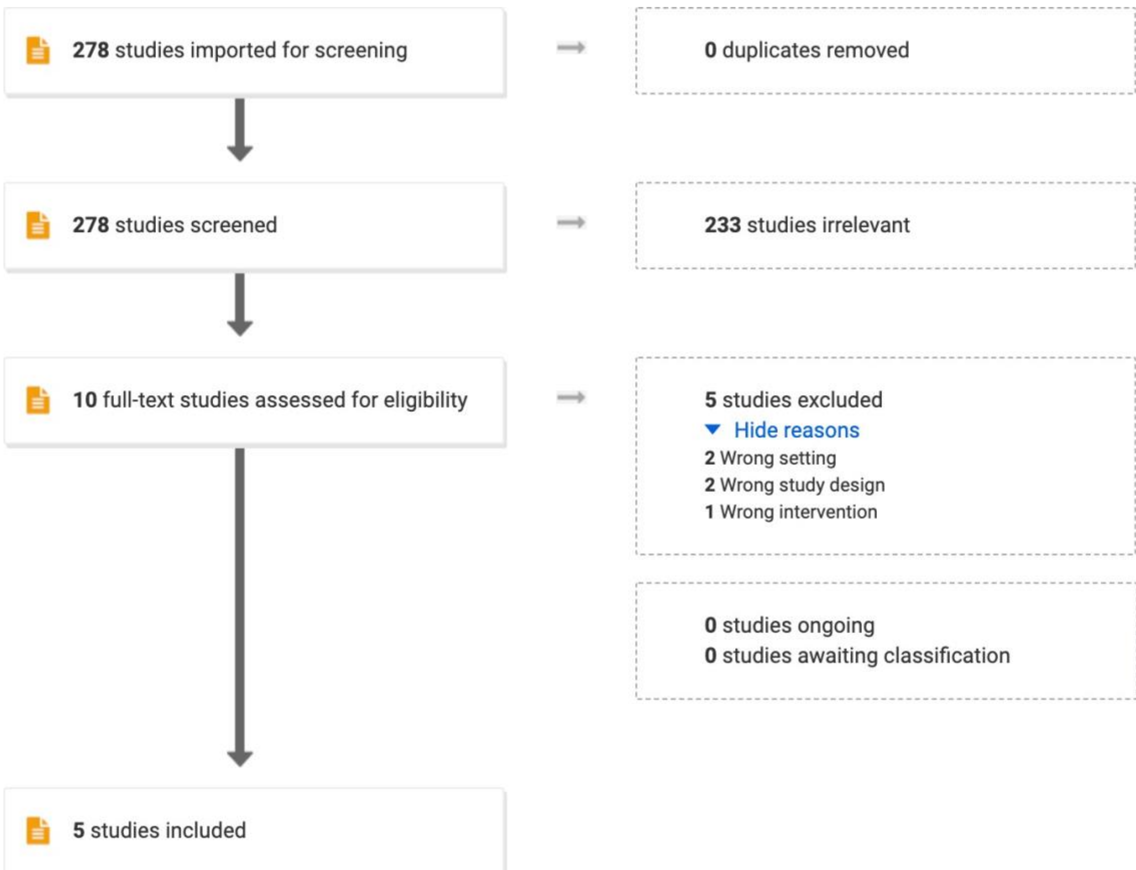
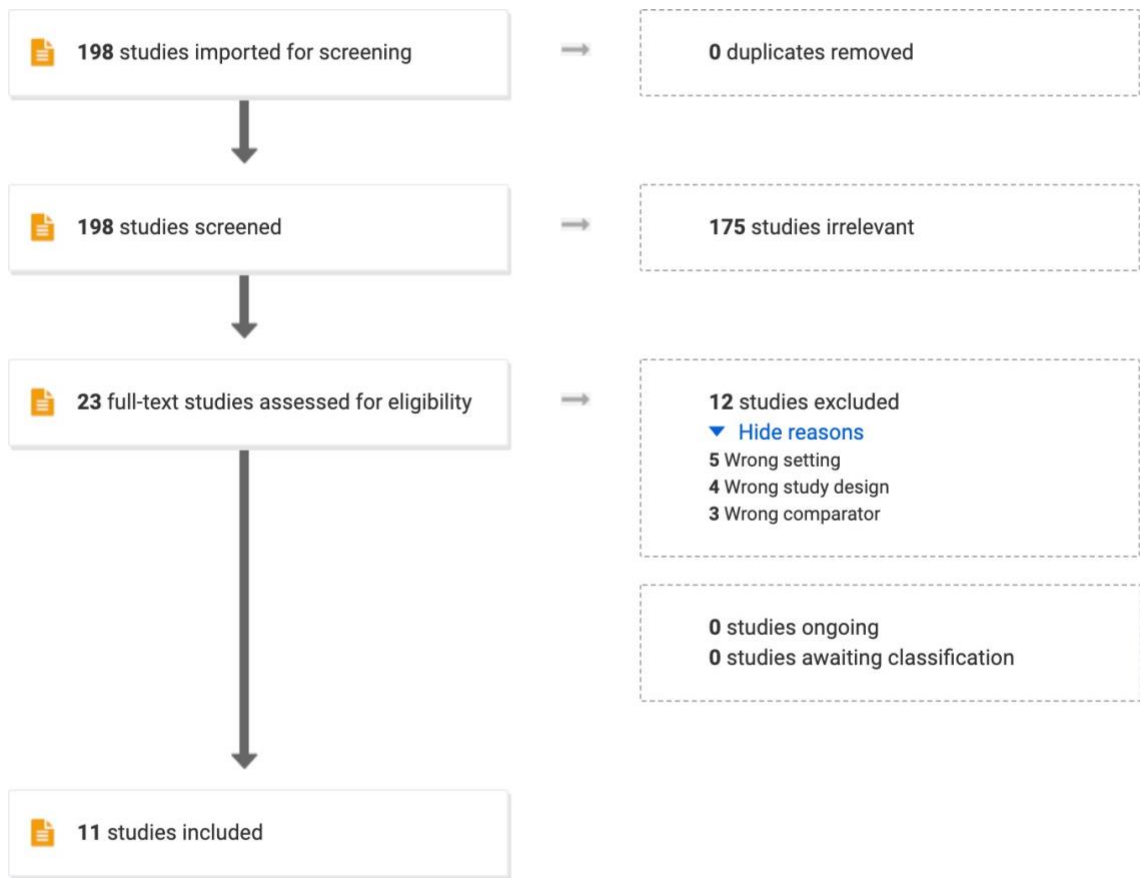


