Rural NC County COVID-19 Responses and Innovations



Recommendations for Pamlico County Health Department

May 3, 2021

Prepared by Anna Bartz, Maggie Chang, and Lucas Stewart

Duke University

Introduction

Our team, consisting of two master's in public policy candidates and one pre-medicine undergraduate student, are part of an experiential learning project at Duke University focused on assessing the rural North Carolina county health systems and their responses to the COVID-19 pandemic. During the fall 2020 semester, we assessed Pamlico County's pandemic response compared with neighboring NC counties. Through data analysis, literature reviews, and stakeholder interviews, we compiled best practices and developed recommendations that Pamlico County Health Department could consider for its ongoing pandemic response[1]:

- Strengthen presentation of a comprehensible and unified message
- Develop academic partnerships with local colleges and institutions
- Explore opportunities to deploy frugal and digital innovations in public health efforts
- Leverage untapped local partnerships and state resources
- Field a resident survey to address ongoing needs

This report builds on our fall 2020 semester work, and investigates community members' attitudes and behaviors during the pandemic, neighboring counties' COVID-19 vaccination efforts, and how community health workers (CHWs) can support Pamlico County public health efforts. We hope that this detailed analysis can be leveraged if the Health Department desires to implement new programs and serve as foundational research for future student teams.

We would like to thank our many partners that helped inform our analysis: Pamlico County Health Department Director, Scott Lenhart; County health department interviewees: Scott Harrelson from Craven County, Dr. Sheila Davies from Dare County, and Davin Madden from Lincoln County; CHW program interviews: Dr. Sallie Allgood, Nimon Badgley, Jennifer Norville, Krystal Shuler; and our project leads, Dr. Diana Silimperi and Dr. Sumedha Ariely.

Executive Summary

As Pamlico County continues to leverage experienced public health leadership in their pandemic response, the Health Department can consider how new partnerships and innovative solutions can help with current and future community health initiatives. While the Health Department has deployed a successful COVID-19 vaccination campaign, vaccine hesitancy and misinformation threaten Pamlico County's ability to achieve herd immunity. Further, Pamlico County's limited number of local health care facilities and residents' higher prevalence of chronic conditions put community members at higher risk for severe COVID-19 cases and poorer health outcomes. Through our research and interviews with neighboring counties, health experts, and CHW educational instructors, we developed recommendations that the Pamlico County Health Department can consider for its ongoing public health efforts:

- Partner with Pamlico County College on public health initiatives
- Develop and deploy CHW program
- Field survey on vaccine attitudes, misinformation, and public health programs
- Form coastal county coalitions and leverage community partners

[1] Fall 2020 semester findings can be found in the appendix

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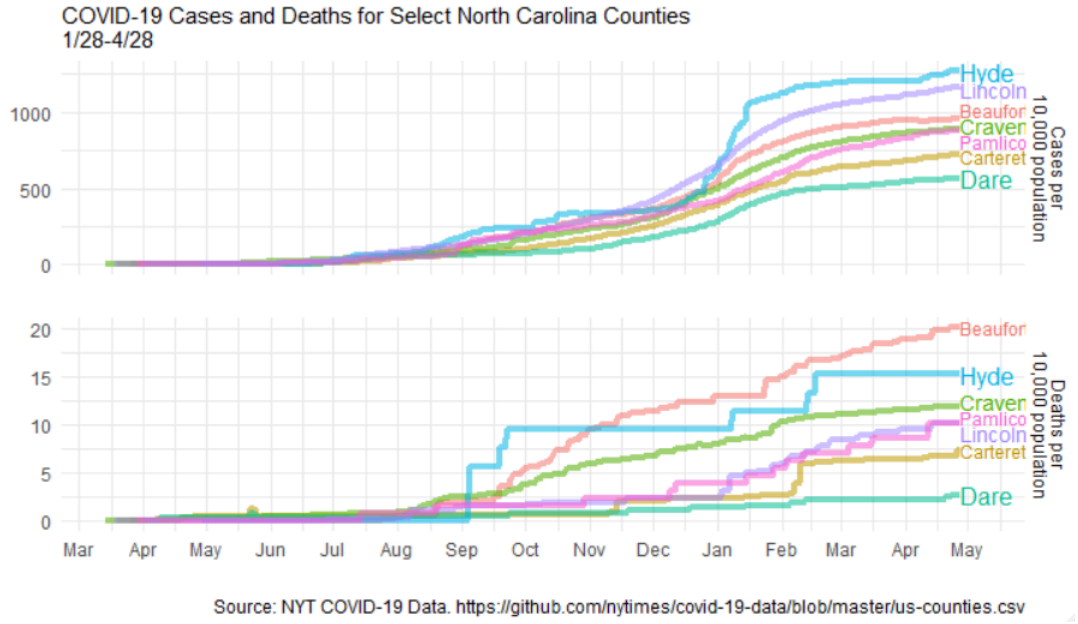
Pamlico County's COVID-19 Case and Vaccination Metrics

Pamlico County did not experience its first wave of COVID-19 cases until after the Memorial Day holiday. The county's COVID-19 cases per 10,000 residents trended below neighboring counties until the area experienced an outbreak at the state prison (Pamlico Correctional Institution) in late August – early September (see Figure 1). Pamlico County has trended in the middle of the other counties examined for both COVID-19 case and death rates per 10,000 residents throughout 2021.



Pamlico County has delivered a strong COVID-19 vaccine rollout. It's rate of individuals with at least one vaccine dose per 10,000 residents is above surrounding counties, with neighboring Dare County currently having the highest first dose vaccination rate.

County	People Vaccinated with at Least One Dose	People Vaccinated with at Least One Dose per 10,000 residents
Pamlico	**5,205**	**4,108**
Beaufort	16,601	3,526
Carteret	24,071	3,462
Craven	30,914	3,004
Dare	18,239	4,985
Hyde	2,378	4,547
Lincoln	22,233	2,654

Survey of Pandemic Behaviors and Attitudes during the Pandemic

Background

We partnered with the Pamlico County COVID-19 Community Task Force (CCTF) to survey Pamlico residents on their perceptions of the COVID-19 pandemic. The CCTF is a volunteer organization established to engage the community in responding to the pandemic and to support and augment the county's efforts. CCTF leadership contacted 20 of its most engaged organizational contacts and asked them to distribute the survey to 5 of their most engaged members.

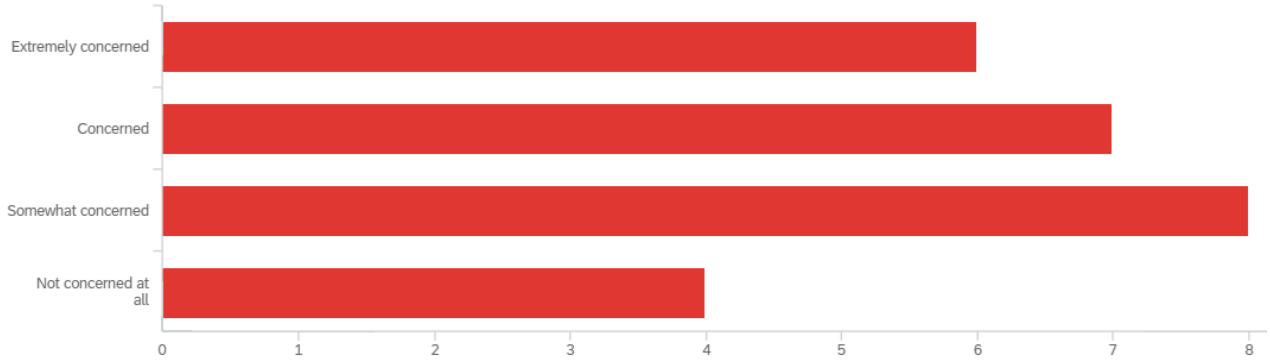
Survey questions focused on the following topics:

