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Government Applications of Digital Health (Telehealth) in Multi-Sectoral Settings: Participatory Action Research with Key Stakeholders

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
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Abstract

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MPH, Nova Southeastern University College of Osteopathic Medicine, 2012

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Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Digital health has not been widely applied in public health settings. The gap in the literature reflected a lack of population health-based, remote access initiatives. The study examined the implementation of digital health programs, including telehealth, in multi-sectoral government applications. The co-generative model of participatory action research was applied to examine the utility of disseminating information in real-time through increased use of digital health, as well as the impact on practice within the field of public health. The framework was based on the diffusion of innovation theory. The two key research questions included understanding the perceptions of government and community stakeholders of the status of digital health in the county of interest and their perceptions regarding digital health utilization in the sphere of emergency preparedness, mental health, substance use prevention, senior services, and public health education. An additional question examined their recommendations for advancing countywide digital health services. Data were reviewed and analyzed in detail and coded as concepts that became apparent at each stage of the analysis. Results suggested that access to digital health is lacking despite the initial telehealth expansion during the COVID-19 pandemic. Stakeholders recommended improving access to digital healthcare; mitigating barriers such as medical transportation issues; and enhancing existing access to care. They recommended improvements to connectivity (broadband), accounting for lack of access to technology and education on use of technology. Implications for positive social change include streamlined health care access that can further disease prevention and potentially reduce healthcare costs and save lives.

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Dedication

To my family, friends, and colleagues. Thank you for all your support and patience.

Acknowledgments

Special acknowledgement of my instructors and mentors for helping me navigate this journey.

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Chapter 1: Introduction to the Study

In the United States of America, digital health initiatives that preserve the continuity of care have the potential to better address the healthcare needs of residents. According to the United States Food and Drug Administration (FDA), "the broad scope of digital health includes categories such as mobile health (mHealth), health information technology (IT), wearable devices, telehealth and telemedicine, and personalized medicine" (FDA, 2020). The Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services defines telehealth as the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health, and health administration (HRSA, 2017).

Digital health platforms, if uniformly adapted, as well as adequately incorporated into the existing infrastructure of care delivery, may improve community support services, as well as public health; however, these options are not readily available (Gelman, 2019). Residents in rural geographic areas have limited access to healthcare, as do their urban and suburban counterparts residing in economically depressed areas, resulting in poor health outcomes (National Conference of State Legislators, 2011). Residents in rural regions face a unique set of challenges and healthcare needs: the low population density in relation to proximity, and low availability of healthcare providers in these regions exacerbate health disparities. The National Conference of State Legislators (NCSL; 2011) reported close to one-fifth of the American population live in rural areas; however, only an estimated ten percent of physicians practice there. The NCSL (2011)

published, “rural Americans are nearly twice as likely to die from unintentional injuries and travel greater distances to reach a doctor or hospital” (National Conference of State Legislators, 2011). As a result of the barriers to accessing care, low socioeconomic factors, and other disparities in health equity and social determinants of health, health indicators are considerably worse for rural populations as compared to their urban counterparts.

Digital health has not been widely applied in public health settings. The gap in the literature review reflected a lack of population, health-based, remote access initiatives. The justification for this research stems from the limited research on viable integration of remote access platforms within population health improvement efforts (Gelman, 2019). Furthermore, the COVID-19 pandemic tested the limits of the public health pandemic response and healthcare delivery infrastructure in the United States and revealed an overwhelming need for improvement. The applications of digital health for population health uses include medical, health education/prevention, emergency response, communicable disease investigation, and remote health monitoring, all of which may ameliorate the current deficiencies. The gap in the literature is the lack of research on expanding digital health to population health applications, specifically with regard to communicable disease investigation and contact tracing; the use of electronic information and telecommunications technologies to support and promote long-distance health education and disease prevention; and improving continuity of and access to medical care, as well as public health emergency response efforts.

Gelman (2019) highlighted the tremendous benefit of telehealth initiatives, along with the potential for transforming the realm of health care by reducing delivery costs and increasing access to continuity and quality of care. It makes sense for government entities to consider integrating multi-sectoral remote access applications for the inherent efficiency of program delivery and ease of incorporation and cost, allowing for virtual cross sector collaborations (Gelman, 2019). Local health departments maintain the facilitator role in convening pertinent stakeholders and partners for community health assessments and community health improvement plans, as well as new public health initiatives. Digital health may assist with delivering epidemiological surveillance of reportable, communicable diseases and chronic conditions, along with other health indicators, as well as improve public health education, disease prevention, emergency preparedness and population health outreach efforts within the assigned geographic region.

Background of the Study

Selected articles relating to telehealth in healthcare describe the reasons why some hospitals implement telehealth programs while others do not. The inherent notion that telehealth may greatly improve access to care as well as healthcare delivery permeates the article by Adler-Milstein (2014) et al., which incorporated several factors that may influence the vast implementation of telehealth initiatives within the U.S. Among the main priorities are state reimbursement, along with licensure and policies that play a pivotal role in the uniform adaptation of these programs. The annual American Hospital Association survey revealed that almost half of the hospitals in the United States

currently possess telehealth capabilities (2014). Wang (2014) provided a novel approach to discussing telehealth initiatives as the research addressed measurable outcomes that are important to the validity of telehealth programs. The scholarly work provided quantifiable data for the increased quality of life as a direct result of telehealth technology utilization. This was a revolutionary work that provided a statistical, evidence-based framework for this dissertation topic.

The United States Department of Health and Human Services: Health Resources and Services Administration (USDHHS HRSA; 2016) concluded that poverty rate and level of educational attainment strongly influence community health outcomes. According to the USDHHS HRSA data, regions considered to be health professional shortage areas for primary care, mental health, and dental care have significant access to care issues, as outlined in the priorities of their Community Health Needs Assessment (USDHHS HRSA, 2016). In these areas, typically, the rate of age-adjusted preventable hospitalizations, ED visits, adults with poor physical health and physical limitations, obesity, and smoking are substantially higher, resulting in increased incidence of COPD, asthma, and lung disease. Similarly, the rate of cardiovascular diseases of the heart, coronary heart disease, and congestive heart failure deaths and hospitalizations, stroke deaths and hospitalizations are higher than the prevention agenda benchmarks, and that of other regions without the barriers to accessing care. On a granular level the urban and suburban population health outcomes are zip code dependent and correlate to the socio-demographics and health equity measures of the area.

Kim et al. (2013) examined how vital public health indicators such as infant mortality rates may be improved with telehealth program utilization, according to the study results. Telehealth offers the opportunity to provide a viable solution to the increased need for remote access to care. The benefits of telehealth include evidence-based cost and time effectiveness. It may have a major impact on overall health outcomes and population health, as evident in this case study. The improved infant mortality rates cited in the article support the implementation of telehealth initiatives. Lowery (2014) and colleagues also presented the versatility of telehealth by depicting the success of the Arkansas telemedicine system, which has been changing since 2003, and now includes support services and consultations through an array of medical specialties. More importantly, the various populations mentioned include everyone from inmates to HIV/AIDS patients, spanning a multitude of demographics and socio-economic determinants (Lowery, 2014). This work highlighted the tremendous benefits for rural settings.

Mueller et al. (2014) also focused on the issue of access to care in rural settings. The authors provided overwhelming evidence of positive responses and outcomes stemming from tele-emergency models in the Midwest. The hindrance noted was associated with reimbursement and lack of legislative uniformity for telehealth services (Mueller, 2014). Pearl (2014) discussed the innovative uses of technological advances with respect to patient accountability for their own health. Kaiser Permanente hospital system has embraced the concept of modern technology in the realm of patient care (Pearl, 2014). This article discussed the challenges, limitations, and immense benefits

involved in utilizing such technology. This publication is instrumental for any entity contemplating the implementation of telehealth initiatives. Similarly, Schwamm (2014) reviewed the seven strategies governing the effective adaptation of telehealth. The article discussed the groundbreaking aspects of telehealth technologies within the traditional systems of health care delivery (Schwamm, 2014). The possibilities of transforming the realm of health care by reducing delivery costs and increasing access to and quality of care are also addressed.

Grabowski (2014) and colleagues published the results of a controlled study of 11 nursing homes that "provides the first indications that switching from on-call to telemedicine physician coverage during off hours could reduce hospitalizations and therefore generate cost savings to Medicare." The authors concluded that the benefits of utilizing telemedicine initiatives are substantial. This article went on to describe the cost effectiveness, as well as the decrease in morbidity and mortality among nursing home residents, as a result of telemedicine utilization (Grabowski et al., 2014). These findings continued to describe the valid, factual basis for the utility of telehealth.

Kvedar et al. (2014) published an article highlighting telehealth as a means of making healthcare more affordable and improving patient care. The strategies discussed demonstrated the inherent benefit of telehealth to both patients and providers; furthermore, the article emphasized the need for collaborative efforts on behalf of all members of the community to implement such initiatives (Kvedar, 2014). Weinstein et al.'s (2014) peer-reviewed article, published in the American Journal of Medicine, outlined specific theories and concepts related to this topic. This journal publication

examined the gaps in the traditional healthcare delivery system that may benefit from telehealth technology. The authors provided an insight into the diverse scope of care and versatility of demographics served, and this topic remains an important one in the post Affordable Care Act era (Weinstein, 2014).

Pérez-Sust (2020) and colleagues published an article in the Journal of Medical Internet Research that discussed the crucial role digital health solutions played during the COVID-19 pandemic response in support of public health policies. It specifically reported on the strategies deployed at scale during the outbreak in Catalonia. This is one of a limited number of articles that described the digital health applications not previously frequently described in publications.

Since the gap identified in the problem statement reflected a lack of population health-based, remote access initiatives using digital health, this research aims to understand the needs, challenges, and benefits of digital health in Orange County, NY, along with the value of integrating viable remote access platforms within population health improvement efforts for other municipalities. This research encompasses government programs in geographic areas within NYS that are in the process of integrating digital health. The original contribution of this study was conducting a survey and interviewing colleagues and other participants in the digital health project in Orange County, NY, to evaluate the application and provide an assessment of digital health initiatives in public health settings. Such integration may significantly expand program capacity and drastically improve communicable disease investigation and contact tracing, health education and prevention; and continuity of and access to medical care, as well as

public health emergency response efforts, thereby counterbalancing health inequity and addressing the social determinants of health (Gelman, 2019). The potential findings may lead to broader applications of remote access platforms within the sphere of public health, thereby leading to positive social change.

Furthermore, the COVID-19 pandemic tested the limits of the public health pandemic response and health care delivery infrastructure in the United States, revealing an overwhelming need for improvement. Although more recent literature publications address some of the COVID-19 pandemic response-related applications of telehealth, they fail to account for the broader utilization of digital health within the public health setting.

The applications of digital health for population health uses includes medical, health education and prevention, emergency response, communicable disease investigation, and remote health monitoring, all of which may ameliorate the current deficiencies. The gap in literature is the lack of research on expanding digital health to population health applications, specifically regarding communicable disease investigation and contact tracing, the use of electronic information and telecommunications technologies to support and promote long-distance health education and disease prevention, improving continuity of and access to medical care, and public health emergency response efforts.