Figure A2

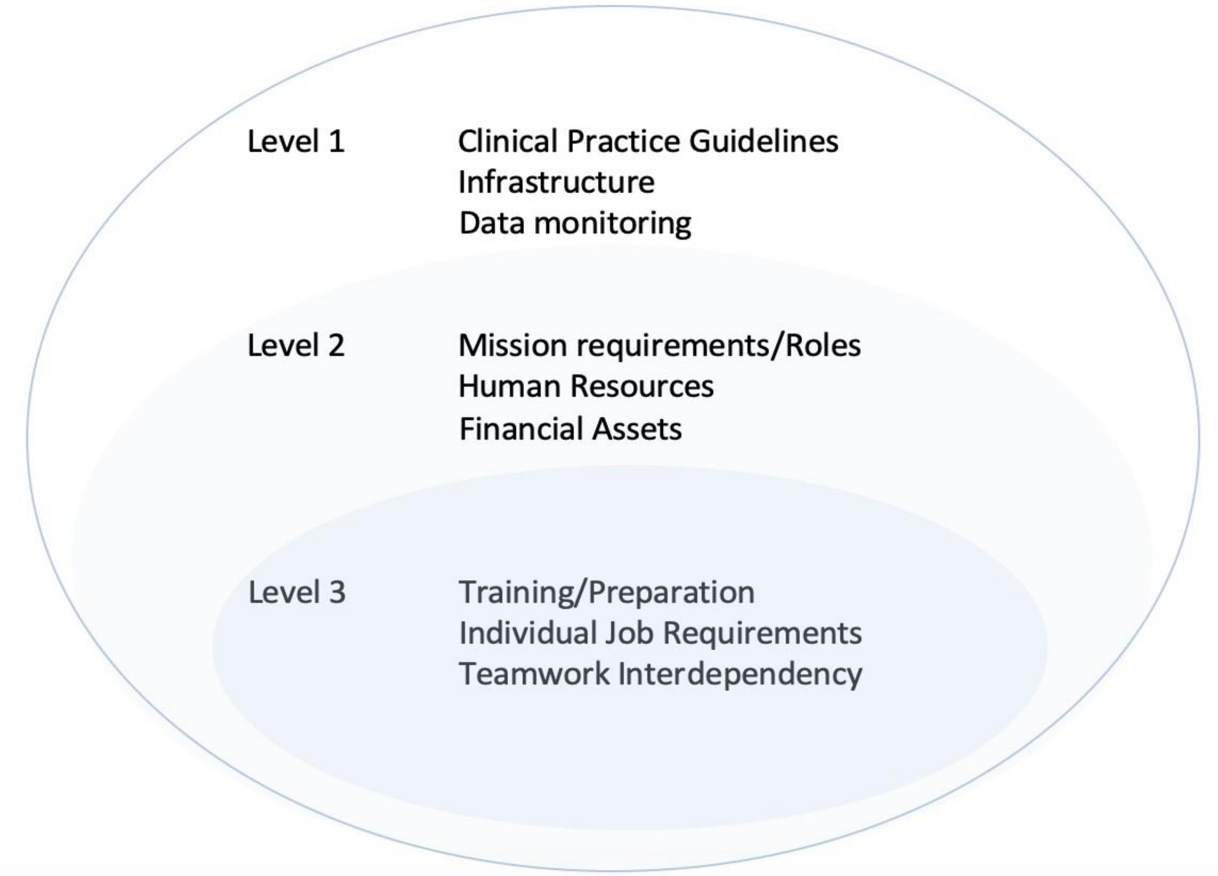
Advanced Practice Provider Led Clinics



Appendix B: Organizing Framework

Figure B1

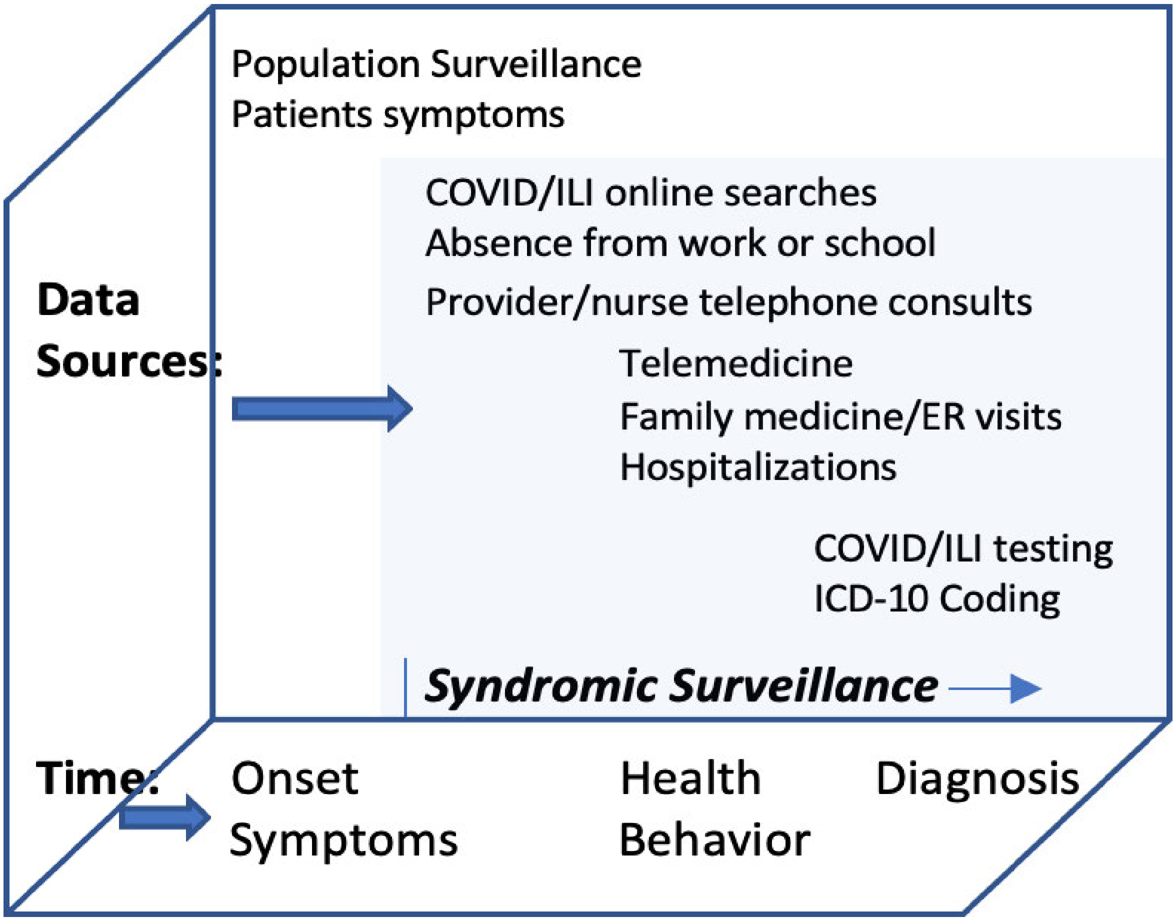
Public Health Capacity Framework



Note: This organizing framework was adapted from 2005 Levels of Capacity within a system context. From "A preliminary framework to measure public health emergency response capacity", by G. Hu, K. Rao & Z. Sun, 2005, *Journal of Public Health,14*(1), 43-47. (https://doi.org/10.1007/s10389-005-0008-2.) Copyright 2005 by Springer Publishing. Adapted with permission.