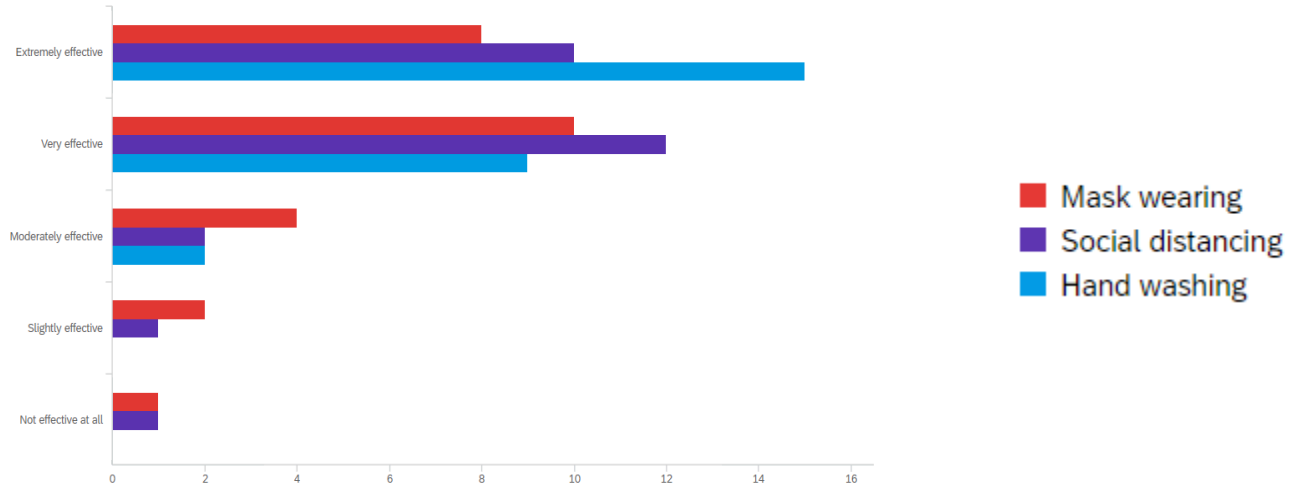
- COVID-19 disease transmission
- Effectiveness of pandemic prevention behaviors (mask wearing and social distancing)
- Flu and COVID-19 vaccination
- COVID-19 information sources and knowledge

Thus far, 23 respondents out of approximately 100 engaged participants have responded to the survey request. The survey takes an average of 10 - 12 minutes to complete. Respondent ages ranged from 57 - 79 years old, with an average of 68. All respondents that identified race and ethnicity were White. Most were college educated and married.

Preliminary Results and Analysis

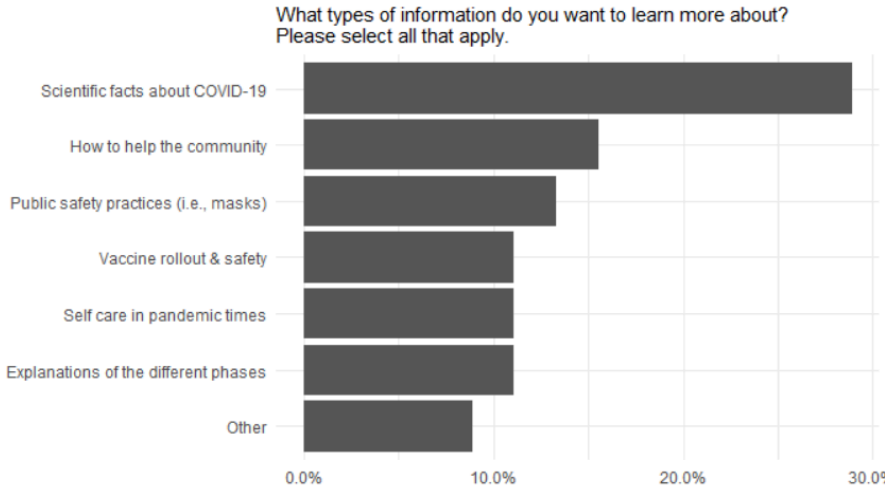
Participants were concerned about contracting COVID-19.



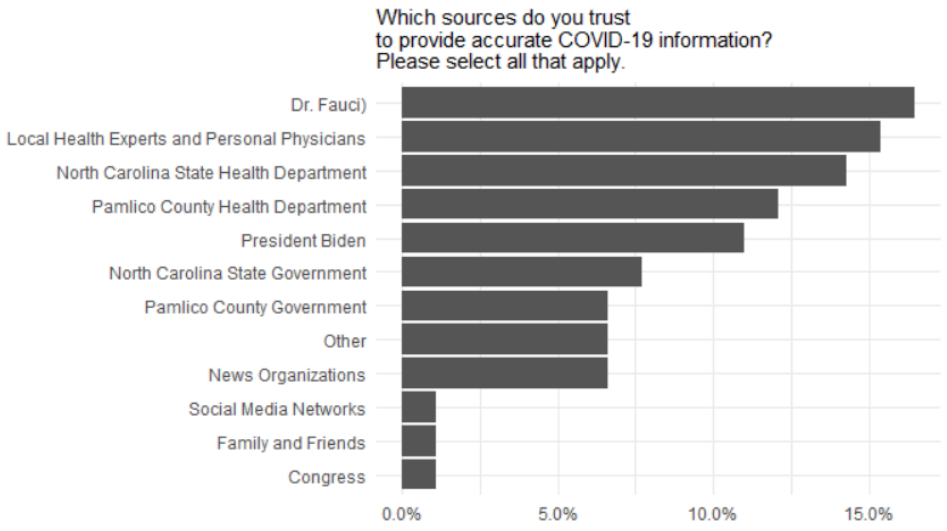


Most respondents received their flu shot in the past 12 months and have been vaccinated for COVID-19. Reasons for not getting vaccinated included not feeling the need, not believing vaccines are effective, and worries about side effects.

Participants were most interested in learning more about the science of COVID-19 and how they could help the Pamlico community.



National health experts like Dr. Fauci were trusted by most participants. Many participants also had strong trust in the Pamlico County Health Department.



The majority of survey participants have received their flu and COVID-19 vaccinations.

During the past 12 months did you get a flu shot?	Have you been vaccinated for COVID-19?
83% of participants (24 out of 29 people) **have received a flu shot** in the past 12 months	**89%** of participants (25 out of 29 people) **have been vaccinated** for COVID-19

Some participants are hesitant about taking vaccines

Why did you not get a flu shot [in the past 12 months]?	Have you been vaccinated for COVID-19?	Why are you undecided or unlikely to get the COVID-19 vaccine when it becomes available to you?
10% of participants (3 out of 29 people) indicated they **do not believe in vaccines** and/or **do not think they are effective**	**11%** of participants (4 out of 29 people) said they **have not been vaccinated** and **do not intend to do so**	Worried about vaccine **side effects** **Don't believe** in vaccines **Not worried** about COVID-19

Recommendations and Next Steps

While these initial findings are intriguing, we recommend deploying the survey to other community members and expanding the sample size to a more diverse subset of participants. Specifically, the Pamlico County Health Department can take the following actions:

- Send survey to county health department listservs
- Collaborate with community organizations, like the Pamlico County Community College, and have partners deploy survey to their members
- Advertise survey on social media accounts and position it as an opportunity for community members to provide feedback
- Leverage results from existing surveys across North Carolina to help inform ongoing health department pandemic strategy

County Health Department COVID-19 Vaccination Efforts

Background

To better understand rural county responses to COVID-19, we interviewed Pamlico County's Health Department Director, as well as other Directors in Craven and Dare counties to identify similarities and differences in vaccine rollout efforts as well as lessons learned for long-term health system improvements. We then summarized key themes that emerged from these conversations by looking for common information, contrasting information, or novel solutions, which are presented below.

Analysis

Vaccination Process Overview

Different health care infrastructure and resources resulted in varied vaccine rollout approaches. Dare County benefitted from running their vaccination process through a large county owned facility, enabling them to avoid renting additional space. This space was sizable enough for 12-14 nursing stations processing 1,000 - 1,500 people daily. Craven's health department gained from renting a recently renovated convention center

Dare and Craven County did automated registration (call or online) with no waitlist (i.e., by appointment only). Craven's director noted that they used a tool called Signup Genius and spoke positively about their process, "*Once everything was automated, our registration and reminder process, things got really efficient.*"

Challenges

Each director noted an initial challenge of having demand for COVID-19 vaccine doses exceed supply. Dare County's director expressed, "*We just couldn't get it out quick enough*" while Craven County remarked, "*We couldn't do it on our own.*"

All health departments also expressed frustration at mixed messaging from the state, especially on vaccine rollout. In particular, health departments encountered confusion and frustration from residents once the state dropped its date of birth requirement for vaccination eligibility. Craven's director described an interesting example, "*We had an elderly gentleman who was 61 years old with a lot of underlying health conditions, but he was retired so not considered an essential worker. His 22-year-old son was a healthy farmworker and was able to come in and get vaccinated based on the current guidelines.*"

However, health department leadership recognized that state officials were themselves dealing with uncertainty. *"That's been a challenge the entire pandemic is messaging and balancing, trying to get the right message out at the right time to the right people, and then it changes."*

The dynamic nature of the pandemic means challenges have changed. Currently, health departments face dampened demand. Craven's director remarked that some of this is due to successful vaccination creating saturation in the population. *"Now we're actually at a point of declining some of our upcoming allocations because our demand has slipped. But it's for good reason. 75% of those 65 and older have had at least one dose here and we're probably at about 58% of people in the county with a vaccine."*

However, lower motivation, greater skepticism, and a fear of side effects among the remaining population, especially younger residents, create other challenges. Dare County described a shift in vaccination strategy to overcome reduced interest. "*We've talked about putting together maybe a short video by pulling in some local healthcare providers to have them encourage and talk about why it's so important to get vaccinated and the safety and science behind the vaccine. So that's probably what our next step is going to be*."