Problem Statement

In the United States of America, digital health initiatives that preserve the continuity of care have the potential to better address the health care needs of residents

(Gelman, 2019). According to the United States Food and Drug Administration (FDA), "the broad scope of digital health includes categories such as mobile health (mHealth), health information technology (IT), wearable devices, telehealth and telemedicine, and personalized medicine" (FDA, 2020). The HSRA defines telehealth as the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health and health administration (HRSA, 2017). Digital health platforms, if uniformly adapted, as well as adequately incorporated into the existing infrastructure of care delivery, may improve community support services, as well as public health; however, these options are not readily available (Gelman, 2019).

Residents in rural geographic areas have limited access to healthcare, as do their urban and suburban counterparts residing in economically depressed areas, resulting in poor health outcomes (National Conference of State Legislators, 2011). Residents in rural regions face a unique set of challenges and healthcare needs, including the low population density in relation to proximity and low availability of healthcare providers in these regions, which exacerbates health disparities. The National Conference of State Legislators (NCSL; 2011) reported close to one-fifth of the American population lives in rural areas; however only an estimated 10% of physicians practice there (National Conference of State Legislators, 2011). The NCSL (2011) published, "rural Americans are nearly twice as likely to die from unintentional injuries and travel greater distances to reach a doctor or hospital" (NCSL, 2011). As a result of the barriers to accessing care, low socioeconomic factors, and other disparities in health equity and social determinants

of health, health indicators are considerably worse for rural populations as compared to their urban counterparts.

Purpose of the Study

The purpose of this study is to examine the perceptions of key stakeholders regarding digital health utilization in mitigating barriers to health care access, as well as the benefit of integration of digital health in every facet of population health, prevention, and health education efforts to adequately address social determinants of health. The research questions focus on evaluating the feasibility and adaptability of digital health platforms for government applications, in multi-sectoral settings including emergency preparedness, mental health, substance use, public health education, senior services, as well as the uniform integration into the healthcare provision model, while preserving the continuity of care.

Research Questions

RQ1. What are the perceptions of government and community stakeholders of the current status of digital health in Orange County, NY?

RQ2. What are the perceptions of key stakeholders on digital health utilization in the sphere of emergency preparedness, mental health, substance use prevention, senior services and public health education?

RQ3. What are the recommendations of key stakeholders for advancement of countywide digital health services?

Theoretical Foundation

In public health, “diffusion of innovation theory is used to accelerate the adoption of important public health programs that typically aim to change the behavior of a social system”, hence this theory was applied in this research (Singer, 2016). The diffusion of innovations theory is commonly used in the public health field, despite several limitations, which include the following:

> Much of the evidence for this theory, including the adopter categories, did not originate in public health; it was not developed to explicitly apply to adoption of new behaviors or health innovations; it does not foster a participatory approach to adoption of a public health program; it works better with adoption of behaviors rather than cessation or prevention of behaviors; and it does take into account an individual's resources or social support to adopt the new behavior or innovation” (Singer, 2016).

For the framework of this research, the proposed initiative utilizing digital health is aimed at addressing an overarching public health program delivery infrastructure problem, and the intervention will be promoted to people in a social system with the goal of adoption based on diffusion of innovation theory, with the underlying principle that the “most successful adoption of a public health program results from understanding the target population and the factors influencing their rate of adoption” (Singer, 2016).

Conceptual Framework

The study examines the implementation of digital health programs in multi-sectoral government applications, and the co-generative model of action research is the

ideal qualitative research process for this. The model will be applied to examine the utility of disseminating information in real time through increased use of digital health, as well as the impact on practice within the field of public health, especially regarding disease surveillance, public health emergency preparedness, and health data statistics. The framework is based on the diffusion of innovation theory. The plan us to conduct participatory action research since this often leads to the most insight. This study could provide valuable information on the needs, challenges, and benefits of digital health in Orange County, with implications for use in similar areas, thus contributing to positive, real-time social change.

Nature of the Study

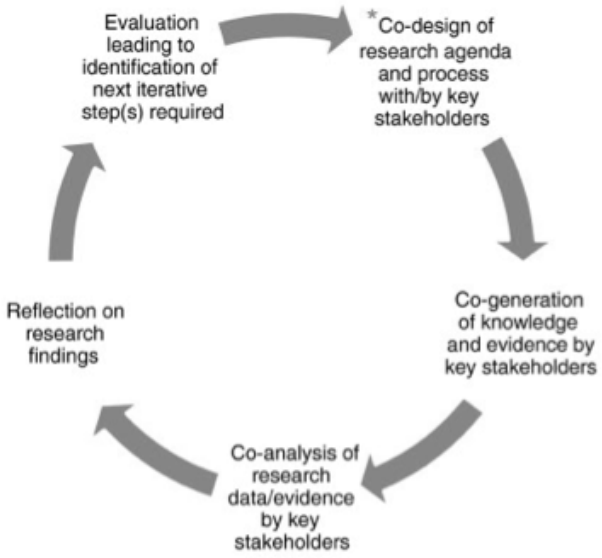
The approach and design of the study are centered on participatory action research. This is a qualitative case study addressing the research questions while exploring the perceptions and recommendations of community and professional leaders in Orange County, NY. This approach is well aligned with the problem statement, and via the recommendations of key stakeholders, will be used to examine the lack of population health-based, remote access initiatives. The aim is to determine how digital health can be better utilized in the sphere of emergency preparedness, mental health, substance use prevention, senior services, and public health education efforts, thereby addressing the absence of viable integration of remote access platforms within population health improvement efforts. Observation and documentation of interviews and surveys are all reliable means of qualitative data collection that will be utilized and incorporated into the narrative as important tools in action research. To compose a narrative that answers the

research questions posed at the beginning of the research process, the data will be analyzed.

This co-generative model, as outlined in Figure 1, is the ideal qualitative research process to examine the utility of disseminating information in real time through increased use of digital health, as well as the impact on practice within the field of public health, especially regarding disease surveillance and health data statistics. The figure below depicts action research, which is a participatory, iterative process, making it the ideal fit for this study.

Figure 1

Participatory Learning and Action Research Methodology: Cycles of Research, Co-analysis, Reflection and Evaluation Over Time (Macfarlane, 2012).



*= initial starting point, which stakeholders may re-visit and continue on from in iterative cycles of research, analysis, reflection and evaluation.

Definitions

Digital health: The United States Food and Drug Administration (FDA) defines digital health as "the broad scope of digital health includes categories such as mobile health (mHealth), health information technology (IT), wearable devices, telehealth and telemedicine, and personalized medicine" (FDA, 2020).

Telehealth: The Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services defines telehealth as the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health and health administration (HRSA, 2017).

Assumptions

In the United States of America, digital health initiatives that preserve the continuity of care have the potential to better address the health care needs of residents. Digital health platforms, if uniformly adapted, as well as adequately incorporated into the existing infrastructure of care delivery, may improve community support services, as well as public health; however, these options are not readily available (Gelman, 2019). The assumptions were necessary in the context of the study to pursue action research and assess the perceptions of key stakeholders, such as local governmental departments and community organizations.

Scope and Delimitations

The scope of the study centers on the perceptions of key stakeholders on digital health utilization in the sphere of emergency preparedness, mental health, substance use

prevention, senior services, and public health education. The delimitations are set around the perceptions of key stakeholders, such as local governmental departments and community organizations, of the status of digital health in Orange County, NY, along with their recommendations for advancement of countywide digital health services.

Limitations

Action research is a practice with a social change agenda, that "involves a critique of conventional academic practices and organizations that assert either the necessity or desirability of studying social problems without trying to resolve them," as such it may be viewed as an inherent limitation of this study (Greenwood, 2007). The research outcomes rely heavily on communication with a variety of community stakeholders and may present potential issues. The competing agendas of participants may present challenges to the design and conduct of the research.

Significance of the Study

Qualitative research looks for an understanding of the issue under study. Population health remains poorly understood by many outside of the sphere of public health and public health policy. Public health is not only healthcare-based; it is focused on multiple determinants of health, including disease reduction through prevention rather than treatment, with access to medical care being just one of the many factors impacting health outcomes. In the public health arena, local health departments and community organization partners must have the mental acuity and fiscal agility to tackle increasing population health issues and a growing number of unfunded mandates, all with an ever-shrinking budget. Hence, there are barriers between prevention and health education and

the intended audience. Since the gap identified in the problem statement reflects a lack of population health-based, remote access initiatives using digital health, this research aims to understand the needs, challenges, and benefits of digital health in Orange County, NY, as well as the value of integrating viable remote access platforms within population health improvement efforts of other counties.

This research encompasses government programs in geographic areas within NYS in the process of integrating digital health. The Orange County Department of Health worked on several digital health integration initiatives within the sphere of public health. For example, on November 7, 2020, the Orange County, NY Department of Health organized an Influenza Vaccination Point of Dispensing (POD) incorporating telehealth for remote medical provider oversight, which typically may be the rate-limiting step in Emergency Preparedness POD drills, due to limited in-person availability of medical providers. The original contribution of this study is conducting a survey and interviewing colleagues and other participants in the digital health project in Orange County, NY, to evaluate the application and provide an assessment of digital health initiatives in public health settings.

The COVID-19 pandemic highlighted the need for the integration of remote access platforms into all facets of public health programs, including health education/ prevention, emergency response, communicable disease investigation, and remote health monitoring applications**.** Although COVID-19 is currently driving a part of the telehealth adoption, it is not the focus of this study. Digital health integration may significantly expand program capacity and drastically improve communicable disease investigation

and contact tracing; health education and prevention; continuity of and access to medical care; and public health emergency response efforts, thereby counterbalancing health inequity and addressing the social determinants of health (Gelman, 2019).

Overall, digital health systems may pave the way for the future of public health with streamlined health care access, along with disease surveillance, disease prevention, population health emergency preparedness response, and health education. The data may be useful as a basis for public health program initiatives, and for recommendations relating to proposed interventions that may lead to easily reproducible, fiscally responsible, long-term changes. Further, these changes may have a positive public health impact in any region and could constitute the quintessential primary prevention strategy (Gelman, 2019). The potential findings may lead to broader applications of remote access platforms within the sphere of public health thereby leading to positive social change.

Significance to Practice

This research encompassed government programs in geographic areas within NYS in the process of integrating digital health. Digital health initiatives have the potential to preserve the continuity of care and better address the health care needs of residents. Digital health platforms, if uniformly adapted, as well as adequately incorporated into the existing infrastructure of care delivery, may improve community support services, as well as public health; however, these options are not readily available (Gelman, 2019).

Significance to Theory

Digital health has not been widely applied in public health settings. The gap in the literature review reflected a lack of population health based remote access initiatives. The justification for this research stemmed from limited research of viable integration of remote access platforms within population health improvement efforts (Gelman, 2019).