Figure B2

Syndromic Surveillance Sources and Timeline



Note: This syndromic surveillance framework was adapted from 2004 Progression of Useful Data sources. From "Implementing Syndromic Surveillance: A Practical Guide Informed by the Early Experience", by K.D. Mandl, J.M.Overhage, M.W. Wagner, W.B. Lober, P. Sebastiani, F. Mostashari, J.A.Pavlin, P.H. Gesteland, T.Treadwell, E. Koski, L. Hutwagner, D.L. Buckeridge, R.D. Aller, S. Grannis, 2004, *Journal of the American Medical Informatics Association*,*11*(2), 141-150.(https://doi.org/10.1197/jamia.m1356) Copyright 2004 by Oxford Academic. Adapted with permission.

Appendix C: Notice of Project Approval

USU
Uniformed Services University

OFFICE OF RESEARCH
4301 JONES BRIDGE ROAD
BETHESDA, MAYLAND 20814
PHONE: (301) 295-3303; FAX: (301) 295-6771

NOTICE OF PROJECT APPROVAL

Change Number: Original

VPR Site Number:	GSN-61-11818
Principal Investigator:	Owes, Melaine
Department:	Graduate School of Nursing
Project Type:	Student
Project Title:	Examination of syndromic surveillence data as a trigger for an alternate care facility in a global pandemic
Project Period:	3/24/2021 **to** 5/21/2021

Assurance and Progress Report Information:

Name	Sup	Approval Type	Status	Approved On	Forms Received
Progress Report	0			To be Submitted	N/A

Remarks:
This Notice Of Project Approval has been reviewed and approved. Please remember that you must submit a final Progress Report (Form 3210) upon completion of this project.

Questions regarding this approval should be directed to the following person in the Office of Research: Sharon McIver, (301) 295-9814.

[redacted]

Mark G. Kortepeter, MD, MPH Date
FACP, FIDSA, FASTMH
COL (R) MC US Army
Vice President for Research
Uniformed Services University of the Health Sciences

cc: [redacted]
Dr. Kennth Radford
Laura Taylor

Appendix D: NMCCL Institutional Review Board Approval

January 27, 2021

MEMORANDUM

From: Chair, Institutional Review Board
To: MAJ MELANIE OWES

Subj: **INSTITUTIONAL** REVIEW BOARD REVIEW DETERMINATION

Ref: **a)** NMCCL Human Research Protection Program (HRPP) Standard Operating Procedure (SOP), October 3, 2019
(b) DASD (HRP&O) Operating Instruction, 2019
(c) 32 CFR 219

Encl: **(1)** Institutional Review Board Determination Application

1. Per the reference, an administrative review of your application, "*Examination of syndromic surveillence data as a trigger for an alternate care facility in a global pandemic*," was completed by the Chair of the Institutional Review Board (IRB).

2. After reviewing your application, the project described does not meet the criteria of activities subject to federal regulations at 32 CFR 219. Based on the materials submitted, it has been determined that IRB oversight is not required at this time.

3. Although IRB oversight is not required, all activities proposed in the submission should be conducted in a responsible and ethical manner, and held to standards required by your field and your responsibilities at Naval Medical Center Camp Lejeune.

4. This determination applies only to the activities described in the determination submission and does not apply should any changes be made. If changes are being considered and there are questions about whether IRB review is needed, please contact the IRB Administrator.

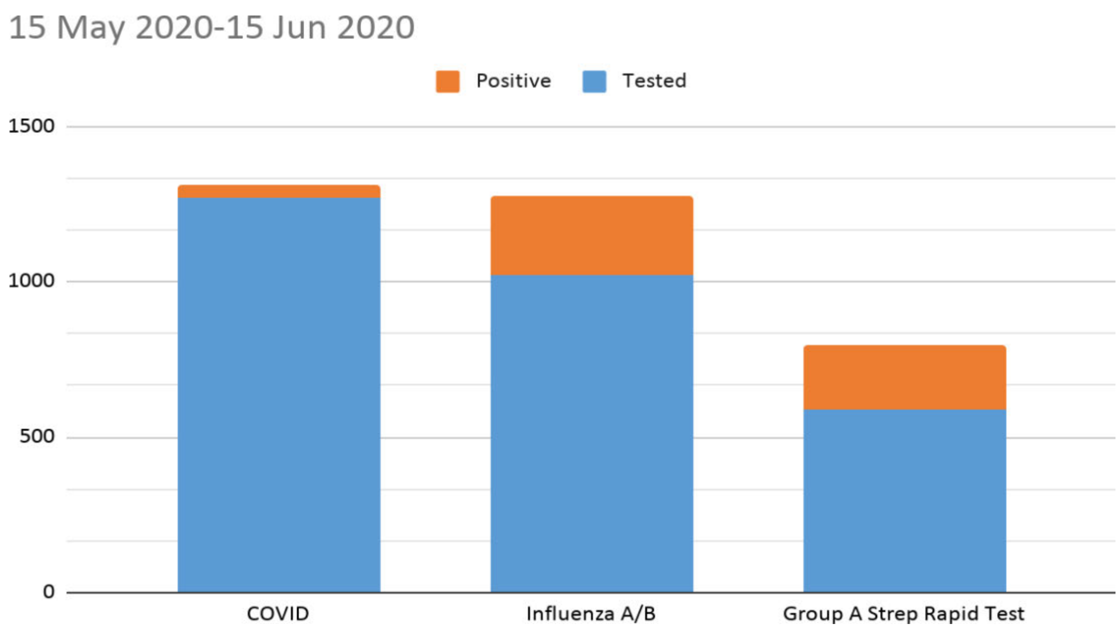
5. If you have any questions or concerns, please contact the IRB Administrator at (910)450-3013 or stephanie.l.dysonelms.ctr@mail.mil.