Another strategy they discussed involved on site vaccination at businesses and churches, "*Now that we're moving into groups four and five, I think we're going to have to shift our efforts to on site vaccination, maybe going on site to businesses and churches and advertising, registering, or actually vaccinating people.*"

Successes

Dare County continued its strong public facing COVID-19 communication campaigns during vaccine rollout. Their director said, *"I do a weekly video and written update on vaccine information.*"

Each county spoke positively about the role partnerships played in vaccine distribution. Dare County said. "*We've had a great partnership between public health, social services, emergency management, EMS, and local law enforcement."* Craven's director described how partnerships with its local hospital and main primary care provider bolstered their vaccination efforts. Speaking about their community partner, Carolina East Hospital, Craven's director said, *"They can see 32 people every 15 minutes with no waiting."* They also noted that Coastal Carolina Health Care has repurposed an old cancer treatment center and can now *"crank out 800 - 1000 doses on a Saturday, just adding to our capacity."*

Departments improved vaccine access among historically marginalized populations like Black and Hispanic Americans in unique ways. Dare County partnered with its state-contracted CHWs to help increase vaccination among its predominantly Black neighborhoods, saying, "*They've been doing door-to-door outreach and signing people up*." Craven County worked with ground level community liaisons to help get people registered for vaccination. The health department sent staff to satellite clinics setup at a local Black church to deliver doses.

Adaptations

Each health department director mentioned using their emergency response management and communication systems (primarily CodeRED) for providing vaccine appointment reminders. Craven's director summarized the benefits of this adaptation well, *"It'll send out a text, email, and a call to remind people of their second appointment. That's a great tool. What would have taken our call center literally all day, and six or seven different staff to do, it can do in 30 seconds."*

While Dare County benefitted from robust resources and space, their director indicated that the smaller, southern part of their county encountered vaccine rollout roadblocks. Clinics in this area were only able to handle about 300 patients per day (rather than 1,000) and limited parking and space availability created traffic flow issues that frustrated vaccine recipients. They overcame this access challenge by distributing vaccines to local pharmacies in the southern part of the county to serve as an alternative distribution site.

Lessons Learned

One of Dare County's takeaways focused on the value of **relationships**. "*The building of relationships with your community partners enables you to mobilize quicker.*"

Dare's director also had pertinent advice for **improving communication between state and local officials**, stating, *"When looking at a county with a smaller population, don't discredit what they're capable of doing."* Each county mentioned exceeding the state's expectations on vaccine allotment and distribution multiple times since vaccination began.

Craven's director had sound advice for state officials. "*Operations drive the train, and local health departments were operations for higher up state incident command. You* (state officials) *need to listen to us.*"

Leadership in Craven also described the **hidden value of public health workers**, saying, "*The community didn't see this behind the scenes struggle and boots on the groundwork that enabled our successful vaccine distribution."*

Health department directors suggested thinking of strategies moving forward to combat the **mental fatigue** of enduring a prolonged emergency response. Dare's leader noted, "*That's something in our (public health/emergency response) training we've never done, …, but it's something we should be talking about moving forward.*"

Recommendations and Next Steps

- Continue strong vaccine rollout efforts in Pamlico County, including the repurposing of staff, automated registration process, and adaptation of CodeRED for vaccine appointment reminders
- Consider advertising and messaging campaigns to reduce hesitancy among those yet to be vaccinated
- Explore additional community partnerships for supporting pandemic response, particularly with Pamlico Community College
- Consider connecting with Craven and Dare County Health Department directors for information and strategy sharing, both during and beyond the pandemic

Community Health Workers Program Considerations

Background

We investigated existing CHW programs across NC and assembled considerations for Pamlico County to deploy CHWs within the health department and other community organizations. To help inform our CHW program considerations and recommendations, we completed literature reviews and interviewed various expert stakeholders. Expert interviewees included Dr. Sallie Allgood from the NC Office of Rural Health, and CHW program coordinators from Catawba Valley, Edgecombe, and Haywood Community Colleges.

Analysis

CHWs Can Take On Many Different Functions and Roles

CHWs are trusted members of the community trained to address residents' behavioral, medical, and social needs. These frontline public health workers help facilitate access to care by serving as a community liaison between residents and local health care providers. CHW training is adaptive, allowing their roles to expand and scale up based on evolving local health system needs. Their tasks vary but frequently include health education and care coordination support. Many CHWs assist patients with appointment reminders, facilitating referrals to community resources, promoting preventive services, and chronic condition management strategies. Interviewees also indicated that CHW are often embedded within health departments and support ongoing public health efforts. Some CHWs take on functions like health department social media coordinator and facilitate communications with community members.

CHWs Help Manage and Reduce Risk of Chronic Conditions

CHWs have successfully reduced risks from chronic conditions like diabetes. A six-month randomized controlled trial (RCT) found that CHWs providing diabetes self-management education and routine home visits significantly reduced HBA1C levels and increased self-reported understanding of diabetes among treated participants relative to the control group. Results from a 24-month RCT involving a diabetes education program delivered by CHWs indicate that participant blood glucose levels and weight were significantly lower than control individuals, demonstrating the promise of CHWs for diabetes prevention.

CHWs Improve Mental Health Management

As trusted community members, CHWs can provide valuable peer support and lend an easy to talk to ear to people suffering with mental health problems. A review of several studies found that these workers successfully reduced poor mental health symptoms and improved care engagement in a variety of settings and for a range of conditions from simple depression to severe mental illness.

CHW Programs Require Sustainable Funding and Community Partnerships

A key consideration for any successful CHW program is sustainable financing. It can be difficult to secure and sustain funding and payer reimbursement for these workers because of state variation in credentialing, training, and scope of practice laws. However, CHWs have

demonstrated a positive return on investment in a variety of environments. Community college program coordinators indicated that many CHWs are funded through grants or paid directly from health departments' budgets.

Community-based partnerships are critical to the effectiveness and sustainability of CHW programs. Partnerships with Hope Clinic or the Greene Health Care Inc. Federally Qualified Health Centers could increase the network through which trained CHWs could operate. Pooling resources with these entities could help the health department champion a local CHW program to state officials at NC DHHS through the Office of Rural Health's (ORH) CHW Initiative.

After developing a standardized training curriculum in collaboration with existing CHW programs, NC ORH began piloting a standardized CHW education series in 2016 through 6 community colleges. ORH plans to expand CHW core competency training to at least 12 community colleges in the next year and plans to launch a statewide program in the next two years.

Opportunities to Leverage North Carolina State and Other Counties' CHW Framework

Pamlico County can leverage existing programs and frameworks across the state as community stakeholders consider how to best deploy CHWs. North Carolina's Community Health Worker Initiative works to standardize the definition and training of CHWs to create a sustainable infrastructure for utilizing these workers throughout the state. Further, partnering with Pamlico Community College to create a CHW curriculum could fill gaps in rural health care.

Pamlico County Health Department and Community College and look to other NC counties and leverage their existing CHW program framework. Durham Technical Community College currently offers a continuing education program that trains CHWs, and their curriculum could inform the development of similar training courses at Pamlico Community College. Other Community Colleges piloting CHW curricula include Catawba Valley Community College, and Edgecombe Community College, and Haywood Community College.

The table below includes a summary of our interview findings with CHW program coordinators from Catawba Valley, Edgecombe, and Haywood Community Colleges.