Significance to Social Change

The applications of digital health for population health uses include medical, health education/prevention, emergency response, communicable disease investigation and remote health monitoring, all of which may ameliorate the current deficiencies. The findings may lead to broader applications of remote access platforms within the sphere of public health, thereby leading to positive social change.

Summary and Transition

Digital health, if uniformly adapted, as well as adequately incorporated into the existing infrastructure of care delivery, may improve community support services, as well as public health; however, these options are not readily available (Gelman, 2019). As a result of the barriers to accessing care, low socioeconomic factors, and other disparities in health equity and social determinants of health, health indicators are considerably worse for rural populations as compared to their urban counterparts.

Digital health has not been widely applied in public health settings. The gap in the literature review reflects a lack of population health based remote access initiatives. The justification for this research stemmed from limited research of viable integration of remote access platforms within population health improvement efforts (Gelman, 2019).

Furthermore, the COVID-19 pandemic tested the limits of the public health pandemic response and health care delivery infrastructure in the United States, and revealed an overwhelming need for improvement. It makes sense for government entities to consider integrating multi-sectoral remote access applications for the inherent efficiency of program delivery, ease of incorporation and cost, allowing for virtual cross sector collaborations (Gelman, 2019).

The study examined the implementation of digital health programs in multi-sectoral government applications, and the co-generative model of action research is the ideal qualitative research process for this. The model is applied to examine the utility of disseminating information in real time through increased use of digital health, as well as the impact on practice within the field of public health, especially regarding disease surveillance and health data statistics. The plan was to conduct action research as participatory research often leads to the most insights, and this study aimed to provide valuable information on the needs, challenges, and benefits of digital health in Orange County, with implications for use in similar areas, contributing to positive, real-time social change.

This research encompassed government programs in geographic areas within NYS that are in the process of integrating digital health. The original contribution of this study was conducting a survey and interviewing colleagues and other participants in the telehealth project in Orange County, NY, to evaluate the application and provide an assessment of digital health initiatives in public health settings. Although COVID-19 is currently driving a part of the telehealth adoption, it is not the focus of this study. Such

digital health integration may significantly expand program capacity and drastically improve communicable disease investigation and contact tracing; health education and prevention; continuity of and access to medical care; and public health emergency response efforts, thereby counterbalancing health inequity and addressing the social determinants of health (Gelman, 2019). The potential findings may lead to broader applications of remote access platforms within the sphere of public health thereby leading to positive social change.

This chapter featured information about the role of digital health as related to government programs and access to health care, and how critical digital health is to public health. The next chapter reveals the fundamentals of the study concerning existing literature and the gaps in the literature.

Chapter 2: Literature Review

In the United States of America, digital health initiatives that preserve the continuity of care have the potential to better address the health care needs of residents (Gelman, 2019). Digital health platforms, if uniformly adapted, as well as adequately incorporated into the existing infrastructure of care delivery, may improve community support services, as well as public health; however, these options are not readily available (Gelman, 2019). The fact is residents in rural geographic areas have limited access to healthcare, as do their urban and suburban counterparts residing in economically depressed areas, resulting in poor health outcomes (NCSL, 2011). As a result of the barriers to accessing care, low socioeconomic factors, and other disparities in health equity and social determinants of health, health indicators are considerably worse for rural populations as compared to their urban counterparts.

Introduction

Digital health has not been widely applied in public health settings. The gap in the literature reflects a lack of population health-based, remote access initiatives. The justification for this research stems from limited research of viable integration of remote access platforms within population health improvement efforts (Gelman, 2019). Furthermore, the COVID-19 pandemic tested the limits of the public health pandemic response and health care delivery infrastructure in the United States, revealing an overwhelming need for improvement. The applications of digital health for population health uses include medical, health education/prevention, emergency response, communicable disease investigation and remote health monitoring, all of which may

ameliorate the current deficiencies. The gap in the literature includes the lack of research on expanding digital health to population health applications, specifically communicable disease investigation and contact tracing; the use of electronic information and telecommunications technologies to support and promote long-distance health education and disease prevention; improving continuity of and access to medical care; and public health emergency response efforts.

The purpose of this study is to examine the perceptions of key stakeholders regarding digital health utilization in mitigating barriers to health care access, as well as the benefit of integration of digital health in every facet of population health, prevention, and health education efforts in order to adequately address social determinants of health. The literature review revealed the following concepts, predominantly relating to telehealth in healthcare, that describe the reasons why some hospitals implement telehealth programs while others do not. The inherent notion that telehealth may greatly improve access to care as well as health care delivery permeated the article by Adler-Milstein (2014) et al. that incorporated several factors that may influence the vast implementation of telehealth initiatives within the United States. The annual American Hospital Association survey revealed that almost half of the hospitals in the United States currently possess telehealth capabilities. Wang (2014) provided a novel approach to discussing telehealth initiatives (Wang, 2014), as the research addressed measurable outcomes that are important to the validity of telehealth programs. United States Department of Health and Human Services: Health Resources and Services Administration (USDHHS HRSA), (2016) concluded that poverty rate and level of

educational attainment strongly influence community health outcomes. According to the U.S. Department of Health and Human Services Health Resources and Services Administration (HRSA) data, regions considered to be Health Professional Shortage areas for Primary Care, Mental Health, and Dental Care have significant access to care issues, as outlined in the priorities of their Community Health Needs Assessment (USDHHS HRSA, 2016). The literature review reflected the theory that in telehealth we have an opportunity to provide a viable solution to the increased need for remote access to care. The benefits of telehealth include evidence-based cost and time effectiveness. It may have a major impact on overall health outcomes and population health, as evident in this case study. Lowery (2014) and colleagues also presented the versatility of telehealth, by depicting the success of the Arkansas telemedicine system which has been changing since 2003 and now includes support services and consultations through an array of medical specialties (Lowery, 2014). More importantly, the various populations mentioned included everyone from inmates to HIV/AIDS patients, spanning a multitude of demographics and socio-economic determinants. This work highlighted the tremendous benefits for rural settings. Mueller (2014) et al. also focuses on the issue of access to care in rural settings. The authors provided overwhelming evidence of positive responses and outcomes stemming from tele-emergency models in the Midwest. The hindrance noted was associated with reimbursement and lack of legislative uniformity for telehealth services (Mueller, 2014). Pearl (2014) discussed the innovative uses of technological advances with respect to patient accountability for their own health. Kaiser Permanente hospital system has embraced the concept of modern technology in the realm of patient

care (Pearl, 2014). Similarly, Schwamm (2014) reviewed the seven strategies governing the effective adaptation of telehealth (Schwamm, 2014).

Grabowski (2014) and colleagues published the results of a controlled study of eleven nursing homes that "provides the first indications that switching from on-call to telemedicine physician coverage during off hours could reduce hospitalizations and therefore generate cost savings to Medicare." The authors concluded that the benefits to utilizing telemedicine initiatives are substantial. This article went on to describe the cost effectiveness, as well as the decrease in morbidity and mortality among nursing home residents because of telemedicine utilization. These findings continued to describe the valid, factual basis for the utility of telehealth. Kvedar (2014) et al. published an article highlighting telehealth as a means of making healthcare more affordable and improving patient care (Kvedar, 2014). The authors presented the utility of telemedicine / telehealth technologies, and the strategies discussed demonstrated the inherent benefit to both patients and providers. Furthermore, the article emphasized the need for collaborative efforts on behalf of all members of the community to implement such initiatives. Weinstein (2014) et al. peer-reviewed article, published in the American Journal of Medicine, outlined specific theories and concepts related to this topic (Weinstein, 2014). This journal publication examined the gaps in the traditional healthcare delivery system that may benefit from telehealth technology. The authors provided an insight into the diverse scope of care and versatility of demographics served, and this topic remains an important one in the post Affordable Care Act era.

Pérez-Sust (2020) and colleagues published article in the Journal of Medical Internet Research discussed the crucial role digital health solutions played during the COVID-19 pandemic response in support of public health policies, and reported on the strategies deployed at scale during the outbreak in Catalonia. This is one of a limited number of articles describing digital health applications that have not been previously frequently described in publications. Since the gap identified in the problem statement reflected a lack of population health based remote access initiatives using digital health, this research aimed to understand the needs, challenges, and benefits of digital health in Orange County, NY, and the value of integration of viable remote access platforms within population health improvement efforts of other municipalities. This research encompassed government programs in geographic areas within NYS in the process of integrating digital health.

Furthermore, the COVID-19 pandemic tested the limits of the public health pandemic response and health care delivery infrastructure in the United States and revealed an overwhelming need for improvement. Although more recent literature publications addressed some of the COVID-19 pandemic response related applications of telehealth, however they failed to address the broader utilization of digital health within the public health setting. The applications of digital health for population health uses include medical, health education/ prevention, emergency response, communicable disease investigation and remote health monitoring, all of which may ameliorate the current deficiencies, however most of the current publications did not reflect that, as the gap in literature demonstrated the lack of research on expanding digital health to

population health applications, specifically with regard to: communicable disease investigation and contact tracing; the use of electronic information and telecommunications technologies to support and promote long-distance health education and disease prevention; improving continuity of and access to medical care, as well as public health emergency response efforts.

Literature Search Strategy

The iterative search process consisted of the following stages: finalizing the review questions, organizing the search strategy, and performing the search. The terms *digital health*, *telehealth*, and *telemedicine* were utilized individually, as well as in combination with the terms *medicine*, *health care* and *public health*. PubMed, Cochrane Library, and Google scholar databases were utilized to identify relevant publication.

Theoretical Foundation

In public health, diffusion of innovation theory is used to accelerate the adoption of important public health programs that typically aim to change the behavior of a social system, hence this main hypothesis of the theory will also be applied in this research (Singer, 2016). For the framework of this research, the proposed initiative utilizing digital health is aimed at addressing an overarching public health program delivery infrastructure problem, and the intervention was promoted to people in a social system with the goal of adoption based on diffusion of innovation theory. The origin of this theory stemmed from the underlying principle that the "most successful adoption of a public health program results from understanding the target population and the factors influencing their rate of adoption" (Singer, 2016), making this the ideal theoretical

proposition to qualitatively evaluate the utility of governmental applications of digital health. The diffusion of innovation theory is commonly used in the public health field, despite the following limitations:

> Much of the evidence for this theory, including the adopter categories, did not originate in public health and it was not developed to explicitly apply to adoption of new behaviors or health innovations; and it does not foster a participatory approach to adoption of a public health program (Singer, 2016).

The research questions build upon and relate well to the selected theory, as the diffusion of innovation theory works better with the adoption of behaviors rather than cessation or prevention of behaviors. It considers individual resources or social support to adopt the new behavior or innovation. The literature and research analysis revealed that the diffusion of innovation Theory has been applied to accelerate the adoption of digital health in the healthcare and clinical medical care setting; however, there remains a lack of research on expanding digital health to population health applications, specifically with regard to communicable disease investigation and contact tracing; the use of electronic information and telecommunications technologies to support and promote long-distance health education and disease prevention; improving continuity of and access to medical care; and public health emergency response efforts.