[redacted]
R.A. Donovan
LCDR, MSC, USN

Appendix E: Project Results

Figure E1

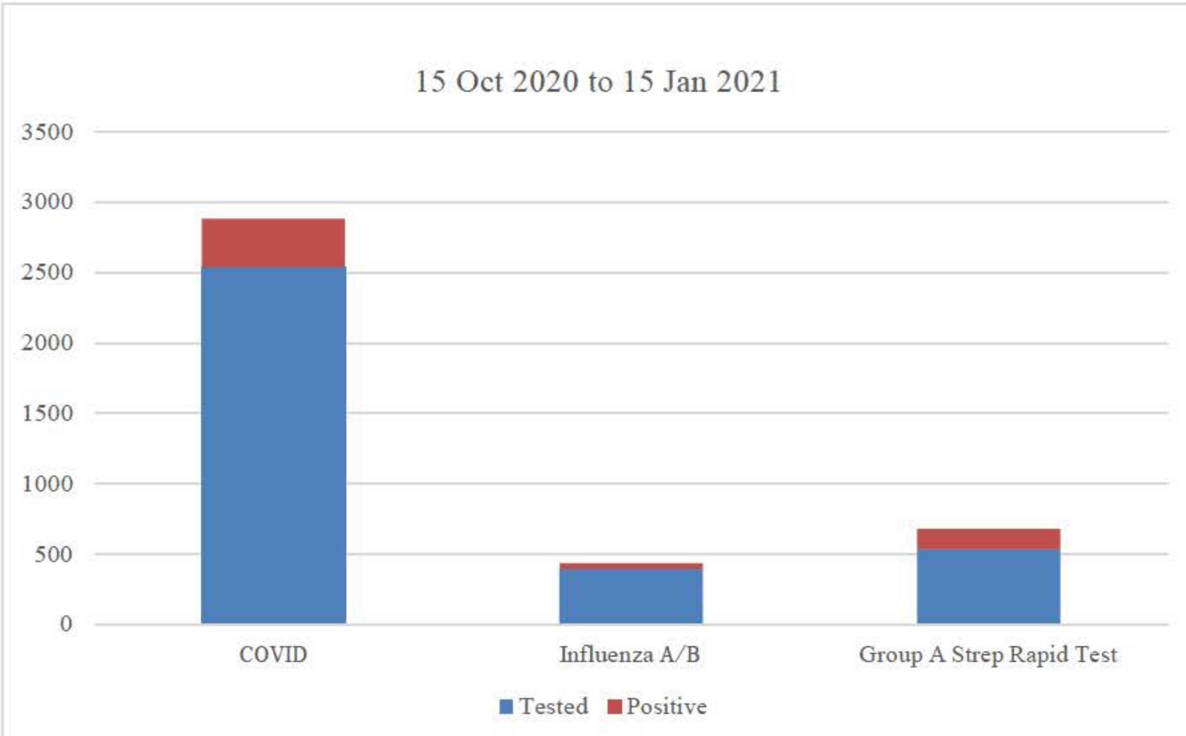
Testing for COVID, Influenza A/B, and Group A Streptococcus 15 May 2020 to 15 June 2020



Note: From 15 Mar to 15 Jun 2020, there were 1269 COVID 19 tests with 44 positives (3.5%), 1019 influenza tests with 257 (25%) positives, and 592 Group A Streptococcus Rapid Tests with 203(34%) positives from the primary hospital clinics analyzed at the NMCCL central laboratory.

Figure E2

Testing for COVID, Influenza A/B, and Group A Streptococcus 15 May 2020 to 15 June 2020



Note: From 15 Oct 2020 to 15 Jan 2021, there were 2538 COVID 19 tests with 344 positives, 391 influenza tests with 43 positives, and 534 Group A Streptococcus Rapid Tests 144 positives from primary hospital clinics analyzed at the NMCCL central laboratory.

Table E1

Clinic Costs and Reimbursement

Emergency Room (BIAA)	15Oct18-15Jan19	15Oct19-15Jan20	15Oct20-15Jan21
Total number of encounters	12,237	11,725	7,672
Number of encounters with identified Diagnostic (Dx) Codes	1,097	1,508	434
Percent of total encounters with Identified Dx Codes	9%	13%	6%
What TRICARE would pay per encounter (with identified Dx codes)	**$168**	**$166**	**$277**
Direct care cost per encounter (with identified Dx codes)	$279	$291	$533

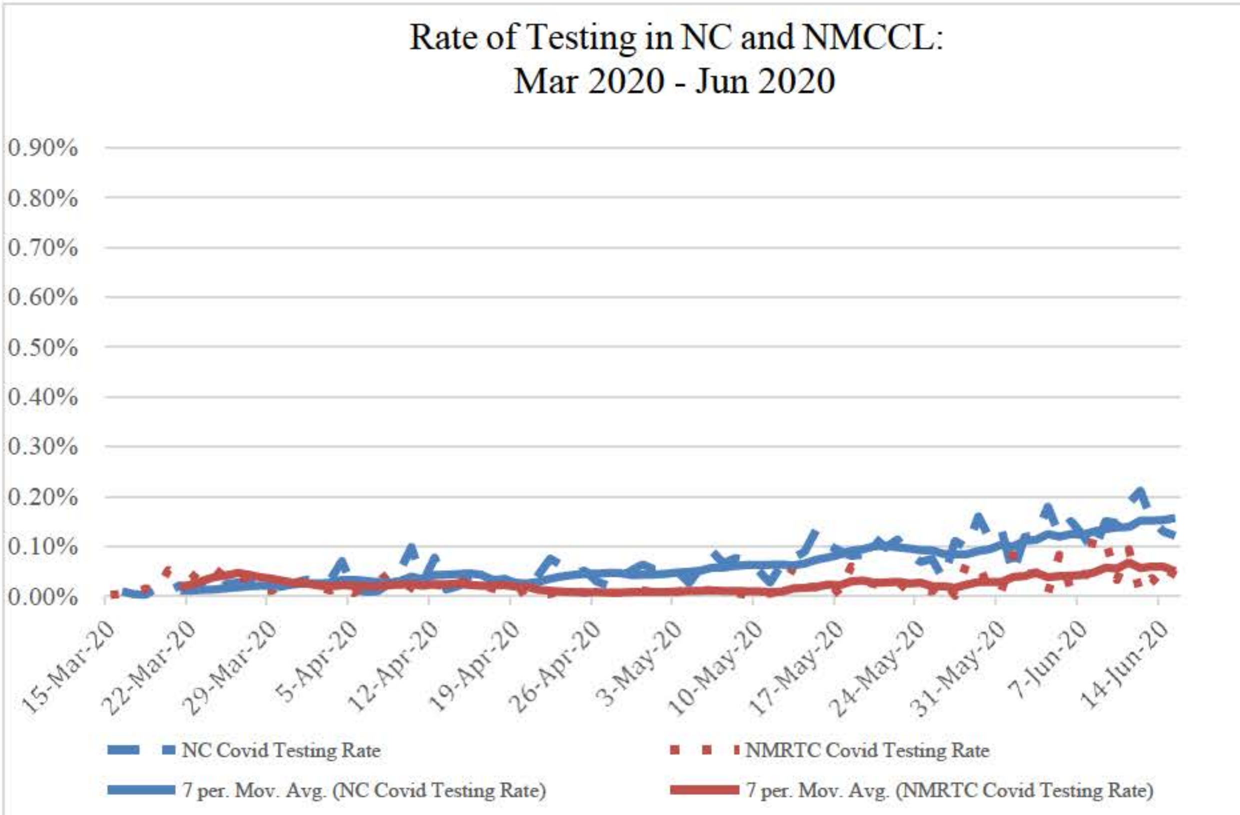
Family Medicine (BGZA-BGZB-BGZC-BGZD)	15Oct18-15Jan19	15Oct19-15Jan20	15Oct20-15Jan21
Total number of encounters	23,305	20,024	19,687
Number of encounters with identified Dx Codes	617	509	110
Percent of total encounters with Identified Dx Codes	3%	3%	1%
What TRICARE would pay per encounter (with identified Dx codes)	**$82**	**$86**	**$76**
Direct care cost per encounter (with identified Dx codes)	$318	$308	$404