Theme	Catawba Valley	Edgecombe	Haywood

Core Competencies	**Communication**/social skills, **knowledge of community resources**	**Trusted community member**, connecting clients with resources, **knowledge of community's social determinants of health**	**Basic healthcare delivery, disease prevention and management**, nutrition/healthy eating, easy to understand language
Roles and Functions	"Community liaison," **health educator**	**Contact tracing, vaccine registration**	Resource hub, veterans health issues, **peer support**
Internship and Job Placement	**County health depts**, **religious organizations**, Dept. of Social Services, clinical environments	County health depts, private hospitals, religious organizations **local non-profits**	County health depts, hospitals, Dept. of Social Services, VA
Funding / Supervision	Office of Rural Health, private grants, county health depts	**Private grants, NC COVID relief,** supervised by clinical professional	Office of Rural Health, County health depts Doctor, nurse, social worker
Advice for Implementation	**Prepare online delivery method**	Create a **supportive environment** for students	**Create local career paths** for Community College program development; Focus on what you need for your community

Recommendations and Next Steps

To build on these findings and interested generated at the Pamlico Community Collaborative April 15, 2021 meeting, we recommend that the Pamlico County Health Department take the following next steps:

- Schedule meeting with Pamlico County Community College leadership and discuss opportunities for future collaboration on CHW program
- Connect with community partners, like the CCTF and Pamlico County Collaborative, and discuss areas where CHWs could support current operations
- Leverage future student teams and state resources to help implement CHW program

Next Steps, Lessons Learned, and Project Legacy

Future Considerations and Partnerships

Below is a list of initiatives, innovations, organizations, and community partners that our research team investigated and engaged with over the course of our project. Further, these are potential implementations and collaborators that Pamlico County Health Department can consider deploying in future public health efforts.

- **Partner with Pamlico Community College for immediate and long-term support**
    - Contacts: President, Dr. Jim Ross and/or VP of Instruction, Ms. Michele Willis
    - Purpose: Communications, graphic design, and/or web development support
    - Discuss allied health curriculum
- **Community health workers can address access to care, chronic conditions, maternal and child health, and more**
    - Pamlico Community College:
        - Contacts: President, Dr. Jim Ross and/or VP of Instruction, Ms. Michele Willis
        - Purpose: PCC could become part of next 6 CCs with pilot program
    - NC Office of Rural Health:
        - Contacts: Mr. John Resendes or Dr. Sallie Allgood
        - Purpose: Learn more about pilot program and technical assistance offerings
    - HIT Community College CHW Program Administrator Contacts
        - Contacts: Catawba Valley, Edgecombe, and Haywood Community College
        - Purpose: Learn more about program and implementation details to pilot CHWs in Pamlico
    - Hope Clinic
        - Potential partner for piloting/supervising CHWs
    - Pamlico Community Collaborative Members
        - Potential partner(s) for piloting/supervising CHWs
- **Forming a Coastal County Coalition can strengthen pandemic response and promote regional public health**
    - Contacts: Craven HD Dir., Mr. Scott Harrelson and Dare HD Dir., Dr. Sheila Davies
    - Purpose: Monthly/quarterly meetings for information, resource, and strategy sharing
- **Text messaging for public health can improve outcomes at a low-cost using existing tools**
    - Contacts: County managers/EMS
    - Purpose: Pair CodeRED, or an alternative like Twilio, with CHWs and mobile health for chronic condition management or other public health efforts
- Consider exploring additional connections and innovations

- Duke School of Nursing Connection
- Mobile health clinics/vans (Durham Tech currently implementing)
- Digital and Frugal Innovators interviewed during semester 1

Lessons Learned and Project Legacy

Prior to joining this project, our research team had limited experience working directly with rural county health departments and partner organizations servicing community members. Now after 9 months of research, we better understand the dedication, collaboration, and innovation required to promote public health efforts.

Pamlico County North Carolina's close-knit community, experienced and motivated public health leadership, and creative use of existing resources has bolstered its response to the COVID-19 pandemic. While the community still faces health barriers like higher prevalence of chronic conditions, mental health and substance abuse concerns, and a limited number of health care facilities, local partnerships and low-cost innovations can help fill gaps in Pamlico County and other rural communities that may lack resources and funding.

Ultimately, we hope that our research will help inform the work of future student groups, community partner collaborations, and health department initiatives. We thank Pamlico County for letting us engage with its dedicated residents, and giving us the important perspective of how small communities can rise up to face any challenge.

Appendix 1

Fall 2020 Semester Findings

Pamlico County's COVID-19 Response and Case Metrics

After Pamlico County went into a state of emergency due to COVID-19, the Health Department acted swiftly with county Emergency Management Services to develop a pandemic response. Measures included curbing travel and issuing guidance on interventions that effectively reduce the spread of COVID-19 like limited public gatherings, social distancing, and mask wearing. The Health Department (HD) leadership met early on with key local health partners to establish testing protocols, admissions criteria, and referral relationships between different providers. They also touched base with local school system leadership and nursing staff as well as community-based organizations and business owners to answer questions and share guidance.

The HD was resourceful in employing existing staff (only 8 staff, 1 nurse, and the director). Staff received training for tracking and tracing of COVID-19. The HD's nurse/WIC coordinator also rotated responsibilities to support contact tracing. School nurses received training in contact tracing to support departmental efforts. The department also made an emergency hire of an additional contact tracer.

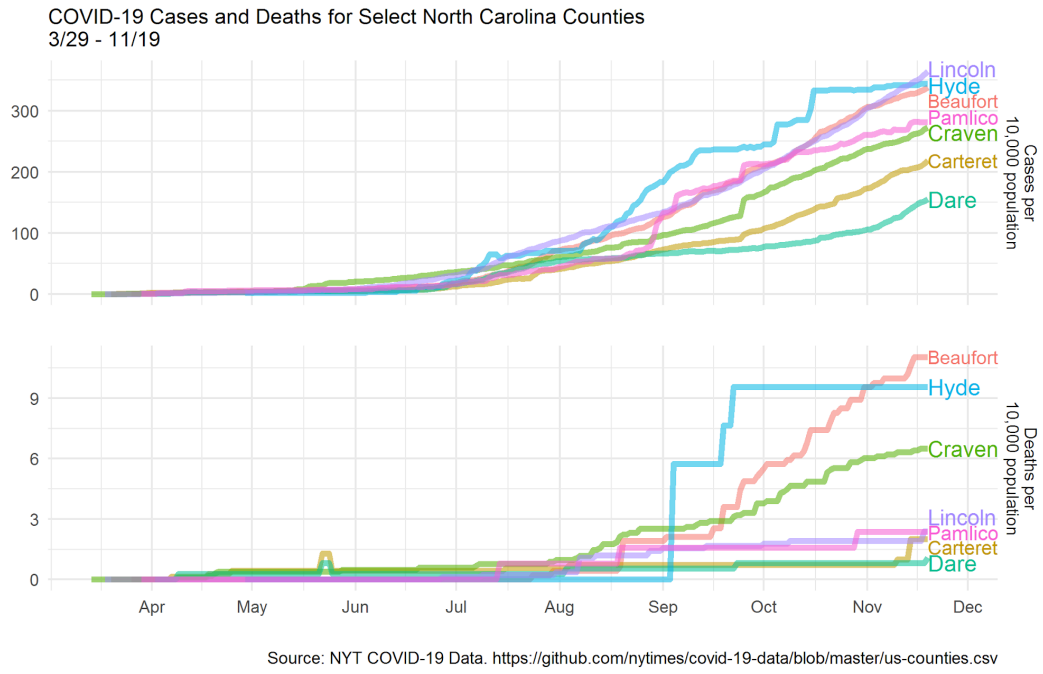


Figure 1. COVID-19 Cases and Deaths per 10,000 Residents for Select North Carolina Counties.

Challenges to Pamlico County COVID-19 Response

Community health and demographics

Pamlico County suffers from a higher disease burden than many other neighboring and rural North Carolina communities (see Fig 2). Combined with its older population, this places county residents at an increased risk for severe risks from COVID-19.