Conceptual Framework

The study examined the implementation of digital health programs in multi-sectoral government applications, and the co-generative model of action research was the ideal qualitative research process for this. The concept of digital health integration within

the public health infrastructure was examined along with the utility of disseminating information in real time through increased use of digital health. The phenomenon of emerging digital health platforms along with the impact on practice within the field of Public Health, especially regarding disease surveillance, health data statistics and public health preparedness is seminal research, and a novel conceptual framework, as digital health platforms are not broadly and consistently utilized for community health applications.

The plan was to conduct action research as participatory research often leads to the most insights, and this study could provide valuable information on the needs, challenges and benefits of \digital health in Orange County, with implications for use in similar areas. Key definitions in the framework included digital health and telehealth. The United States Food and Drug Administration (FDA) defines digital health as "the broad scope of digital health includes categories such as mobile health (mHealth), health information technology (IT), wearable devices, telehealth and telemedicine, and personalized medicine" (FDA, 2020). The Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services defines telehealth as the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health, and health administration (HRSA, 2017).

This concept has not been articulated in previous research, only a limited number of articles described the digital health applications in the field of public health as the phenomenon has not been frequently described in publications. This research aims to

understand the needs, challenges, and benefits of digital health in Orange County, NY, and the value of integration of viable remote access platforms within population health improvement efforts of other similar areas. Furthermore, the COVID-19 pandemic tested the limits of the public health pandemic response and health care delivery infrastructure in the United States and revealed an overwhelming need for improvement. Although more recent literature publications addressed some of the COVID-19 pandemic response related applications of telehealth, however they failed to address the broader utilization of digital health within the public health setting.

Literature Review

The literature review revealed the following concepts, predominantly relating to telehealth in healthcare, that describe the reasons why some hospitals implement telehealth programs while others do not. The inherent notion that telehealth may greatly improve access to care as well as health care delivery permeated the article by Adler-Milstein (2014) et al. that incorporated several factors that may influence the vast implementation of telehealth initiatives within the United States. The annual American Hospital Association survey revealed that almost half of the hospitals in the United States currently possess telehealth capabilities. Wang (2014) provided a novel approach to discussing telehealth initiatives (Wang, 2014), as the research addressed measurable outcomes that are important to the validity of telehealth programs. United States Department of Health and Human Services: Health Resources and Services Administration (USDHHS HRSA), (2016) concluded that poverty rate and level of educational attainment strongly influence community health outcomes. According to the

U.S. Department of Health and Human Services Health Resources and Services Administration (HRSA) data, regions considered to be Health Professional Shortage areas for Primary Care, Mental Health, and Dental Care have significant access to care issues, as outlined in the priorities of their Community Health Needs Assessment (USDHHS HRSA, 2016). The literature review reflected the theory that in telehealth we have an opportunity to provide a viable solution to the increased need for remote access to care. The benefits of telehealth include evidence-based cost and time effectiveness. It may have a major impact on overall health outcomes and population health, as evident in this case study. Lowery (2014) and colleagues also presented the versatility of telehealth, by depicting the success of the Arkansas telemedicine system which has been changing since 2003 and now includes support services and consultations through an array of medical specialties (Lowery, 2014). More importantly, the various populations mentioned included everyone from inmates to HIV/AIDS patients, spanning a multitude of demographics and socio-economic determinants. This work highlighted the tremendous benefits for rural settings. Mueller (2014) et al. also focuses on the issue of access to care in rural settings. The authors provided overwhelming evidence of positive responses and outcomes stemming from tele-emergency models in the Midwest. The hindrance noted was associated with reimbursement and lack of legislative uniformity for telehealth services (Mueller, 2014). Pearl (2014) discussed the innovative uses of technological advances with respect to patient accountability for their own health. Kaiser Permanente hospital system has embraced the concept of modern technology in the realm of patient

care (Pearl, 2014). Similarly, Schwamm (2014) reviewed the seven strategies governing the effective adaptation of telehealth (Schwamm, 2014).

Grabowski (2014) and colleagues published the results of a controlled study of eleven nursing homes that "provides the first indications that switching from on-call to telemedicine physician coverage during off hours could reduce hospitalizations and therefore generate cost savings to Medicare." The authors concluded that the benefits to utilizing telemedicine initiatives are substantial. This article went on to describe the cost effectiveness, as well as the decrease in morbidity and mortality among nursing home residents because of telemedicine utilization. These findings continued to describe the valid, factual basis for the utility of telehealth. Kvedar (2014) et al. published an article highlighting telehealth as a means of making healthcare more affordable and improving patient care (Kvedar, 2014). The authors presented the utility of telemedicine / telehealth technologies, and the strategies discussed demonstrated the inherent benefit to both patients and providers. Furthermore, the article emphasized the need for collaborative efforts on behalf of all members of the community to implement such initiatives. Weinstein (2014) et al. peer-reviewed article, published in the American Journal of Medicine, outlined specific theories and concepts related to this topic (Weinstein, 2014). This journal publication examined the gaps in the traditional healthcare delivery system that may benefit from telehealth technology. The authors provided an insight into the diverse scope of care and versatility of demographics served, and this topic remains an important one in the post Affordable Care Act era.

Pérez-Sust (2020) and colleagues published article in the Journal of Medical Internet Research discussed the crucial role digital health solutions played during the COVID-19 pandemic response in support of public health policies, and reported on the strategies deployed at scale during the outbreak in Catalonia. This is one of a limited number of articles describing digital health applications that have not been previously frequently described in publications. Since the gap identified in the problem statement reflected a lack of population health based remote access initiatives using digital health, this research aimed to understand the needs, challenges, and benefits of digital health in Orange County, NY, and the value of integration of viable remote access platforms within population health improvement efforts of other municipalities. This research encompassed government programs in geographic areas within NYS in the process of integrating digital health.

Furthermore, the COVID-19 pandemic tested the limits of the public health pandemic response and health care delivery infrastructure in the United States and revealed an overwhelming need for improvement. Although more recent literature publications addressed some of the COVID-19 pandemic response related applications of telehealth, however they failed to address the broader utilization of digital health within the public health setting. The applications of digital health for population health uses include medical, health education/ prevention, emergency response, communicable disease investigation and remote health monitoring, all of which may ameliorate the current deficiencies, however most of the current publications did not reflect that, as the gap in literature demonstrated the lack of research on expanding digital health to

population health applications, specifically with regard to: communicable disease investigation and contact tracing; the use of electronic information and telecommunications technologies to support and promote long-distance health education and disease prevention; improving continuity of and access to medical care, as well as public health emergency response efforts.

Summary and Conclusion

Digital health has not been widely applied in public health settings. The gap in the literature review reflected a lack of population health based remote access initiatives. The justification for this research stemmed from limited research of viable integration of remote access platforms within population health improvement efforts (Gelman, 2019). This chapter outlined the literature search criteria along with the literature review highlighting existing literature regarding telehealth initiatives, while exposing the gaps in the literature. Based on the identified gaps in literature, specifically pertaining to digital health applications in public health, the next chapter provides the research design and rationale.

This qualitative study aimed to examine the perceptions of key stakeholders regarding digital health utilization in mitigating barriers to health care access, as well as the benefit of integration of digital health in every facet of population health, prevention, and health education efforts to adequately address social determinants of health. The study examined the implementation of digital health programs in multi-sectoral government applications, and the next chapter will present the methodology, instrumentation, and address issues of trustworthiness of the study.

Chapter 3: Research Method

The purpose of this study is to examine the perceptions of key stakeholders regarding digital health utilization in mitigating barriers to health care access, as well as the benefit of integration of digital health in every facet of population health, prevention, and health education efforts to adequately address social determinants of health. The research questions focus on evaluating the feasibility and adaptability of digital health platforms for government applications, in multi-sectoral settings including emergency preparedness, mental health, substance use, public health education, senior services, as well as the uniform integration into the healthcare provision model, while preserving the continuity of care. This chapter will include the research design, rationale, methodology, and instrumentation, as well as address issues of trustworthiness of the study.

Research Design and Rationale

RQ1. What are the perceptions of key governmental and community stakeholders on the current status of digital health in Orange County, NY?

RQ2. What are the perceptions of key stakeholders on digital health utilization in the sphere of emergency preparedness, mental health, substance use prevention, senior services and public health education?

RQ3. What are the recommendations of key stakeholders for advancement of countywide digital health services?

This qualitative study examines the perceptions of key stakeholders regarding telehealth utilization in mitigating barriers to health care access, as well as the benefit of integration of digital health in every facet of population health, prevention, and health

education efforts to adequately address social determinants of health. The research questions focus on evaluating the feasibility and adaptability of digital health for government applications, in multi-sectoral settings including emergency preparedness, mental health, substance use, public health education, as well as the uniform integration into the healthcare provision model, while preserving the continuity of care. The study examines the implementation of digital health programs in multi-sectoral government applications, and the co-generative model of action research was the ideal qualitative research tradition for this.

The central concept of the study was to examine the phenomenon of disseminating information in real time through increased use of digital health, as well as the impact on practice within the field of public pealth, especially with regard to disease surveillance and health data statistics. The plan was to conduct action research, as it often leads to the most insights. Action research is a participatory, iterative process and the ideal fit; other possible choices would be less effective, as they would not provide as much insight and real-time solutions.

Role of the Researcher

For the purposes of this study, the researcher was in the observer-participant capacity, facilitated by the professional relationships the researcher had with the participants. The participants were colleagues of equal standing within the public service work environment in Orange County, NY. The fact that the participants have equal job standing diminished the potential biases, as there was no supervisory relationship between the researcher and the study participants. There were no ethical issues, as the

study was not conducted within the researcher's immediate department, and more in an extended work environment, thus eliminating conflict of interest and power differentials. Furthermore, the County ethics committee evaluated any potential conflicts of interest, and there was no use of incentives.

Methodology

This research explored the possibility of digital health integration across a multitude of sectors within a local county government in NYS, while concurrently examining the utility of use of such platforms. A comprehensive discussion on this topic with community partners culminated in an evaluation of outcomes, constituting the nature of the study. The co-generative model of action research consisted of "two analytically distinct phases: the first involves the clarification of an initial research question, whereas the second involves the initiation and continuation of a social change and meaning construction process" (Greenwood, 2007). This was a qualitative case study, exploring the perceptions and recommendations of community and professional leaders in Orange County, NY. Participatory learning and action research methodology incorporated cycles of research, co-analysis, reflection, and evaluation over time (Macfarlane, 2012).

Participant Selection Logic

Since this research examined the possibility of digital health integration across a multitude of sectors within a local county government in NYS, the sampling strategy involved community and professional leaders in Orange County, NY. The number of participants was 20 to meet anticipated thematic saturation and out of pragmatic considerations (Vasileiou, 2018). Community and professional leaders in Orange County,

New York were identified based on their expertise in the sphere of digital health and public service, contacted via phone call or e-mail, and recruited to participate in this research study. The final sample size was based on the anticipated thematic saturation. Interview and survey data were collected from appropriate participants until saturation occurred.