COVID19 Clinic (BHI8)	15Mar20-15Jun20	15Oct20-15Jan21
Total number of encounters	1,413	11,927
Number of encounters with identified Dx Codes	953	8,700
Percent of total encounters with Identified Dx Codes	67%	73%
What TRICARE would pay per encounter (with identified Dx codes)	**$40**	**$38**
Direct care cost per encounter (with identified Dx codes)	$193	$205

Note: The Military Health System management and analysis Reporting tool (M2) was searched for the number of daily visits in the ARC, emergency department, and family medicine clinics.

Figure E3

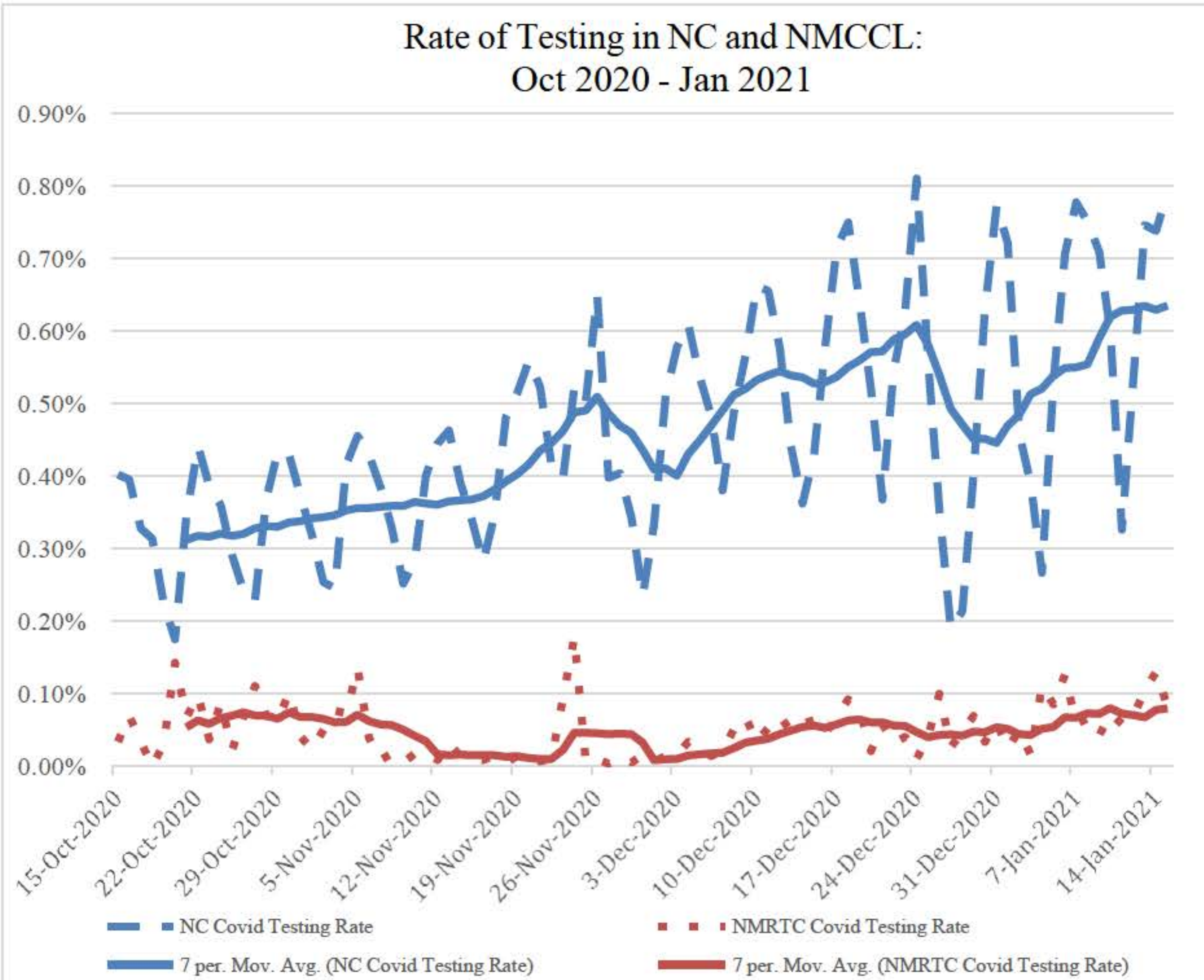
Rate of Testing in NC and NMCCL from March 2020 to June 2020



Note: From 15 March-15 June 2020, there was a moderately strong relationship between the rate of testing for COVID of North Carolina and NMCCL ($p<0.001$,=0.399(95%CI: 0.292,0.505), $R^2=0.358$).