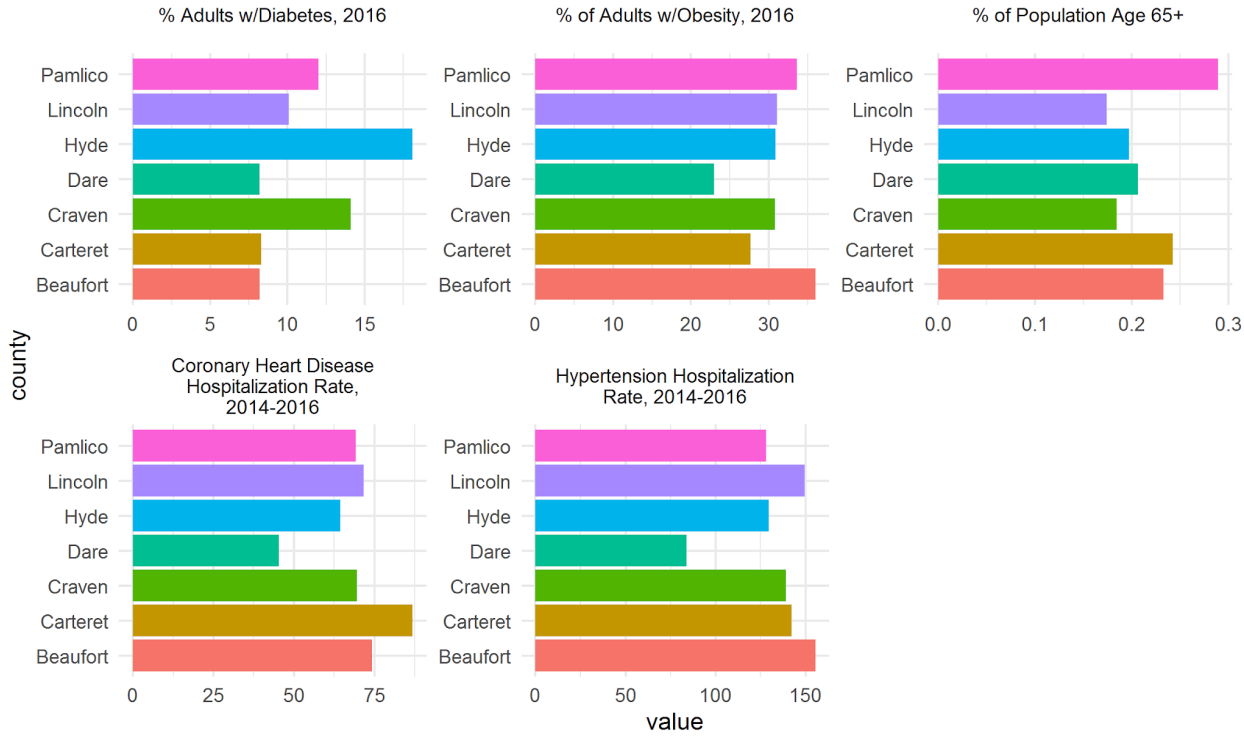


Figure 2. COVID-19 Risk Factors for Severe Illness. Source: Authors' analysis of publicly available data from Chin et al. (2020).

Local health care infrastructure and access to care

Pamlico County does not have a local hospital and has fewer health care facilities than neighboring counties (Fig 3). Having more facilities or better access to existing facilities in neighboring counties would increase access to care and testing capacity for COVID-19 and other chronic or new emerging health conditions.

The limited number of health care locations also creates barriers through increased driving distances and limited transportation options. For example, Lynn Hardison, a member of the Pamlico County Health Advisory Board and experienced health educator and nurse, indicated that mental health services are available for county residents, but that transportation issues limit access.



Figure 3 - Health care workforce and capacity.

Pamlico County residents also have limited economic resources and higher rates of people without insurance than other rural areas examined. These factors create economic insecurity and further limit access to care.

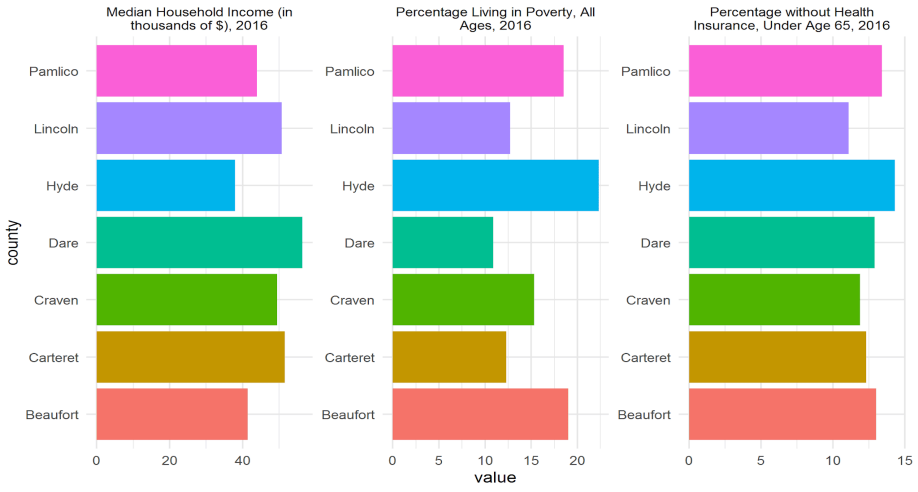


Figure 4 - Income levels, poverty rate, and uninsured rate.

State and Local Funding Support

Higher total CARES Act relief funding, CDC ELC funding for the health department, and county general fund spending allocations bolstered other county responses.

Table 1 - COVID-19 Relief Funding - Totals and Amount per Resident.

County	CARES Act Relief Funding Municipal Distribution	CDC Epidemiology and Laboratory Capacity Funding	Total COVID-19 Relief Funding	COVID-19 Relief Funding per Resident
Pamlico	176,010	108,477	284,487	22
Beaufort	481,666	158,029	639,695	14
Carteret	682,169	181,749	863,918	12
Craven	973,536	296,294	1,269,830	12
Dare	392,604	137,837	530,441	15
Hyde	106,536	96,370	202,906	39
Lincoln	830,573	223,490	1,054,063	13

Note: Larger values have darker shading. Source: Authors' analysis of data from the following sources - CARES Act relief funding https://files.nc.gov/ncgov/Local-Government-Coronavirus-Relief-Fund-County-Allocations.pdf; CDC ELC funding https://files.nc.gov/ncdhhs/documents/ELC-LHD-Funding-Allocation.pdf.

As seen in Table 1, Pamlico County received COVID-19 relief funding amounts per person above some other rural counties, but the county's general fund budget indicates that its overall funding resources were lower than its neighbors.

Understaffed Health Department

The Pamlico County Health Department consists of eight staff members, a nurse, and the director. Other departments examined are larger and have more providers covering a broader

range of health services. For example, the Craven County Health Department is also a Federally Qualified Health Center, meaning it engages in more direct health service provision. Similarly, Dare County has 196 staff affiliated with its Health and Human Services Department.

Key Interview Findings

To better understand rural county responses to COVID-19, we interviewed other health department directors (Craven, Dare, and Lincoln). Interviews identified similarities and differences in pandemic responses as well as common issues that rural public health leaders have encountered in responding to COVID-19. Our findings are summarized below across key themes that emerged from these conversations.

Local and State Leadership Support

Many directors felt adequately supported by other local leaders. They expressed that having strong supportive relationships with political leadership before the pandemic ensured that their resource and funding needs were addressed. Existing strong relationships also kept politics from influencing the county's public health response.

One participant indicated that while they have been supported during the pandemic, that long-term public health funding was "a sore spot." They said that "Public health doesn't get the recognition it needs until a catastrophe strikes," and expressed the need for recurring funding to bolster local health systems and ensure an action-ready public health infrastructure.

Perceptions of state support were mixed. Participants benefited from state officials' weekly updates and sharing of funding information. However, directors indicated that the development and implementation of state support was too slow to meet their immediate pandemic needs. They also felt left out of policy development decisions and highlighted that guidance did not always address their community's concerns - "we know our community and people." Directors had a desire for state officials to get more rural county perspectives "instead of all the rulemaking coming out of Raleigh."

Strong and Consistent Communication Strategies

Partnering early with key stakeholders (health care providers, other county leadership, schools, businesses, nonprofits, and law enforcement) promoted the delivery of a strong and unified COVID-19 communication strategy. Directors mentioned how delivering a consistent message on a predictable timeline increased public trust and acceptance of response measures like contact tracing - "people understood the process, understood the benefits, and felt accountable to the community." HD leaders also held targeted sessions for specific stakeholders like schools or daycares and businesses to address their exact concerns.

Frequent information sharing with county commissioners ensured these political leaders were equipped with up-to-date technical information for decision making. Social media messaging also bolstered public health communications by promoting wider access to key COVID-19

metrics to a broader audience. Early and frequent communication with school systems enabled directors to address parent and teacher concerns while proactively stopping misinformation rumor mills. Novel messaging methods like videos featuring directors ensured that residents knew their public health leader and promoted accountability.

Leverage Local Partnerships

Participants indicated that short small-scale briefings with other rural HDs would provide a forum for having challenging questions answers and for sharing pandemic response best practices. However, they recognized that local departments are "in the trenches" dealing with their own county's concerns.

Existing strong stakeholder relationships were key to developing and maintaining a robust pandemic response. Participants expressed that early engagement and consistent communication with other health care providers, businesses, schools, and nonprofits improved their testing and contact tracing procedures. This communication also ensured a consistent and unified public health message.

