

Adapting Emergency Medical Services Care Delivery with Mobile Integrated Health:

A Program Development Project

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Abstract

In the United States, a small percentage of the patient population accounts for a large proportion of the total health care expenditure. This high-needs population suffers a disproportionate burden of medical, social, and behavioral challenges and ultimately has worse outcomes. Many traditional health and social care services are not designed to effectively meet the needs of these vulnerable individuals. The failure of traditional care systems to reliably match care delivery with needs results in uncoordinated, inefficient, and ineffective care for vulnerable populations. Care fragmentation also leads to an increased reliance on emergency 911 services, emergency department visits, and hospital admissions. Traditional emergency medical service (EMS) systems operate at the intersection of community, public health, and hospital systems and are strategically positioned to adapt care delivery to match the needs of vulnerable populations. An innovative EMS service called mobile integrated health (MIH) could help drive the Quadruple Aim: to control healthcare costs, improve health outcomes, increase patient satisfaction, and increase provider engagement. The purpose of this DNP project was to develop an MIH service for Gresham Fire and Emergency Services (GFES) to better address the unmet social, economic, and health care needs of the community's vulnerable population, to maintain emergency unit availability, and improve inefficiencies in the EMS system. To develop this new service, project partners developed a strategic proposal utilizing current evidence-based literature, subject matter experts, local experience and knowledge, and local 911 caller data. The project development proposal was drafted and presented to the Gresham City Council for consideration.

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Adapting Emergency Medical Services Care Delivery with Mobile Integrated Health:

A Program Development Project

In 2018, the United States spent \$3.6 trillion on healthcare, double that of any other country (Centers for Medicare & Medicaid Services, 2019). An estimated \$750 billion was wasted on unnecessary healthcare services, ineffective delivery, unnecessary administration costs, and prevention failures (Institute of Medicine, 2012). Despite the tremendous expenditure, American's have the worst health outcomes across an array of measures (Papanicolas, Woskie, & Jha, 2018; Squires & Anderson, 2015; Tikkanen & Abrams, 2019).

It is estimated that 5% of the population accounts for nearly 50% of the total healthcare expenditures (Cohen, 2014). These high-needs populations suffer a disproportionate burden of medical, social, and economic obstacles that many of our current health systems are not designed to manage (Georgiev, Stryckman, & Velez, 2019). Ineffective care delivery results in fragmented care, increased reliance on emergency medical services (EMS), inappropriate emergency department (ED) utilization, unnecessary hospital admissions, and avoidable hospital readmissions (Sun, Karaca, & Wong, 2018). The result of these failures in care delivery is extensive suffering and wasteful healthcare expenditure.

An important opportunity for improvement exists within the EMS response system. The Healthcare Cost and Utilization Project Statistical Brief analyzed data from 2006–2015 and reported that the rate of ED visits per 100,000 population reached a 10-year high for all age groups; paradoxically, the proportion of ED visits resulting in hospital admission decreased over that same time (Sun et al., 2018). This illustrates the growing utilization of EMS for care needs that could be addressed more efficiently by other providers or departments. A unique opportunity for upstream intervention exists within our traditional EMS systems that operate at the

intersection of community, public health, and hospital EDs (Chan, Griffith, Costa, Leyenaar, & Agarwal, 2019).

Across the nation, EMS systems are adapting care delivery to better meet the needs of the populations they serve. This new approach to EMS care delivery has been termed mobile integrated health (MIH) or community paramedicine (CP) (Choi, Blumberg, & Williams, (2016). Gresham Fire and Emergency Services (GFES) have recognized this need and are seeking assistance in developing an MIH service to better address unmet community needs.

Background and Significance

GFES currently operates according to a traditional EMS response model. Traditional EMS models are well equipped to respond to fires and medical emergencies of high acuity. High acuity describes health emergencies that require immediate stabilization and transport to the nearest ED. Other conditions that do not meet the EMS definition of a medical emergency are termed low acuity. Traditional EMS models intercept medical 911 calls and rapidly deploy personnel and equipment to the scene, all without substantial consideration of acuity level or patient-specific needs. Once on scene, the response unit is tasked with addressing immediate needs and quickly returning back to service. This level of efficiency ensures vital public resources are available for other emergencies, but this model fails to meet the often complex medical and social needs of low-acuity callers. Compounding this is the fact that over the past several years, EMS systems around the nation have experienced unsustainable increases in the volume of low-acuity medical 911 calls (Cannuscio et al., 2016; Sanko et al., 2019).

The inadequacy of these traditional responses to meet the low-acuity caller's needs coupled with increased volume of low-acuity 911 calls results in unnecessary transportation to hospital EDs, increased health care costs, decreased efficiency of EMS resources, and

disintegrated care (Sanko et al., 2019). These low-acuity 911 callers often require chronic disease management, close follow-up, health prevention and promotion, ongoing behavioral health support, and connection to social support networks. Failure of traditional EMS models to meet the needs of low-acuity callers strains the capabilities of public resources and results in fragmented, wasteful, costly, and inadequate healthcare.