Figure E4

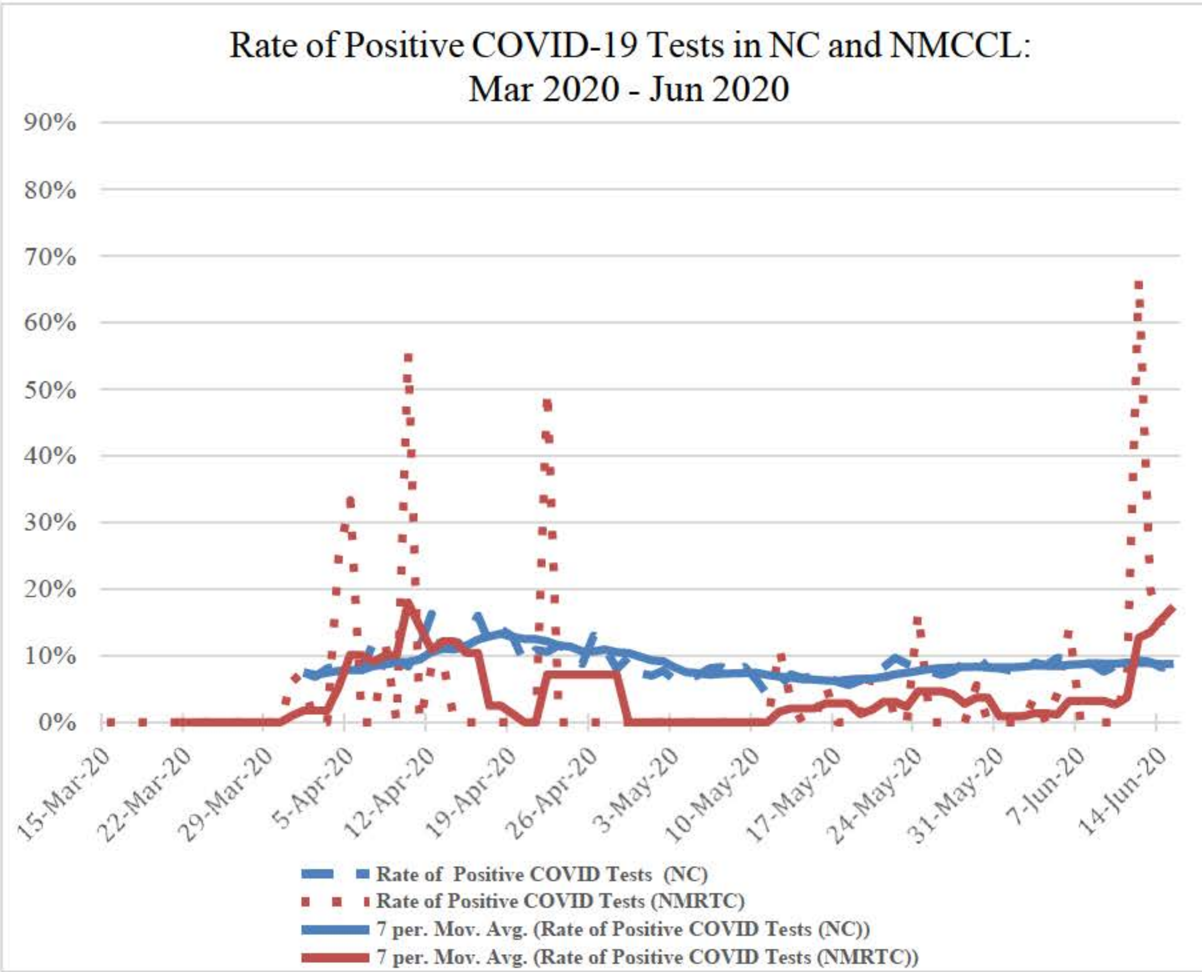
Rate of COVID19 testing in NC and NMCCL from Oct 2020 to Jan 2021



Note: From 15 October 2020 through 15 January 2020 there was no significant relationship between North Carolina and NMCCL rates of COVID testing rates ($p>0.05$).

Figure E5

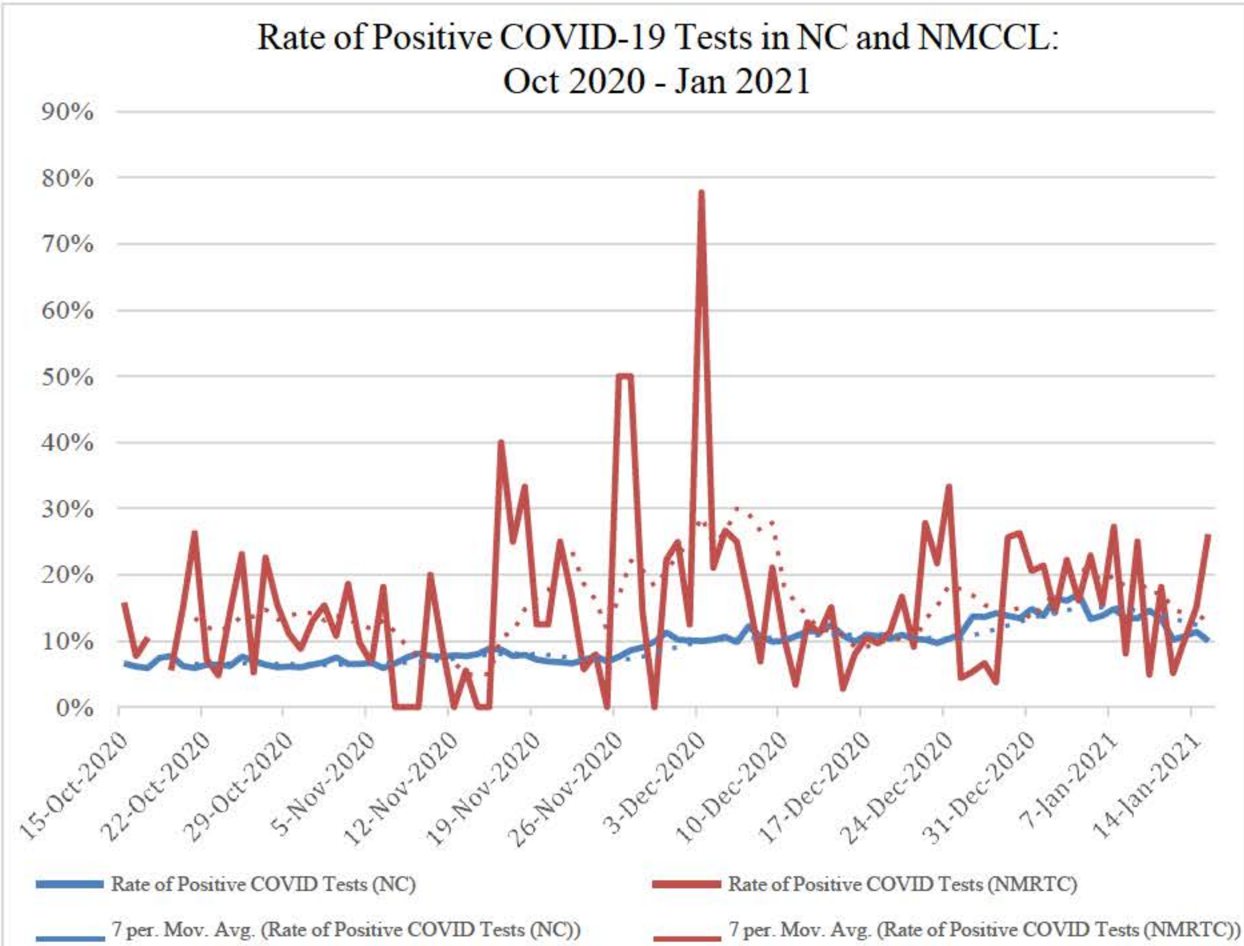
Rate of Positive COVID-19 Tests in NC and NMCCL from Mar 2020 to Jun 2020



Note: There is a significant relationship between NC and NMCCL positive rates in the early pandemic, p=0.024, β=0.718 (95%CI 0.096,1.340) and the relationship is weak R^2=0.080.