All participants described their community colleges as a source of "untapped potential" for bolstering their county's pandemic response and local health system. Having health students support immediate contact tracing efforts was intriguing to directors. Longer-term collaborations on community health worker or community paramedicine programs were also of interest to interviewees.

Repurposing Untapped Labor and Resources

Participants mentioned training school nurses and health educators to support their COVID-19 responses, particularly contact tracing. Some counties also pulled in social workers and administrative staff to increase their contact tracing capacity. Repurposing existing resources helped rural counties overcome initial resource constraints while the state built up additional supports.

Contact Tracing and Testing

As cases increased across North Carolina, health department directors noted that counties had to implement creative contact tracing solutions while state resources lagged. Many repurposed staff, like social workers or school nurses, for contact tracing efforts. Similarly, Pamlico County increased contact tracing capacity with school nurses support and added contact tracing as a rotating requirement for the HD's nurse and WIC coordinator. A main takeaway for contact tracing and any future public health response was to assess the manpower power needed up front and train resources earlier on before cases greatly increased.

Health departments also describe the importance of educating groups on the importance of contact tracing. Some counties worked with local employers and managers to spread accurate information on contact tracing.

Several counties implemented drive-thru COVID-19 testing. Residents were able to call ahead and make appointments, and counties reported the process was overall smooth. Additionally, the number of people attending testing clinics helped health departments gage the potential number of COVID-19 cases in a given week.

Some County Collaboration on COVID-19, but Room for More

Health departments reported partnering with neighboring counties on health initiatives prior to the pandemic, but for the most part have operated individually on COVID-19 efforts. Counties that share health centers with neighboring areas note the importance of strong communication between health departments on positive COVID-19 cases across community lines. Additionally, several health department directors participate in ongoing updates calls with other county leaders. These meetings give counties the opportunity to share pertinent information and feedback, and brainstorm solutions when unique county-specific issues arise.

Exacerbated Mental Health Concerns

Participants told us that mental health and substance use disorder were pre-existing issues in their communities that have been exacerbated by COVID-19. School closures and job losses increased stress and anxiety for families. No longer having separate daily routines increased frustration among family members, with participants noting rises in alcohol sales, drug-related overdoses, and domestic violence.

Telehealth was cited as a critical care delivery method for maintaining access to mental health services during the pandemic. Directors worked to develop telehealth resource guides and promote its use among local health providers. Multiple participants said that having relationships between their community-based providers and behavioral specialists at East Carolina University's NC Statewide Telepsychiatry (NC STeP) program helped address the mental and social needs of residents.

COVID-19 Fatigue

Several health departments noted that COVID-19 fatigue had permeated their communities, with many residents feeling apathetic towards public health efforts. Residents in some counties seem more complacent about mask wearing and social distancing since the start of the pandemic. Additionally, issues like people refusing to work with contact tracers or telling friends and family that the virus is not harmful after surviving a mild case hinder COVID-19 public health campaigns. To combat the fatigue, health departments continue to provide community members accurate and non-politicized pandemic content and leverage local partnerships where applicable.

Health Department Burnout

Interviews indicated that contact tracing efforts required long consistent work hours. Departments felt these hours were not sustainable based on their staffing levels. Directors made

efforts to create a more sustainable work schedule, reduce weekend hours, and train other staff for increased rotation of contact tracing responsibility to prevent burnout.

"There's been some long hours and some short tempers because we've been doing this (contact tracing), you know, nonstop, seven days a week."

Summary of Best Practices in County COVID-19 Response

Based on our interview findings, other health departments emphasize the below best practices in assisting with effective county COVID-19 response:

- Have strong and consistent messaging on COVID-19 from all county leadership
- Leverage local partnership and untapped resources to help fill gaps in health department staffing
- Promote telehealth and other digital technologies for provider care during the pandemic to help alleviate exacerbated mental health concerns

Recommendations

Below are our team's preliminary recommendations to bolster the Pamlico County COVID-19 response. We will continue to revise recommendations as we gather more research and collaborate with community partners and the Pamlico County Health Department on next steps.

<u>Strengthen presentation of a comprehensible and unified message</u>

Continue sharing press releases on COVID-19 trends and working with local partners to deliver a more consistent public health message across different mediums. Consider establishing inventive communication campaigns, such as COVID-19 dashboard for the Health Department website, video campaigns, or infomercials.

<u>Develop academic partnerships with local colleges and institutions</u>

In the short-term, collaborate with the Pamlico County Community College's graphic design/web development students to support an updated HD website for streamlined navigation and COVID-19 information and resource access. Students focusing on audio/visual technologies and communications could help develop video campaigns and infomercials. Establish a long-term collaboration with the community college by jointly creating an experiential learning internship program for health students to boost the health department's workforce and strengthen human capital in Pamlico County. Students could also be placed at Hope Clinic or the local Federally Qualified Health Center for additional rotation. The health department can also consider exploring partnerships with East Carolina University and other academic institutions to support ongoing public health efforts.

<u>Leverage untapped local partnerships and state resources</u>

Form and expand partnerships with community-based organizations (churches, schools, and local businesses and nonprofits) to promote effective interventions like mask wearing and social distancing, that also supports community cohesion and development. For instance, the health department could consider leveraging the Pamlico County COVID-19 Community Task Force further and co-brand and sponsor ongoing organization efforts. The health department can also consider the use of drive-thru testing sites or vaccination sites in the future. Seek out longer-term collaboration with the NC Statewide Telepsychiatry program to overcome mental health access barriers and allow residents to receive care in the community. Lastly, Pamlico County can explore opportunities with the North Carolina Office of Rural Health, Duke University and University of North Carolina Chapel Hill that place medical providers and students on clinical rotations in the county.

Field a resident survey to address ongoing needs

Use the annually required Community Health Needs Assessment to also identify resident needs and leading health concerns during the pandemic, as well as acceptance and adherence to social distancing and mask wearing. Consider incorporating questions that measure community perceptions on vaccines. Additional topics and considerations for the resident survey are included in the Appendix.

Form North Carolina county coalitions

Establish ongoing brief meetings with other rural county HD directors to answer questions and disseminate information. Long-term relationships could support collaborative efforts to provide essential public health services. Dr. Bill Pan, an Associate Professor of Global Environmental Health at Duke and author of a report on the effectiveness of county-level COVID-19 interventions, indicated that high resource counties were better able to implement interventions like quarantining and mask wearing than under-resourced communities. He suggested that smaller rural counties band together to form coalitions that would magnify rural leaders' voices at the state level and facilitate information sharing and best practices among front line public health leadership. This research team could explore if the North Carolina Office of Rural Health could help facilitate these county partnerships or offer technical assistance.

Next Steps

As our team continues to investigate best practices in county COVID-19 responses, we plan to explore the following next steps:

- Gather additional COVID-19 response data, like other HD staffing levels, contact tracers, and testing capacity
- Conduct interviews with the following entities:
    - Pamlico Community College
    - Other Community Colleges with CHW curriculums - Catawba, Durham Tech, Edgecombe, Haywood
    - Other County Health Departments - Beaufort, Catawba, Hyde, and Robeson

    - Other pertinent Pamlico County public health officials
- Explore available grants:
    - Broadband access
    - NC Office of Rural Health (CHC and HRSA grants)
        - NC SteP collaboration
- Investigate additional innovations that can bolster pandemic response:
    - Vaccine distribution and access
    - Mobile health clinics/vans (Durham Tech currently implementing)

Appendix 2

Methodology

Research Questions

- What were effective Pamlico County responses to Pandemic Mitigation?
- In comparison with 3 or more other counties, identify the most effective county level responses to the Pandemic
- How might Pamlico improve in the future and adopt best practices from other counties?
- How might digital and proven frugal innovations, specifically addressing county health system gaps, COVID-19 or other epidemics/crises be used in Pamlico County in the future?
- How might Pamlico County use digital and proven frugal innovations to fill any gaps and address citizens' chronic conditions that NC state health resources do not support?

Methods

Our team used a literature review, in-depth semi structured interviews, and a review of county health department websites and public resources to better understand the policy environment of rural North Carolina county-level responses to COVID-19. Comparing findings between Pamlico County and neighboring or other small rural counties will identify strengths and opportunities for improvement related to pandemic response and general health needs in the local community. In-depth semi-structured interviews with other county health department directors enhanced the literature review by adding the richness of lived experience and state and community specific context. Specific findings from each research method informed our recommendations. Additionally, we reviewed digital and frugal innovations to reduce health system gaps in Pamlico County. Topics of focus included access to care, chronic conditions (especially diabetes), and mental health. Innovation ideas explored included: community paramedics/community health workers for home visits and chronic condition management; using text messaging to promote patient medication adherence and self-management of chronic conditions; partnering with telepsychiatry providers for community-based behavioral health; and, pooling resources through

the development of rural county coalitions and partnerships with the local school system or community college to improve intervention effectiveness and sustainability.