Instrumentation

Two data collection instruments were utilized for this study: interviews and questionnaires. The interview protocol included pre-formulated questions, which are listed in Appendix B. Literature sources were used for researcher-developed instruments. Two participatory action research cycles were conducted, using semi-structured one-on-one interviews to inform the development of a draft framework, then questionnaires to gather evaluation and feedback on the developed draft framework to establish sufficiency of data collection instruments to answer the research questions (Heslop, 2017). The data collected were reviewed and analyzed in detail and coded as concepts that became apparent at each stage of the process to establish content validity (Heslop, 2017).

Procedures for Recruitment & Participation

To ensure adequate sample size, participants answered a brief questionnaire to qualify for recruitment (Appendix A), and qualifying participants completed the consent form (Appendix B). In collaboration with community stakeholders, and with the approval of the Orange County Executive, the Orange County Legislators, the University IRB, the Orange County Board of Health and the County ethics committee, a cohort of the Orange County Department directors, and local organizational leaders were interviewed. Some of

the Orange County community and government organization representatives included were Health Centers/ Planned Parenthood; Counseling services, Colleges, Emergency Service Offices, Mental Health Departments and Facilities; Community Services agencies, Office for Aging and Youth; Veterans Affairs; Public Schools, BOCES; Law Enforcement Agencies, Prevention Councils; Hospice and/or Nursing/ Rehabilitation centers, Hospitals; FQHC's; Medical care providers/ Physician affiliate groups; and the Housing Authority (Housing Authority housing types to include but not limited to family, low income, senior, special needs/ disabled).

Data Collection

Participatory action research is defined as "cycles of active experimentation, reflection over outcomes, and sense making of what has produced or created those outcomes" (Greenwood, 2007). Two participatory action research cycles were conducted, using semi structured, one-on-one interviews to inform the development of a draft framework, then questionnaires to gather evaluation and feedback on the developed draft framework to establish sufficiency of data collection instruments to answer the research questions (Heslop, 2017). Participatory action research is "context bound and is inquiry through which participants and researchers cogenerate knowledge using collaborative communicative processes; the meanings constructed lead to social action, or these reflections on action lead to the construction of new meanings" (Greenwood, 2007). Participants exited the study with a debriefing questionnaire. Follow-up interviews were conducted as necessary for further data collection.

Data Analysis Plan

Researcher produced sources and literature sources were utilized for the data collection instruments, including the interview and questionnaire. Documentation of interviews and surveys via electronic mail is a reliable means of qualitative data collection that may be incorporated into the narrative, which is an important tool in action research. The established professional relationship of the researcher with colleagues in the noted County departments was beneficial, specifically in gathering and analyzing the qualitative information.

- Data were collected via two participatory action research cycles, using semi structured one-on-one interviews.
- The researcher collected the data via e-mail.
- Frequency included two cycles of semi structured, one-on-one interviews.
- Duration did not exceed one hour per data collection event.
- Data were recorded via written questionnaire and electronic mail.
- The follow-up plan includes repeating the preliminary steps, as necessary.

The data collected were reviewed and analyzed in detail and coded as concepts became apparent at each stage of the process to establish content validity (Heslop, 2017). Stakeholder engagement and consistent communication were instrumental in mitigating any potential weaknesses in the research study design. To compose a narrative that answered the research questions posed at the beginning of the research process, the data were analyzed, “the activity revolves around cycles of active experimentation, reflection over outcomes, and sense making of what has produced or created those outcomes”

(Greenwood, 2007). The co-generative model was the ideal qualitative research process to examine the utility of disseminating information in real time through increased use of digital health, as well as the impact on practice within the field of Public Health.

Issues of Trustworthiness

Credibility

Credibility and internal validity were established by integrating appropriate strategies, such as methods triangulation utilizing different data collection methods, as well as triangulation of sources by interviewing participants at different points in time. Furthermore, member checks were used via sharing the data interpretations with participants. Finally, anticipated thematic saturation was reached with appropriate sample size.

Transferability

Transferability, also considered external validity, was established by utilizing applicable strategies. For example, thick description was used to provide evidence that the research study's findings could be applicable to other populations and contexts.

Dependability

Dependability was established by integrating appropriate strategies, such as triangulation utilizing different data collection methods outlined above, as well as participants at different points in time. In addition, evaluation of the findings by participants and assessing the stability of data over time will ensure the reproducibility of findings, along with the future interpretations and conclusions by outside researchers.

Confirmability

Confirmability was established by integrating strategies such as reflexivity, including researcher and study participants. An audit trail was utilized through the natural progression of the research study to determine how the results were achieved.

Ethical Procedures

Institutional permissions were obtained, including the Institutional Review Board (IRB) application, the approval of the Orange County Executive, the Orange County Legislators, and the notification of the Orange County Board of Health and the County ethics committee prior to gathering information. There were no ethical concerns related to recruitment materials and processes or the plan to address them. There were no ethical concerns related to data collection/intervention activities. All data, including archival data, were confidential. Only the researcher had access to all confidential data; the participants could be granted access to their own data only, as needed for member checking. Data were stored electronically in a password-protected file and will be destroyed within 10 years of the conclusion of the research study.

The participants were colleagues of equal standing within the public service work environment. The fact that the participants have an equal job standing diminished the potential biases. There were no ethical issues, as the study was not conducted within the researcher's immediate department, but within an extended work environment, thus eliminating conflict of interest and power differentials. Furthermore, County ethics committee evaluated any potential conflict of interest. No incentives were used.

Summary

The participatory action research study included a pre-study consultation with participants encompassing their input on problem and interview questions definition, while addressing the research questions and exploring the perceptions and recommendations of community and professional leaders in Orange County, NY. This approach was well aligned with the problem statement, and via the recommendations of key stakeholders, helped explore the lack of population health-based, remote access initiatives. This study can also help determine how telehealth can be better utilized in the spheres of emergency preparedness, mental health, substance use prevention, and public health education efforts, thereby addressing the problem with the absence of viable integration of remote access platforms within population health improvement efforts.

Documentation of interviews via electronic mail, and surveys are all reliable means of qualitative data collection that were utilized and incorporated into the narrative, which is an important tool in action research. The data were then analyzed. The co-generative model was the ideal qualitative research process to examine the utility of disseminating information in real time through increased use of digital health, as well as the impact on practice within the field of public health, especially with regard to disease surveillance and health data statistics. The next chapter will include the research setting, demographics, as well as the study results.

Chapter 4: Results

The purpose of this study was to examine the perceptions of key stakeholders regarding digital health utilization in mitigating barriers to health care access, as well as the benefit of integration of digital health in every facet of population health, prevention, and health education efforts centered around adequately addressing social determinants of health. The research questions focused on evaluating the feasibility and adaptability of digital health platforms for government applications, in multi-sectoral settings including emergency preparedness, mental health, substance use prevention, public health education, senior services, as well as the uniform integration into the healthcare provision model while preserving the continuity of care. The study addressed the following research questions:

RQ1. What are the perceptions of government and community stakeholders of the current status of digital health in Orange County, NY?

RQ2. What are the perceptions of key stakeholders on digital health utilization in the sphere of emergency preparedness, mental health, substance use prevention, senior services and public health education?

RQ3. What are the recommendations of key stakeholders for advancement of countywide digital health services?

Research Setting

Some of the participants were government employees working in the community and public service sector who were able to utilize their professional experience at the time of study. This did not influence the interpretation of the study, and only enhanced

action research. Initially the potential competing agendas of participants were identified as a possible challenge in the design of the research, but this was resolved and accounted for to sufficiently complete the research.

This research explored the possibility of digital health integration across a multitude of sectors within a local county government in NYS, while concurrently examining the utility of use of such platforms. A comprehensive survey and interviews on this topic with community partners, culminating in an evaluation of outcomes, constituted the nature of the study. The co-generative model of action research consists of "two analytically distinct phases: the first involves the clarification of an initial research question, whereas the second involves the initiation and continuation of a social change and meaning construction process" (Greenwood, 2007). This qualitative case study explored the perceptions and recommendations of community and professional leaders in Orange County, NY. Participatory learning and action research methodology incorporates cycles of research, co-analysis, reflection, and evaluation over time (Macfarlane, 2012).

Demographics

Since this research examined the possibility of digital health integration across a multitude of sectors within a local county government in NYS, the sampling strategy involved the community and professional leaders in Orange County, NY. Community and professional leaders in Orange County, New York were identified based on their expertise in the sphere of digital health and public service, contacted via e-mail, and recruited to participate in this research study. Twenty participants met anticipated thematic saturation and satisfied pragmatic considerations. The final sample size was

based on the anticipated thematic saturation, with interview and survey data collected from appropriate participants.

To ensure adequate sample size, participants answered a brief questionnaire to qualify for recruitment (Appendix A). In collaboration with community stakeholders, and with the approval of the Orange County Executive, the Orange County Legislators, the University IRB, as well as the notification of the Orange County Board of Health and the County ethics committee, a cohort of the Orange County Department directors and local organizational leaders were interviewed. The Orange County community and government organization representatives included but were not limited to the: Health Centers/ Planned Parenthood; Counseling services, Colleges, Emergency Service Offices, Mental Health Departments and Facilities; Community Services agencies, Office for Aging and Youth; Veterans Services; Public Schools, BOCES; Law Enforcement Agencies, Prevention Council; Hospice and/or Nursing/ Rehabilitation centers, Hospitals; FQHC's; Medical care providers/ Physician affiliate groups and the Housing Authority – (Housing Authority housing types including but not limited to family, low income, senior, special needs/ disabled).

Data Collection

In collaboration with community stakeholders, and with the approval of the Orange County Executive, the Orange County Legislators, the University IRB, as well as the notification of the Orange County Board of Health and the County ethics committee, a cohort of the Orange County Department directors and local organizational leaders

were interviewed. The one-on-one interview questions were submitted, and responses were recorded via electronic mail.

There were no variations in data collection from the previously presented plan. There were no unusual circumstances encountered in data collection. Two participatory action research cycles were conducted, using semi structured, one-on-one interviews to inform the development of a draft framework, with questionnaires to gather evaluation and feedback on the developed draft framework to establish the sufficiency of data collection instruments to answer the research questions (Heslop, 2017). Participants exited the study with the debriefing questionnaire that included two questions, “is there anything that has not been addressed?” and “what would you like to add or discuss?”

Interview Questions

Q1. What do you think about the current status of digital health in Orange County, NY?

Q2. What do you think about digital health utilization in the sphere of emergency preparedness in Orange County, NY?

Q3. What do you think about digital health utilization in the sphere of mental health in Orange County, NY?

Q4. What do you think about digital health utilization in the sphere of substance use prevention in Orange County, NY?

Q5. What do you think about digital health utilization in the sphere of senior services in Orange County, NY?

Q6. What do you think about digital health utilization in the sphere of public health in Orange County, NY?

Q7. What are your recommendations for advancement of countywide digital health services in Orange County, NY?