Figure E6

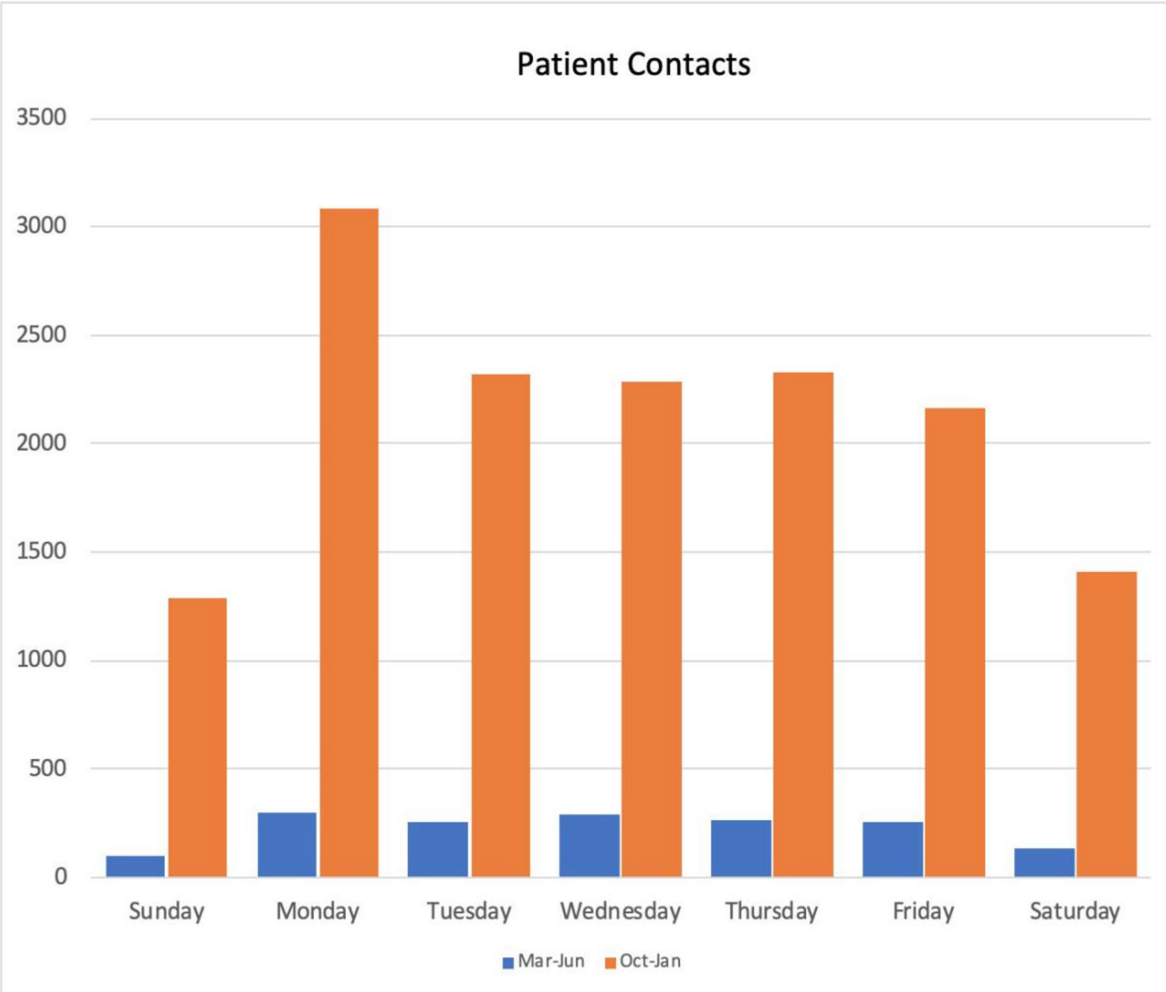
Rate of positive COVID-19 tests in NC and NMCCL from Oct 2020 to Jan 2021



Note: There is a significant relationship between NC and NMCCL positive rates in the winter respiratory season p=0.017, ββ=0.541(95%CI 0.100,0.982) and the relationship is weak R^2=0.068.

Figure E7

Number of patient contacts per day of the week



Note: There was a 976% increase in patient contacts at the ARC. Specifically, there were 1413 contacts from 15 March to 15 Jun 2020 and 11,927 contacts from 15 Oct- 15 Jan 2021. With the most contacts occurring on Monday.

Table E2

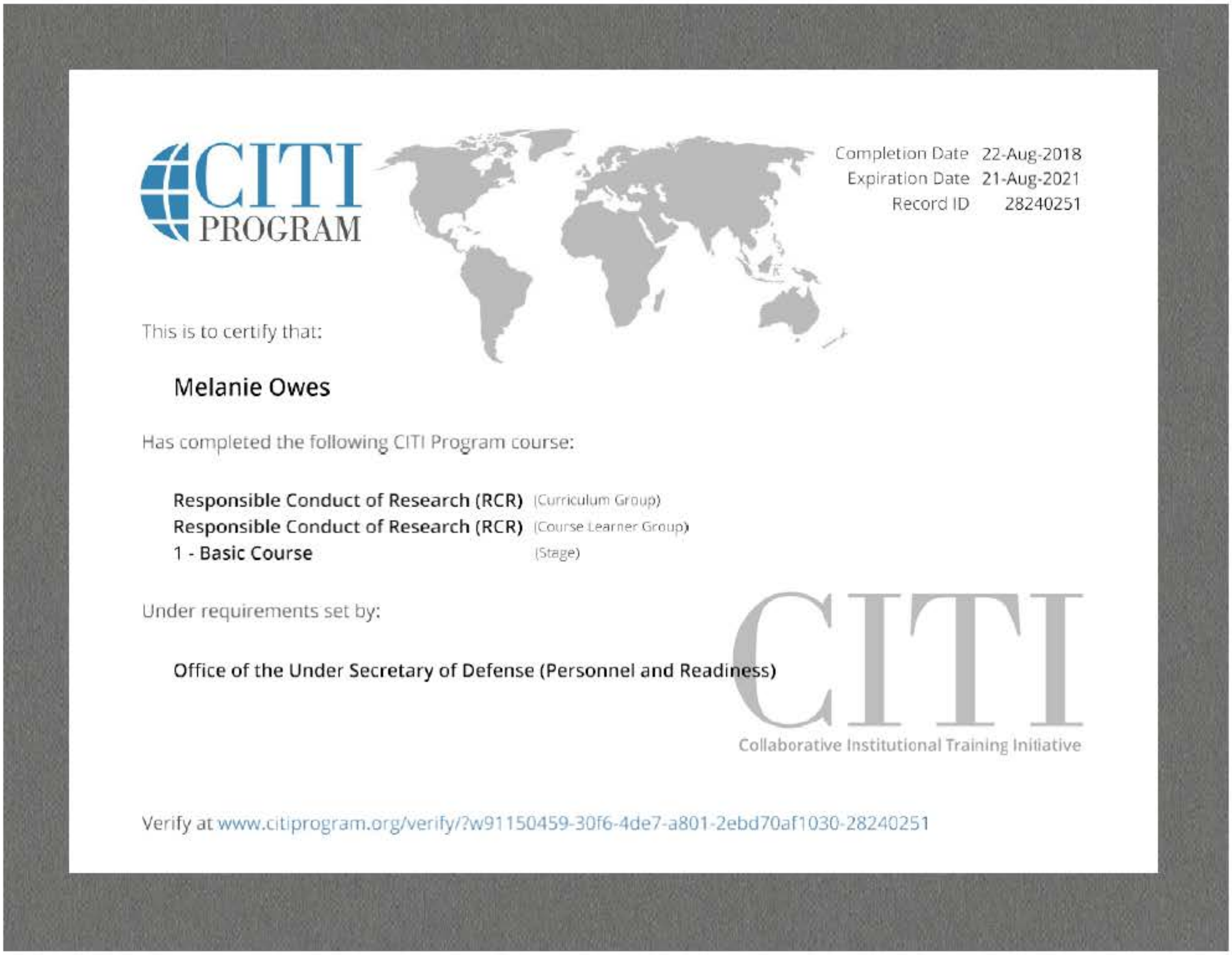
Direct care costs for the Emergency Room, Family Medicine and Acute Respiratory Clinic