Participants

This spreadsheet summarizes our interview contacts.

Process

We conducted our literature reviews by searching for key terms in academic and gray literature repositories like Google Scholar and PubMed. This initial search identified critical papers. The snowball method expanded the literature search beyond critical papers to identify further resources. Snowballing refers to identifying new papers based on references in the critical papers as well as papers that cite the critical reports (Wohlin, Mendes, Felizardo, & Kalinowski, 2020).

Our PIs identified some interviewees for us. We identified additional participants through snowball sampling – asking participants for recommendations on others to speak with. Interviews were scheduled using email. Interviews lasted between 30-60 minutes, consisted of 5-10 questions, and occurred over Zoom. Participant consent was obtained before recording interviews. Otter transcribed the audio content from interviews. Transcript analysis consisted of identifying common themes and differences among participants.

Data analysis of trends in COVID-19 cases, county demographic, socioeconomic, and disease profiles, as well as county-level budgets and COVID-19 relief funding complemented our qualitative work. These data were all publicly available. Microsoft Excel and the R statistical analysis software were used for quantitative analysis.

Preliminary Survey Considerations

- Partner with HD through on community survey
- Topics to address
    - Public acceptance and adherence to COVID-19 interventions like mask wearing, social distancing, and quarantining
    - Community perceptions on vaccines
    - Resident perceptions and experiences with county response
    - Political determinants
    - Additional topics important to HD

Access and Recruitment

1. How can we survey a representative sample given broadband access limitations and low smartphone/internet use?
    a. For example, would SMS/email recruitment be more effective?
2. Fielding survey opportunities
    a. Convenience sample of CCTF newsletter or TownDock blog readers
    b. Churches
    c. Facebook

3. What is our message to motivate response? Could we offer incentives?
    a. Likely needs to be some social norming (e.g., completing this survey makes Pamlico stronger and keeps your loved ones safe)

Methods and Instruments

- Qualtrics, Google Form, others?

Topics

1. Demographics
2. Community members thoughts on what went well and what didn't go well in COVID-19 response
    a. Trust in county health system
3. Behavioral questions related to COVID-19 intervention behavior (acceptance and adherence to mask wearing, social distancing, quarantining, vaccines, etc.)
4. Leading health concerns/priorities (previous and amid pandemic)
5. Chronic condition management (prior management and changes due to COVID-19)
6. Politics/partisanship

Appendix 3

Frugal and Digital Innovations Report

Introduction

In conjunction with our team's review of various North Carolina rural county COVID-19 responses, we have investigated how frugal (low cost) and digital innovations can bolster community public health. The COVID-19 pandemic has exacerbated existing health conditions and barriers in Pamlico County, like access to care, difficulties in cardiovascular disease and diabetes management, as well as mental health issues. Digital and frugal innovations can help to address these leading health topics.

This report includes our interim findings on various frugal and digital innovations that bolster health systems. Additionally, we have interviewed several innovators aligned with Innovations in Healthcare, a Duke University Global Health collaboration with other partners, to help inform our understanding of the current innovation landscape. After we review our research findings on frugal and digital innovation, we will provide an overview of our interviews with the various digital entrepreneurs and discuss best practices. Lastly, we conclude with next steps.

We would like to thank our many partners that helped inform our analysis of frugal and digital innovations: Company innovators: Liberty Bunce, Leticia Cintra, Dr. Garson, Lily Olson, Dr. Rangarajan, Ting Shih, and Dr. Singa; Judd Staples from Innovations in Healthcare; and our project leads, Dr. Silimperi and Dr. Ariely.

COVID-19 Exacerbated Health Conditions and Barriers

Chronic Conditions – Cardiovascular Disease and Diabetes Management

Cardiovascular diseases and diabetes are also among the top 20 health concerns cited by Pamlico County Residents (see County Profiles in the Appendix). These conditions are both risk factors for severe illness from COVID-19. Limitations to seeing patients in person during the pandemic decrease the likelihood of proper management of these chronic conditions.

Mental Health

According to the 2018 Community Health Needs Assessment, Pamlico County residents expressed that substance abuse and mental health disorders are some of their leading health concerns. The COVID-19 pandemic has further exacerbated these concerns, creating a mental health epidemic. Job loss, economic and political uncertainty, and social isolation contribute to depression, anxiety, and suicidal ideation. The pandemic has also contributed to a large spike in drug overdoses. Local Pamlico County health educator and nurse, Lynn Haridson, reported high incidences of mental health episodes in public schools since the pandemic and cited concerns that many families lack transportation necessary for accessing care.

Opportunities to Bolster Pamlico County COVID-19 Pandemic Response and Address Community Health Barriers Through Frugal and Digital Innovations

Access to Care

COVID-19 has created further delays in medical care. The CDC estimates that, by the end of June 2020, 41% of US adults delayed or avoided health care because of COVID-19. The rate of avoided emergency care was highest among vulnerable populations like Black and Hispanic adults, as well as those with chronic conditions. Avoiding needed medical care is costly for health systems and increases the risk of complications from chronic conditions.

Usefulness of Frugal and Digital Innovations

Frugal innovations allow local health systems to do more with less, for the many. Implementation of frugal innovations often occurs in contexts that are resource constrained or lack institutional capacity. Because there is not a hospital in Pamlico County, moving care delivery to lower cost community- and home-based settings is advantageous. Broadening the number of low-cost local providers can ensure residents receive care from trusted community members who understand their unique needs.

The limited number of healthcare facilities and workers also demonstrates a role for digital services like telehealth and remote patient monitoring. Simple digital interventions like text message reminders use a ubiquitous resource (phones) to promote patient self-care management for chronic conditions and increase appointment attendance and medication adherence.

Overview of Frugal and Digital Innovations Interventions

Pamlico County Health Department can consider implementing the following frugal and digital innovation interventions to help bolster ongoing pandemic response.

- **Partnering with the Pamlico Community College** and pursuing funding through the Duke Endowment could be promising options for developing and implementing these models in Pamlico County. The NC DHHS Office of Rural Health can also offer technical assistance and guidance on credentialing and training frontline public health providers.
    - **Community health workers** are trusted members of a community that bridge gaps between providers and patients through home visits, health navigation, and health education/promotion. Evidence indicates that they significantly lower diabetes risk.
    - **Community paramedics** perform routine remote patient check-ups and home visits to address the unmet social and medical needs of vulnerable rural residents. Evidence indicates that they improve patient care coordination, increase medication adherence, reduce preventable emergency visits, and improve self-management of chronic conditions like diabetes.
    - **Communications and graphics designer students** from the Pamlico Community College can assist with ongoing Health Department public health campaigns and COVID-19 messaging. These students can help fill capacity gaps in the Health Department and manage communication projects while receiving class credit and gaining internship experience.
- **Leverage state digital resources and pair innovations with untapped local partnerships** to bolster Pamlico County community health.
    - **Telehealth and telepsychiatry** services like the North Carolina Statewide Telepsychiatry Program (NC STeP) use videoconferencing technology to provide specialty mental health services that reduce costly unnecessary emergency department visits and hospitalizations, reduce stigma, and increase access by removing transportation barriers. This program has successfully partnered with community-based providers in Craven and Hyde counties.
    - **Text messaging** campaigns use widely available technology (mobile phones) to improve appointment and medication adherence while promoting patient self-management, which increases patient satisfaction. Evidence also indicates that text messaging improves diabetes self-management.
    - **Establish health advocates** within the community to help guide residents on available digital health services and navigate the local health system. Community-based organizations like churches, schools, and local businesses and nonprofits can designate representatives that will act as community experts on available digital health programs. Further, the Health Department could leverage community college students and the COVID-19 Community Task Force (CCTF) to assist with managing the health advocate network and future text messaging campaigns.

Frugal and Digital Innovations Opportunities

Community Health Workers

Community health workers (CHWs) are trusted members of the community trained to address residents' behavioral, medical, and social needs. These frontline public health workers help facilitate access to care by serving as a community liaison between residents and local health care providers. CHW training is adaptive, allowing their roles to expand and scale up based on evolving local health system needs. Their tasks vary but frequently include health education and care coordination support. Many CHWs assist patients with appointment reminders, facilitating referrals to community resources, promoting preventive services, and chronic condition management strategies.