Data Analysis

Documentation of interviews and surveys, via electronic mail as a reliable means of qualitative data collection, were incorporated into the narrative for the purposes of this action research. The established professional relationship of the researcher with colleagues in the noted County departments assisted in the role as researcher, specifically with gathering and analyzing the qualitative information.

- Data were collected via two participatory action research cycles, using semi structured, one-on-one electronic mail interviews.
- The researcher collected the data via electronic mail.
- Frequency included two cycles of semi structured, one-on-one interviews.
- Duration did not exceed one hour per data collection event.
- Data were recorded via written questionnaire and electronic mail.
- The follow-up plan included an exit debriefing questionnaire

The data collected were reviewed and analyzed in detail and coded as concepts became apparent at each stage of the process, to establish content validity (Heslop, 2017). Stakeholder engagement and consistent communication were instrumental in mitigating any potential weaknesses in the research study design.

The following narrative process was used to move inductively from coded units to larger representations including categories and themes in this action research approach. Interviews from multiple sources included the study participants and were used to gain practical knowledge and utilized the approved interview protocol (Appendix B). The analysis focuses on the content of each data set that was later examined, compared and contrasted with the rest of the data sources. With the dynamic aspects of action research, the data were collected and analyzed several times to represent the changing experience.

Two participatory action research cycles were conducted, using semi-structured one-on-one interviews to inform the development of a draft framework, then questionnaires to gather evaluation and feedback on the developed draft framework to establish sufficiency of data collection instruments to answer the research questions (Heslop, 2017). The data collected were reviewed and analyzed in detail and coded as concepts became apparent at each stage of the process, to establish content validity (Heslop, 2017).

Once collected, in order to compose a narrative that addressed the research questions posed at the beginning of the research process, the data were then analyzed. The co-generative model is the ideal qualitative research process to examine the utility of disseminating information in real time through increased use of digital health, as well as the impact on practice within the field of public health. According to Braun and Clark, “a code represents the researcher’s interpretation of a pattern of meaning, or a commonality, or central organizing concept in a dataset” (Braun, 2012). The interviews contributed to

paragraphs of rich, thick data that generated many codes, which were later organized in Table 1, after a two-cycle coding process.

Table 1

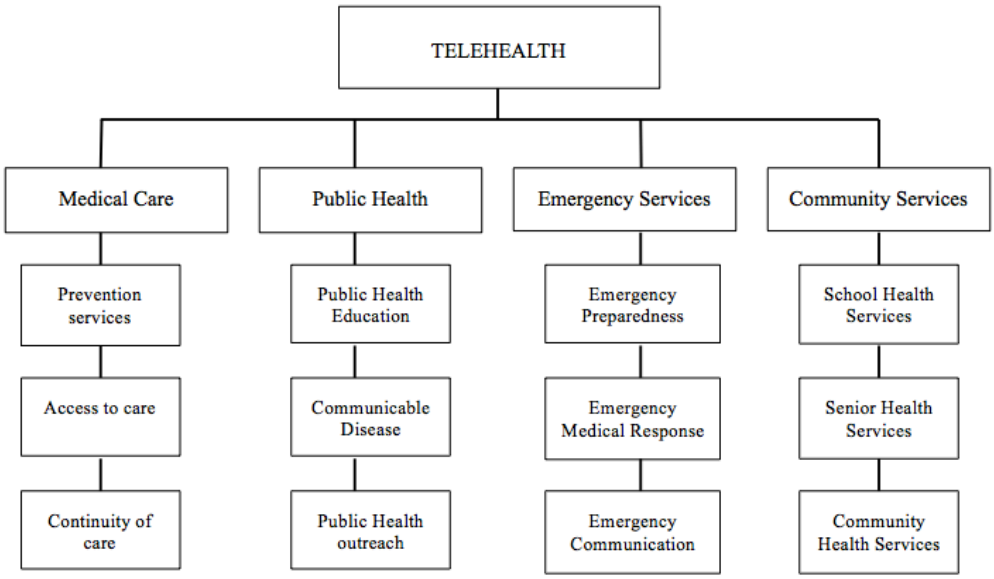
Text, Code and Type of Code

Text	Code	Type of Code
Need technology and connectivity (broadband)	Access to care	Repeated words
Improve access to health care	Access to care	Repeated words
Mitigate transportation issues	Access to care	Repeated words
Socioeconomic status	Access to care	Repeated words
Level of education	Access to care	Repeated words
Health equity and social determinants of health	Access to care	Perception/ Belief
Enhance existing access to care	Access to care	Perception/ Belief
Support service	Continuity of Care	Perception/ Belief
Supplemental sand adjunct service	Continuity of Care	Perception/ Belief
Improved access to care	Continuity of Care	Perception/ Belief
Digital health is lacking locally	Continuity of Care	Perception/ Belief
Remote access follow up visits after Emergency Department discharge	Continuity of care	Description of process
Telehealth expansion during COVID pandemic response	Prevention Services	Description of process
Connect to a healthcare provider from home with questions	Prevention Services	Description of process
Tele-monitoring from home instead of hospitalization, before or after hospitalization	Prevention Services	Description of process
Community paramedic connecting remotely with primary care or treating medical provider	Prevention Services	Description of process
Expanding the public health educator outreach by remotely connecting to populations of interest	Public Health Education	Description of process
Communicable disease and medical therapies remote monitoring (ex. TB, COVID)	Communicable Disease	Description of process
Isolation and quarantine remote observation and direct observe therapy	Communicable disease	Description of process
Telehealth stations at the local health department	Public Health Outreach	Description of process
Remote medical provider oversight for dispensing medical countermeasures during Point of Dispensing (POD) drills or actual emergency response medical countermeasures	Emergency Preparedness	Description of process
Remote connectivity from responding ambulance (EMT, Paramedic) to hospital of transport	Emergency Medical Response	Description of process
Emergency drone response (with countermeasures) for rural and remote areas outfitted with telehealth capabilities	Emergency Communication and Medical Response	Description of process
Telehealth stations at the local schools, colleges and other educational institutions to connect with medical, mental health and early intervention provider of choice	School Health Services	Description of process
Telehealth stations at the local senior centers, adult and senior residential living communities, rehabilitation centers, nursing homes, and local offices for the aging to connect with medical and mental health provider of choice, while including designated care giver or guardian	Senior Health Services and Continuity of Care	Description of process
Telehealth stations at the housing authority low income housing, homeless shelters and correctional facilities to connect with medical provider, mental health provider and substance use prevention provider of choice, while including designated care giver or guardian	Community Health Services	Description of process
Infrastructure cost to taxpayers as a concern	Cost	Something surprising
Cyber security as a concern	Cyber Security	Something surprising

Codes were organized into categories by type of code, and categories were then arranged based on commonality. After completing the iterative process of coding all the qualitative narrative data that included transcribing; immersing; reflecting; examining sorting; and grouping it into categories, apparent themes emerged. The specific codes and four themes that emerged from the data are depicted in Table 2.

Figure 2

Codes and Themes in Government Applications of Digital Health (Telehealth) in Multi-Sectoral Settings



There were two discrepant cases to report that were not factored into the analysis but were documented. One of the participants noted that "digital health is a valuable component of our healthcare system going forward;" however, they also emphasized that telehealth "should be driven by market forces with private corporations leading the way" so that "taxpayers should not have to build out the system." Another participant

mentioned “cyber security” as a concern, despite the overall “benefit to continuity of care, and utility of use.”

Results

The following data supports each finding and discusses the discrepant, non-confirming data.

RQ1. What are the perceptions of government and community stakeholders of the current status of digital health in Orange County, NY?

AQ1. The perception of government and community stakeholders is that digital health is lacking on Orange County, NY, despite the initial telehealth expansion during COVID pandemic response.

RQ2. What are the perceptions of key stakeholders on digital health utilization in the sphere of emergency preparedness, mental health, substance use prevention, senior services and public health education?

AQ2. The perception of key stakeholders is that expanding digital health services in Orange County, NY may improve access to health care; mitigate barriers such as medical transportation issues; and enhance existing access to care. Furthermore, it was noted that remote-access, follow-up visits after Emergency Department discharge may preserve continuity of healthcare. Several participants mentioned that tele-monitoring from home, instead of hospitalization, and before or after hospitalization may be a viable preventative service.

A number of other prevention services were highlighted, including connecting to a healthcare provider from home with questions, as well as community paramedics

connecting remotely with primary care or treating medical provider. Expanding the public health educator outreach by remotely connecting to populations of interest was noted as a useful public health education process. Furthermore, for public health communicable disease prevention purposes, isolation and quarantine remote observation and direct observation therapy (ex. TB, COVID) were listed as the ideal process given staffing and resource shortages. Telehealth stations at the local health department were described as ideal for public health outreach efforts.

In emergency preparedness, remote medical provider oversight for dispensing medical countermeasures during Point of Dispensing (POD) drills or actual emergency response medical countermeasures were identified as a means of addressing medical provider shortages. For emergency medical response telehealth applications from the ambulance (EMT, Paramedic) to hospital of transport; and emergency drone response (with countermeasures) for rural and remote areas outfitted with telehealth capabilities were listed as useful emergency communication tools.

Telehealth stations at the local schools, colleges and other educational institutions to connect with medical and mental health providers of choice, as well as for early intervention services, were suggested for filling in the gap of lack of onsite health care services, because virtual clinics may be better than no health care services. For senior health services, as well as to preserve the continuity of senior care, there was repeated mentions of telehealth stations at the local senior centers, adult and senior residential living communities, rehabilitation centers, nursing homes, and local offices for the aging

to connect with medical and mental health provider of choice, while including designated care giver or guardian.

Telehealth stations at the housing authority low-income housing, homeless shelters and correctional facilities to connect with medical provider, mental health provider and substance use prevention provider of choice, while including designated care giver or guardian were cited as a means of improving community health, mental health and substance use prevention services.

RQ3. What are the recommendations of key stakeholders for advancement of countywide digital health services?

AQ3. The key stakeholders recommended improvements to connectivity (broadband), accounting for lack of access to technology and education on use of technology, in order to address the existing health inequities and social determinants of health and mitigate barriers such as, socioeconomic status and level of educational attainment.

There were two discrepant cases to report that were not factored into the analysis, however, were documented. One of the participants noted that “digital health is a valuable component of our healthcare system going forward”, however they also emphasized that telehealth “should be driven by market forces with private corporations leading the way” so that “taxpayers should not have to build out the system”. Another participant mentioned “cyber security” as a concern, despite the overall “benefit to continuity of care, and utility of use”.

Summary

The next chapter includes the discussion, conclusions, and recommendations. The purpose of this study was to examine the perceptions of key stakeholders regarding digital health utilization in mitigating barriers to health care access, as well as the benefit of integration of digital health in every facet of population health, prevention, and health education efforts in order to adequately address social determinants of health. The research questions focused on evaluating the feasibility and adaptability of digital health platforms for government applications, in multi-sectoral settings including emergency preparedness, mental health, substance use, public health education, senior services, as well as the uniform integration into the healthcare provision model, while preserving the continuity of care.