Emergency Room	15Oct20 – 15Jan21
Number of encounters with identified Diagnostic (Dx) Codes	434
Direct care cost per encounter (with identified Dx codes)	$533
Emergency Room Total Direct Care Cost	$231,322
Family Medicine	
Number of encounters with identified Diagnostic (Dx) Codes	110
Direct care cost per encounter (with identified Dx codes)	$404
Family Medicine Total Direct Care Cost	$44,440
COVID-19 Clinic	
Number of encounters with identified Diagnostic (Dx) Codes	8,700
Direct care cost per encounter (with identified Dx codes)	$205
COVID Clinic Total Direct Care Cost	$1,783,500

Direct Care costs include facilities and ancillary care costs incurred to provide care for specified ICD-10 codes within the syndromic surveillance aggregation.

Note: The average direct care cost for a COVID-like illness in the ARC averaged half the cost of a visit for the same diagnosis in the Emergency Department or Family Medicine.

Appendix F: CITI Program Certificates



CITI PROGRAM

Completion Date 22-Aug-2018
Expiration Date 21-Aug-2021
Record ID 28240251

This is to certify that:

Melanie Owes

Has completed the following CITI Program course:

Responsible Conduct of Research (RCR) (Curriculum Group)
Responsible Conduct of Research (RCR) (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w91150459-30f6-4de7-a801-2ebd70af1030-28240251

CITI PROGRAM

Comple ion Date 22-Aug- 2018
Expiration Date 21-Aug-2021
Record ID 28240250

This is to certify that:

Melanie Owes

Has completed the following CITI Program course:

Good Clinical Practice (U.S. FDA Focus)	(Curriculum Group)
GCP for Clinical Trials with Investigational Drugs and Medical Devices (U.S. FDA Focus)	(Course Learner Group)
1 - GCP	(Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citip rogram.org/verify/?w7972fd c8-3042-4c8c-967d-900fa43cd be0-28240250

CITI PROGRAM

Completion Date 21-Aug-2018
Expira ion Date 20-Aug-2021
Record ID 28240249

This is to certify that:

Melanie Owes

Has completed the following CITI Program course:

OUSDP&RHumanR earrh (Curriculum Group)
Biomedical Investigators and Research Study Team (Course Learner Group)
1 - Biomedical Investigators (Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogra m.org/verify/?w08494abc-c5fd-4e86-94b5-4ed1ce5a13b4-28240249

CITI PROGRAM

Completion Date 27-Aug-2 018
Expiration Date 26-Aug-2 021
Record ID 28243070

This is to certify that:

Bryan Hersch

Has completed the following CITI Program course:

Responsible Conduct of Research (RCR) (Curriculum Group)
Responsible Conduct of Research (RCR) (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wec1d077a-d003-4edc-a026-0ba89f088e37-28243070

CITI PROGRAM

Completion Date 27-Aug-2018
Expiration Date 26-Aug-2021
Record ID 28243069

This is to certify that:

Bryan Hersch

Has completed the following CITI Program course:

Good Clinical Practice (U.S. FDA Focus)	(Curriculum Group)
GCP for Clinical Trials with Investigational Drugs and Medical Devices (U.S. FDA Focus)	(Course Learner Group)
1 - GCP	(Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w8cd00286-b57a-469d-99b2-302a20f37ff1-28243069

CITI PROGRAM

Completion Date 21-Aug-2018
Expiration Date 20-Aug-2021
Record ID 28243068

This is to certify that:

Bryan Hersch

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

OUSD P&R Human Research
(Curriculum Group)
Biomedical Investigators and Research Study Team
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wb08003c2-996a-4a7a-a420-72927219700b-28243068

Appendix G: NMCCL PAO Project Clearance/ Level of Dissemination Classification

Appendix H: DNP Project Completion Verification Form

Appendix G: Daniel K. Inouye Graduate School of Nursing
DNP Project Completion Verification Form

DOCTOR OF NURSING PRACTICE PROJECT
Completion Verification Form

The DNP Project titled: Examination of syndromic surveillance data as a trigger for an alternate care facility in an epidemic/pandemic

was completed at Naval Medical Center Camp Lejeune by the following student(s):

(Student Name)	*(Digital Signature)*
Maj. Bryan Hersch	[redacted]
MAJ Melanie Owes	

The DNP Practice Project Team verifies that the following components of the DNP project, accomplished by the above students, is of sufficient rigor and demonstrates doctoral level scholarship to meet the requirements for USUHS GSN graduation:

- Presentation of DNP project to the leadership/stakeholders at the Phase II Site,
- Abstract/Impact Statement (*Appendix F*), and
- DNP Project written report (*Appendix E)*.

Verified by:

(type name)	*(Digital Signature)*	
Dr. Heather L. Johnson	[redacted]	Senior Mentor
		Team Mentor
		Team Mentor
CDR Robert Kimberling	[redacted]	Team Mentor & Phase II Site Director

***For RNA Students only** - add the following additional signature for final verification of project completion:*

RNA Project Director *(type name)* *(Digital Signature)*

Form Version: 4 December 2020