A key consideration for any successful CHW program is sustainable financing. It can be difficult to secure and sustain funding and payer reimbursement for these workers because of state variation in credentialing, training, and scope of practice laws. However, CHWs have demonstrated a positive return on investment in a variety of environments.

North Carolina's Community Health Worker Initiative works to standardize the definition and training of CHWs to create a sustainable infrastructure for utilizing these workers throughout the state. Partnering with Pamlico Community College to create a CHW curriculum could fill gaps in rural health care. Durham Technical Community College currently offers a continuing education program that trains CHWs, and their curriculum could inform the development of similar training courses at Pamlico Community College. Other Community Colleges piloting CHW curricula include Catawba, Edgecombe, and Haywood. Partnerships with Hope Clinic or the Greene Health Care Inc. Federally Qualified Health Center could increase the network through which trained CHWs could operate. Pooling resources with these entities could help the health department champion a local CHW program to state officials at NC DHHS.

CHWs have successfully reduced risks from chronic conditions like diabetes. A six-month randomized controlled trial (RCT) found that CHWs providing diabetes self-management education and routine home visits significantly reduced HBA1C levels and increased self-reported understanding of diabetes among treated participants relative to the control group. Results from a 24-month RCT involving a diabetes education program delivered by CHWs indicate that participant blood glucose levels and weight were significantly lower than control individuals, demonstrating the promise of CHWs for diabetes prevention. Community-based partnerships were critical to the effectiveness and sustainability of these CHW programs.

Community Paramedicine

Community paramedicine, also known as mobile integrated health, gives paramedics a broader

role in the health care system and fills access gaps, particularly in rural areas. CP's tasks vary, but may include performing discharge follow-up, ensuring patient understanding of prescription medications/when and how to get refills, or connecting patients with social support services like the Supplemental Nutrition Assistance Program.

An evaluation of six community paramedicine programs in California found that it resulted in improved care coordination among medical, behavioral, and social services providers. This model also reduced avoidable emergency department visits and hospital readmissions.

The Duke Endowment has funded several CP projects in North Carolina, including one in Ashe County. The Ashe CP model demonstrated similar successes to those noted above between 2018 and 2019. It reduced hospital readmission rates and ER visits while improving patient medication adherence.

Community paramedicine relies on having an integrated relationship with the health system. Formalizing a CP model will require moving beyond the volunteer nature of Emergency Management Services in Pamlico County. Pamlico Community College is a promising partner for developing a more formal CP workforce. The college already offers EMS training and certification, so integrating CP courses into the curriculum seems feasible. As the Duke Endowment has funded seven CP projects since 2017, this organization represents a potential funding source.

The CP care delivery model has demonstrated success in addressing unmet medical and social needs of patients with chronic conditions. The Community Health Assessment Program through EMS (CHAP-EMS) conducted weekly visits with seniors living in subsidized housing to assess cardiovascular and diabetes risk. Visits also included health education and referrals to community support services. Program evaluation indicates that CP home visits resulted in reduced participant blood pressure and lower diabetes risk one year after implementation.

Telehealth and Telepsychiatry

Tele-mental health is a promising strategy for addressing this epidemic in a pandemic. This method overcomes access issues by utilizing phone or video conferencing for care delivery. The virtual nature of care also provides patients with anonymity that reduces stigma, rather than having to park their vehicle outside of a mental health care provider's office.

Telepsychiatry is an innovative and cost-effective strategy for increasing access to mental health care in underserved rural areas. In participant interviews, both Craven and Dare County Health Department Directors expressed how valuable the North Carolina Statewide Telepsychiatry (NC STeP) program has been for their residents. Craven and Hyde County (not interviewed) each have community-based telepsychiatry sites where residents can connect with specialty providers at East Carolina University's Center for Telepsychiatry and e-Behavioral Health through videoconferencing technology.

NC STeP began as a method for treating the acute mental health needs of patients presenting to emergency departments. It has expanded to include seven community-based sites. This expansion of care allows for patient engagement within the community before reaching a costly mental health crisis in an expensive ED environment.

The program has improved patient outcomes. Further, it reduces the time patients spend waiting in ERs for treatment, decreases the number of costly unnecessary hospitalizations due to involuntary commitments, and enhances community capacity for mental health treatment.

Potential barriers to program adoption include patient privacy concerns and comfort with video conferencing technologies. Community-based providers may also be concerned about liability for potential privacy violations, care coordination between specialists and their site, and reimbursement.

Text Messaging

Text messaging campaigns can be used as a tool for behavior change to help individuals better manage chronic conditions and increase disease prevention. Randomized controlled studies found that increased weight loss, smoking cessation and diabetes management occurred after implementing text messaging campaigns. Other studies have found that text messaging strategies significantly improve medication adherence by sending patients nudge reminders to take their daily prescriptions. Similarly, text messaging was found to be effective in increasing medication refill rates among Medicare patients.

The Pamlico County Health department could consider implementing text messaging campaigns that remind community members of available health services and nudge residents to partake in healthy activities, like getting a flu shot. The health department can also investigate partnering with Pamlico Community College students interested in mobile app development to create text messaging public health campaigns. Further, the CCTF communications team and potential digital health advocate network could contribute campaigns and ensure best practices are followed.

Digital Entrepreneur Interviews

In addition to our literature review on frugal and digital innovations, we interviewed several digital entrepreneurs aligned with Innovations in Healthcare to help inform our understanding of the current innovation landscape. While we do not necessarily recommend that Pamlico County partner with any of these specific innovators at this time, insights gleaned from their interviews and business models can help inform future county frugal and digital projects, particularly for community health workers.

Babylon Health

Babylon Health partners with rural and under-resourced communities by focusing on healthcare accessibility and affordability. Through a sophisticated digital app, Babylon Health helps patients navigate any health questions and provides virtual medical consultations. The virtual technology helps overcome barriers to care, like transportation or the inability to take off work to attend an in-person doctor's appointment. To gain greater community acceptance of the app technology, Babylon Health partners with local governments, health facilities, and ambassador networks to promote and educate residents on the tool. If Pamlico County decides to implement any digital

tools, they can partner with local and trusted stakeholders to promote the technology to the community.

ClickMedix

ClickMedix is a telehealth app that can be used by individuals for medical consultations, but also by community health workers serving patients in rural areas that are without smartphones. Rural communities typically lack specialist provider care, but the ClickMedix app fills this gap by connecting local health workers with specialists for more complex cases. The ClickMedix technology has recently been deployed to assist with COVID-19 symptom monitoring and protocols for individuals that require quarantine. Pamlico County could consider investigating similar telehealth tools to help fill gaps for patients that are unable to access in-person medical care.

Dimagi, Inc.

Dimagi, Inc. has developed digital app tools to assist community health workers servicing rural and under resourced populations. Community health workers that once had to rely on paper processes for patient reporting due to broadband constraints now can use Dimagi's "CommCare" technology that can operate offline. Dimagi recently pivoted their business model to include COVID-19 contract tracing capabilities and have new partnerships with several U.S. cities' public health departments. If Pamlico County pursues any digital technology to bolster local public health efforts, tools will need to have both internet and offline capabilities due to broadband access issues in the community.

Grand - Aides

Grand-Aides works with hospital systems and clinics, pairing aides with recently discharged patients for ongoing home visits. During the visits, aides foster a relationship of trust and review the treatment plan with patients and their caregivers. Further, Grand-Aides has found through randomized controlled studies that their approach improves health outcomes and decreases patient hospital readmission rates. Grand-Aides business model is successful because aides are highly trained and have direct supervision from medical providers in the hospital or clinic. As Pamlico County considers how community health workers can be integrated into the local health system, it may be beneficial to place workers within specific facilities, like Hope Clinic, so they can engage with patients during health visits.

Noora Health

Noora Health focuses on supporting caregivers of individuals that were recently discharged from the hospital to improve patient recovery outcomes. The company cites that most patients and their families are given complicated or limited information on how to manage their medical condition after discharge. Noora Health educates caregivers and the health care workers that interact with families on best practices and provide various tools to promote healthy recoveries. Future community health workers operating in Pamlico County can leverage this model and work more directly with caregivers and patients to bolster health recoveries.

Projecto CIES

Projecto CIES operates in several major Brazilian cities and uses mobile health clinics to bring care to vulnerable populations. Their services focus on specialty procedures like ultrasounds, colonoscopies, and ophthalmology care. The mobile medical centers help alleviate long patient wait times experienced in a more traditional setting. Pamlico County can leverage this model as they consider opportunities for community paramedicine and mobile health clinics.