The nature of the study was anchored in participatory action research. This is a qualitative study addressing the research questions while exploring the perceptions and recommendations of community and professional leaders in Orange County, NY. This approach is well aligned with the problem statement, and via the recommendations of key stakeholders will examine the lack of population health based remote access initiatives and determine how digital health can be better utilized in the sphere of: emergency preparedness, mental health, substance use prevention, senior services and public health education efforts, thereby addressing the problem with the absence of viable integration of remote access platforms within population health improvement efforts.

The perception of government and community stakeholders is that digital health is lacking in Orange County, NY, despite the initial telehealth expansion during COVID pandemic response.

The key stakeholders believe that expanding digital health services in Orange County, NY may improve access to health care; mitigate barriers such as medical transportation issues; and enhance existing access to care. Furthermore, it was noted that remote-access follow-up visits after Emergency Department discharge may preserve continuity of healthcare. Several participants mentioned that tele-monitoring from home, instead of hospitalization, and before or after hospitalization may be a viable preventative service. A number of other prevention services were highlighted, including: connecting to a healthcare provider from home with questions, as well as community paramedics connecting remotely with primary care or treating medical provider. Expanding the public health educator outreach by remotely connecting to populations of interest was noted as a useful public health education process. Furthermore, for public health communicable disease prevention purposes, isolation and quarantine remote observation and direct observation therapy (ex. TB, COVID) were listed as the ideal process given staffing and resource shortages. Telehealth stations at the local health department were described as ideal for public health outreach efforts.

In emergency preparedness, remote medical provider oversight for dispensing medical countermeasures during Point of Dispensing (POD) drills or actual emergency response medical countermeasures were identified as a means of addressing medical provider shortages. For emergency medical response telehealth applications from the

ambulance (EMT, Paramedic) to hospital of transport; and emergency drone response (with countermeasures) for rural and remote areas outfitted with telehealth capabilities were listed as useful emergency communication tools.

Telehealth stations at the local schools, colleges and other educational institutions to connect with medical and mental health provider of choice, as well as for early intervention services, were suggested for filling in the gap of lack of on site health care services, because virtual clinics may be better than no health care services.

For senior health services, as well as to preserve the continuity of senior care, there was repeated mentioning of telehealth stations at the local senior centers, adult and senior residential caregiver communities, rehabilitation centers, nursing homes, and local offices for the aging to connect with medical and mental health provider of choice, while including designated care giver or guardian.

Telehealth stations at the housing authority low income housing, homeless shelters and correctional facilities to connect with medical providers, mental health provider and substance use prevention provider of choice, while including designated care giver or guardian were cited as a means of improving community health, mental health and substance use prevention services.

The participating stakeholders recommended improvements to connectivity (broadband), accounting for lack of access to technology and education on use of technology, in order to address the existing health inequities and social determinants of health and mitigate barriers such as, socioeconomic status and level of educational attainment.

Evidence of Trustworthiness

Credibility

Credibility and internal validity were established by integrating appropriate strategies, such as methods triangulation utilizing different data collection methods, as well as triangulation of sources by interviewing participants at different points in time. Furthermore, member checks were used via sharing the emerging themes from the data interpretations with participants.

Two participatory action research cycles were conducted, using semi structured, one-on-one interviews to inform the development of a draft framework, with questionnaires to gather evaluation and feedback on the developed draft framework to establish sufficiency of data collection instruments to answer the research questions (Heslop, 2017). Participants exited the study with the debriefing questionnaire that included two questions, “is there anything that hasn’t been addressed?” and “what would you like to add or discuss?” Finally, anticipated thematic saturation was reached with appropriate sample size. There were no variations in data collection from the previously presented plan.

Transferability

Transferability, or external validity, was established by utilizing applicable strategies, such as thick description, to provide evidence that the research study’s findings could be applicable to other populations and contexts. The community stakeholders participating in the study included a cohort of the Orange County Department directors

and local organizational leaders who were comparable to similar experts in their field within any other localities in the nation.

Dependability

Dependability was established by integrating appropriate strategies, such as outside researcher inquiry audit, and triangulation utilizing different data collection methods outlined above, as well as interviewing participants at different points in time. In addition, evaluation of the findings by participants and assessing the stability of data over time will ensure the reproducibility of findings. Since digital health is a rapidly evolving field, continued inquiry, interpretations, and conclusions by outside researchers will further contribute to consistency strategies.

Confirmability

Confirmability was established by integrating strategies such as reflexivity, including researcher and study participants and their respective roles and participation in the study. An audit trail was utilized through the natural progression of the research study to demonstrate how the results were achieved, as well as provide rationale for the decisions made during the research process. These details provided valuable insight to understanding how the themes emerged from the data.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to examine the perceptions of key stakeholders regarding digital health utilization in mitigating barriers to health care access, as well as the benefit of integration of digital health in every facet of population health, prevention, and health education efforts to adequately address social determinants of health. The research questions focused on evaluating the feasibility and adaptability of digital health platforms for government applications in multi-sectoral settings including emergency preparedness, mental health, substance use, public health education, and senior services, as well as the uniform integration into the healthcare provision model while preserving the continuity of care.

The nature of this study included the approach and design that centered on participatory action research. This was a qualitative case study addressing the research questions while exploring the perceptions and recommendations of community and professional leaders in Orange County, NY. This approach was well aligned with the problem statement, and via the recommendations of key stakeholders, examined the lack of population health based remote access initiatives. It also determined how digital health can be better utilized in the spheres of emergency preparedness, mental health, substance use prevention, senior services, and public health education efforts, thereby addressing the problem with the absence of viable integration of remote access platforms within population health improvement efforts.

The study was conducted to explore how digital health initiatives have the potential to preserve the continuity of care and better address the health care needs of

residents. Digital health platforms, if uniformly adapted, as well as adequately incorporated into the existing infrastructure of care delivery, may improve community support services, as well as public health; however, these options are not readily available, as evidenced by the gap in the literature review (Gelman, 2019).

Overall, digital health systems may pave the way for the future of public health with streamlined health care access, disease surveillance, as well as disease prevention, population health emergency preparedness response, and health education. The data may be useful as a basis for a public health program initiative, and for recommendations relating to proposed interventions that may lead to easily reproducible, fiscally responsible, long-term changes that may provide a positive public health impact in any region and would constitute the quintessential primary prevention strategy (Gelman, 2019). The potential findings may lead to broader applications of remote access platforms within the sphere of public health thereby leading to positive social change.

Key findings included the perception of government and community stakeholders that digital health is lacking on Orange County, NY, despite the initial telehealth expansion during COVID pandemic response. The instrumental stakeholders believe that expanding digital health services in Orange County, NY may improve access to health care; mitigate barriers such as medical transportation issues; and enhance existing access to care. Furthermore, it was noted that remote-access, follow-up visits after Emergency Department discharge may preserve continuity of healthcare. Several participants mentioned that tele-monitoring from home, instead of hospitalization, and before or after hospitalization may be a viable preventative service.

A number of other prevention services were highlighted, including connecting to a healthcare provider from home with questions, as well as community paramedics connecting remotely with primary care or treating medical providers. Expanding the public health educator outreach by remotely connecting to populations of interest was noted as a useful public health education process. Furthermore, for public health communicable disease prevention purposes, isolation and quarantine remote observation and direct observation therapy (ex. TB, COVID) were listed as the ideal process given staffing and resource shortages. Telehealth stations at the local health department were described as ideal for public health outreach efforts.

In emergency preparedness, remote medical provider oversight for dispensing medical countermeasures during Point of Dispensing (POD) drills or actual emergency response medical countermeasures were identified as a means of addressing medical provider shortages. For emergency medical response telehealth applications from the ambulance (EMT, Paramedic) to hospital of transport; and emergency drone response (with countermeasures) for rural and remote areas outfitted with telehealth capabilities were listed as useful emergency communication tools.

Telehealth stations at the local schools, colleges, and other educational institutions to connect with medical and mental health providers of choice, as well as for early intervention services, were suggested for filling in the gap of lack of onsite health care services, because virtual clinics may be better than no health care services.

For senior health services, as well as to preserve the continuity of senior care, there was repeated mentioning of telehealth stations at the local senior centers, adult and

senior residential living communities, rehabilitation centers, nursing homes, and local offices for the aging to connect with medical and mental health provider of choice, while including designated care giver or guardian.

Telehealth stations at the housing authority low-income housing, homeless shelters and correctional facilities to connect with medical provider, mental health provider and substance use prevention provider of choice, while including designated care giver or guardian were cited as a means of improving community health, mental health and substance use prevention services.

The participating stakeholders recommended improvements to connectivity (broadband), accounting for lack of access to technology and education on use of technology, in order to address the existing health inequities and social determinants of health and mitigate barriers such as, socioeconomic status and level of educational attainment.

Interpretation of Findings

Since the gap in peer-reviewed literature reflected a lack of population health-based, remote access initiatives using digital health, this research contributed to an extended understanding of the needs, challenges, and benefits of digital health integration in multi-sectoral government settings, and the value of viable remote access platforms within population health improvement efforts. This research encompassed government programs in geographic areas within NYS that are in the process of integrating digital health. The original contribution of this study was conducting a survey and interviewing colleagues and other participants in the digital health project in Orange County, NY, to

evaluate the application and provide an assessment of digital health initiatives in public health settings. Such integration may significantly expand program capacity and drastically improve communicable disease investigation and contact tracing; health education and prevention; continuity of and access to medical care; and public health emergency response efforts, thereby counterbalancing health inequity and addressing the social determinants of health (Gelman, 2019). The findings may lead to broader applications of remote access platforms within the sphere of public health, thereby leading to positive social change.

These findings confirm and extend knowledge in the discipline. Key findings included the perception of government and community stakeholders that digital health is lacking in Orange County, NY, despite the initial telehealth expansion during COVID pandemic response. The instrumental stakeholders believe that expanding digital health services in Orange County, NY may improve access to health care by mitigating barriers such as medical transportation and enhancing existing access to care. Furthermore, it was noted that digital health may be instrumental in addressing the continuity of medical care delivery via: remote-access follow-up visits; prevention services; and remote connectivity for community paramedics.

Public health impact included expanding remote public health educator outreach; population health communicable disease prevention purposes, isolation and quarantine; remote observation and remote direct observation therapy (ex. TB, COVID); and telehealth stations at the local health department for public health outreach efforts.

In emergency preparedness the following potential benefits of digital health were noted: remote medical provider oversight for dispensing medical countermeasures during Point of Dispensing (POD) drills; emergency medical response telehealth applications from the ambulance (EMT, Paramedic) to hospital of transport; and emergency drone response (with countermeasures) for rural and remote areas outfitted with telehealth capabilities.

For community services the following initiatives were suggested for improving access, accounting for the social determinants of health and addressing the lack of onsite health care services, because limited virtual clinics may be better than no healthcare services: telehealth stations at the local schools, colleges and other educational institutions; early intervention services; remote senior health services; continuity of senior care; remote oversight for designated care giver and/ or legal guardian; telehealth stations at the local senior centers, adult and senior residential living communities, rehabilitation centers, nursing homes, and local offices for the aging; as well as telehealth stations at the housing authority low income housing, homeless shelters and correctional facilities to connect with medical/ mental health/ substance use prevention provider of choice.

The participating stakeholders recommended improvements to connectivity (broadband), accounting for the lack of access to technology and education on use of technology, in order to address the existing health inequities and social determinants of health and mitigate barriers such as, socioeconomic status and level of educational attainment.

Limitations of the Study

Action research is a practice with a social change agenda, that "involves a critique of conventional academic practices and organizations that assert either the necessity or desirability of studying social problems without trying to resolve them" as such it may be viewed as inherent limitations of this study (Greenwood, 2007). It was anticipated that there may be potential issues because the research outcomes relied heavily on communication with a variety of community stakeholders with possible competing agendas. However, there were no such challenges with the study participants during data collection. Also, the research design pre-emptively addressed any potential limitations by ensuring a sufficient participant sample size based on the anticipated thematic saturation, in order to sufficiently complete the research.

Recommendations

The recommendations for further research are grounded in the strengths and limitations of this study, as well as the literature reviewed in previous chapters. This qualitative research outlined the potential benefit of digital health integration in multi-sectoral government settings, and the value of viable remote access platforms within population health improvement efforts. Such integration may significantly expand program capacity and drastically improve communicable disease investigation and contact tracing; health education and prevention; continuity of and access to medical care, as well as public health emergency response efforts, thereby counterbalancing health inequity and addressing the social determinants of health (Gelman, 2019). The

potential findings may lead to broader applications of remote access platforms within the sphere of public health thereby leading to positive social change.

The applications of digital health for population health uses include medical, health education/ prevention, emergency response, communicable disease investigation and remote health monitoring, all of which may ameliorate the current deficiencies. There is a benefit in expanding digital health to population health applications, specifically with regard to: communicable disease investigation and contact tracing; the use of electronic information and telecommunications technologies to support and promote long-distance health education and disease prevention; improving continuity of and access to medical care, as well as public health emergency response efforts.

The government and community stakeholders noted that digital health expansion would be beneficial in upstate areas New York. The participating stakeholders believe that expanding digital health services in upstate New York may improve access to health care by mitigating barriers such as medical transportation and enhancing existing access to care. Furthermore, digital health may be instrumental in addressing the continuity of medical care delivery via: remote-access follow-up visits; prevention services; and remote connectivity for community paramedics.

Public health impact includes: expanding remote public health educator outreach; population health communicable disease prevention purposes, isolation and quarantine; remote observation and remote direct observation therapy (ex. TB, COVID); and telehealth stations at the local health department for public health outreach efforts.

In emergency preparedness there are the following potential benefits of digital health: remote medical provider oversight for dispensing medical countermeasures during Point of Dispensing (POD) drills; emergency medical response telehealth applications from the ambulance (EMT, Paramedic) to hospital of transport; and emergency drone response (with countermeasures) for rural and remote areas outfitted with telehealth capabilities.

Community services digital health initiatives may improve access to care, mitigate the social determinants of health and address the lack of on site health care services, because limited virtual clinics may be better than no health care services, the following may prove useful: telehealth stations at the local schools, colleges and other educational institutions; early intervention services; remote senior health services; continuity of senior care; remote oversight for designated care giver and/ or legal guardian; telehealth stations at the local senior centers, adult and senior residential living communities, rehabilitation centers, nursing homes, and local offices for the aging; as well as telehealth stations at the housing authority low income housing, homeless shelters and correctional facilities to connect with medical/ mental health/ substance use prevention provider of choice.

Implications

The broad application of telehealth for public health, emergency preparedness, as well as community services has the potential impact for positive social change at all levels: individual, family, organizational, societal and policy.

Public health is not only healthcare-based; it is focused on multiple determinants of health, and disease reduction through prevention rather than treatment alone, with access to medical care being just one of the many factors impacting health outcomes. In the public health arena, local health departments and community organization partners must have the mental acuity and fiscal agility to be able to tackle increasing population-wide not individual health issues, along with a growing number of unfunded mandates, all with an ever-shrinking budget. Hence, prevention and health education face barriers in reaching the intended audience. Since the gap identified in the problem statement reflected a lack of population health based remote access initiatives using digital health, this research aimed to understand the needs, challenges and benefits of digital health in Orange County, NY, and the value of integration of viable remote access platforms within population health improvement efforts of other counties.

This research encompassed government programs in geographic areas within NYS in the process of integrating digital health. For example, on November 7, 2020, the Orange County, NY Department of Health organized an Influenza Vaccination Point of Dispensing (POD) incorporating telehealth for remote medical provider oversight, which typically may be the rate-limiting step in Emergency Preparedness POD drills, due to limited in-person availability of medical providers. The original contribution of this study was conducting a survey and interviewing colleagues and other participants in the digital health project in Orange County, NY, in order to evaluate the application and provide an assessment of digital health initiatives in public health settings. The Orange County Department of Health worked on several digital health integration initiatives within the

sphere of public health. The current COVID-19 pandemic highlighted the need for the integration of remote access platforms into all facets of public health programs, including health education/ prevention, emergency response, communicable disease investigation and remote health monitoring applications**.** Although COVID-19 is currently driving a part of the telehealth adoption it is not the main focus of this study. Digital health integration may significantly expand program capacity and drastically improve communicable disease investigation and contact tracing; health education and prevention; continuity of and access to medical care, as well as public health emergency response efforts, thereby counterbalancing health inequity and addressing the social determinants of health (Gelman, 2019). Overall, digital health systems may pave the way for the future of public health with streamlined health care access, along with disease surveillance, as well as disease prevention, population health emergency preparedness response, and health education. The data may be useful as a basis for public health program initiatives, and for recommendations relating to proposed interventions that may lead to easily reproducible, fiscally responsible, long-term changes that may provide a positive public health impact in any region, and would constitute the quintessential primary prevention strategy (Gelman, 2019). These methodological, theoretical, and/or empirical implications must be considered, as the findings may lead to broader applications of remote access platforms within the sphere of public health practice thereby leading to positive social change.

Significance to Practice

This research encompassed government programs in geographic areas within NYS in the process of integrating digital health. Digital health initiatives have the potential to preserve the continuity of care and better address the health care needs of residents. Digital health platforms, if uniformly adapted, as well as adequately incorporated into the existing infrastructure of care delivery, may improve community support services, as well as public health; however, these options are not readily available (Gelman, 2019).

Significance to Theory

Digital health has not been widely applied in public health settings. The gap in the literature review reflected a lack of population health based remote access initiatives. The justification for this research stemmed from limited research of viable integration of remote access platforms within population health improvement efforts (Gelman, 2019).

Significance to Social Change

The current COVID-19 pandemic tested the limits of the public health pandemic response and health care delivery infrastructure in the United States, and revealed an overwhelming need for improvement. The applications of digital health for population health uses include medical, health education/ prevention, emergency response, communicable disease investigation and remote health monitoring, all of which may ameliorate the current deficiencies. The gap in literature is the lack of research on expanding digital health to population health applications, specifically with regard to: communicable disease investigation and contact tracing; the use of electronic information

and telecommunications technologies to support and promote long-distance health education and disease prevention; improving continuity of and access to medical care, as well as public health emergency response efforts. The potential findings may lead to broader applications of remote access platforms within the sphere of public health.

The perception of government and community stakeholders is that digital health is lacking on Orange County, NY, despite the initial telehealth expansion during COVID pandemic response. The key stakeholders believe that expanding digital health services in Orange County, NY may improve access to health care; mitigate barriers such as medical transportation issues; and enhance existing access to care, thereby offering tangible improvements within public health practice.

Furthermore, it is important to highlight the following recommendations for practice. It was noted that remote-access follow-up visits after Emergency Department discharge may preserve the continuity of healthcare. Several participants mentioned that tele-monitoring from home, instead of hospitalization, and before or after hospitalization may be a viable preventative service. A number of other prevention services were highlighted, including: connecting to a healthcare provider from home with questions, as well as community paramedics connecting remotely with primary care or treating medical providers. Expanding the public health educator outreach by remotely connecting to populations of interest was noted as a useful public health education process. Furthermore, for public health communicable disease prevention purposes, isolation and quarantine remote observation and direct observation therapy (ex. TB, COVID) were listed as the ideal process given staffing and resource shortages. Telehealth

stations at the local health department were described as ideal for public health outreach efforts.

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Telehealth stations at the housing authority low-income housing, homeless shelters and correctional facilities to connect with medical provider, mental health provider and substance use prevention provider of choice, while including designated

care giver or guardian were cited as a means of improving community health, mental health and substance use prevention services.

The participating stakeholders recommended improvements to connectivity (broadband), accounting for lack of access to technology and education on use of technology, in order to address the existing health inequities and social determinants of health and mitigate barriers such as, socioeconomic status and level of educational attainment.

Conclusions

The key essence of this study was the examination of the perceptions of key stakeholders regarding digital health utilization in mitigating barriers to health care access, along with the findings that may lead to broader applications of remote access platforms within the sphere of public health practice thereby leading to positive social change. The benefit of integration of digital health in every facet of population health includes prevention and health education efforts that adequately address social determinants of health.

Digital health integration may significantly expand program capacity and drastically improve communicable disease investigation and contact tracing; health education and prevention; continuity of and access to medical care, as well as public health emergency response efforts (Gelman, 2019).

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Appendix A: Pre-Interview Questionnaire

Please answer YES or NO to the following questions:

Q1. Do you live, work or attend school in Orange County, NY?

Q2. Have you volunteered or worked in the public or community service sphere?

Q3. Have you volunteered or worked in emergency preparedness?

Q4. Have you volunteered or worked in the mental health field?

Q5. Have you volunteered or worked in the substance use prevention field?

Q6. Have you volunteered or worked in in the senior services field?

Q7. Have you volunteered or worked in the public health field?

Q8. Have you volunteered/worked, and/or are you currently volunteering/ working at the Orange County Department of Health (NYS)?

Q9. Do you have any conflict of interest to participation in this research study?

Appendix B: Interview Protocol

Definitions

Digital Health: the United States Food and Drug Administration (FDA) defines digital health as "the broad scope of digital health includes categories such as mobile health (mHealth), health information technology (IT), wearable devices, telehealth and telemedicine, and personalized medicine" (FDA, 2020).

Telehealth: the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services defines telehealth as the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health and health administration (HRSA, 2017).

Interview Questions

Q1. What do you think about the current status of digital health in Orange County, NY?

Q2. What do you think about digital health utilization in the sphere of emergency preparedness in Orange County, NY?

Q3. What do you think about digital health utilization in the sphere of mental health in Orange County, NY?

Q4. What do you think about digital health utilization in the sphere of substance use prevention in Orange County, NY?

Q5. What do you think about digital health utilization in the sphere of senior services in Orange County, NY?

Q6. What do you think about digital health utilization in the sphere of public health in Orange County, NY?

Q7. What are your recommendations for advancement of countywide digital health services in Orange County, NY?