Healthcare delivery in the United States is transforming and EMS models are no exception. Organizations must adapt their services in meaningful ways to meet the needs of the populations they serve. EMS-based MIH/CP services have emerged to address the growing number of low-acuity and frequent 911 callers. Most MIH care models pair EMS personnel with other members of the healthcare team (nurses, physicians assistants, social workers, case management, etc.) and implement an alternative response for low-acuity 911 callers (Wilcoxson, 2016). The combined interprofessional skills of MIH personnel expand EMS capabilities by incorporating holistic assessments, integrating disease and injury prevention, and enabling complex care navigation (Sanko et al., 2019). These models aim to provide patient-centered care, decrease unnecessary EMS utilization, decrease low-acuity ED use, lower healthcare costs, and improve outcomes (Sanko et al., 2019).

Target Population

In 2018, GFES responded to 12,878 medical calls in East Multnomah County for residents living in the cities of Gresham, Fairview, Troutdale, Wood Village, and unincorporated areas (City of Gresham Oregon, 2020). The city of Gresham is the fourth largest city in Oregon and accounts for the bulk of GFES medical responses. In 2018, the United States Census Bureau reported 19.2% of Gresham city residents were living below the poverty level compared to Oregon's average of 12.6%. East Multnomah County residents face higher rates of

unemployment, lower educational levels, lower median household incomes, and higher percentages of individuals without health insurance compared to Oregon's average (United States Census Bureau, 2018). It is well documented that populations faced with social and economic burdens suffer disproportionately from adverse health outcomes (Heiman & Artiga, 2015). Not only is this population facing social and economic challenges, but the tax-funded EMS services are also operating with a budget significantly lower than many other Oregon cities—a budget nearly half that of the city of Portland (Lewis, 2018). These factors present Gresham Fire with an important opportunity to improve care integration to drive the Quadruple Aim: to reduce total resource expenditure, improve community health outcomes, improve experience of care, and increase provider gratification.

Problem Statement

GFES is a traditionally operated EMS system that is currently ill-equipped to adequately address the complex care needs of low-acuity 911 callers. Without meaningful systems-level change, the vulnerable populations served will continue to suffer disproportionately from fragmented and ineffective care delivery resulting in wasteful healthcare expenditures. GFES is strategically positioned to augment care delivery by developing an alternative response for its low-acuity 911 callers: MIH. This program development project may drive the Quadruple Aim framework for healthcare improvement by improving patient care experience, improving population health, decreasing healthcare expenditure, and improving care provider well-being (Feeley, 2017; Institute for Healthcare Improvement, n.d.).

Review of the Literature

A literature review was conducted to explore and explain the many aspects of MIH/CP care model implementation. This review was used to describe the MIH/CP care model and assess opportunities, benefits, and challenges with program implementation.

Search Strategy

Databases searched in January 2020 included PubMed, CINAHL, and Scopus. Limits were set for the English language and included academic articles. The two main search terms of “mobile integrated healthcare/health care/health” or “community paramedicine” were used. Articles with EMS-based programs were included. The search yielded 43 articles and was further narrowed to 27 articles after including keywords of improving population health, decreasing healthcare costs, reducing low-acuity 911 calls, reducing EMS utilization, increasing patient satisfaction, or increasing provider satisfaction. For comparison, articles from MIH/CP programs implemented in other industrialized countries with similar outcome measures were included.

Mobile Integrated Health Program Concept

MIH/CP programs are EMS response models designed to leverage the strengths of the current EMS system and adapt care delivery to meet the growing number of high-frequency and low-acuity 911 callers (Choi, Blumberg, & Williams, 2016; Wilcoxson, 2016). MIH/CP models serve as an alternative EMS response, allowing healthcare providers to address patient-specific needs and more appropriate utilization of EMS resources (Choi et al., 2016; Wilcoxson, 2016). This model expands on EMS roles to address patient-specific needs, including wellness, prevention, chronic disease management, postdischarge care, and accessing social support networks (Choi et al., 2016). The American College of Emergency Physicians (2015) policy statement advocates that MIH/CP programs can fill community healthcare gaps and are an

integral part of the public safety net. Enthusiasm has grown for MIH/CP programs to improve patient outcomes, decrease frequent low-acuity 911 utilization, reduce ED transportation, reduce ED overcrowding, reduce hospital admissions/readmissions, and decrease healthcare costs (Choi et al., 2016; Georgiev et al., 2019; Gregg et al., 2019; Pang et al., 2019).

Target Population Needs

It is important to understand what conditions are affecting the individuals associated with the increased utilization of EMS. EMS personnel often interact with the same individuals in their communities and many of those who call 911, call frequently (Mahmuda et al., 2018). Many factors can be attributed to frequent 911 usage, including complex chronic disease, multiple comorbid conditions, mobility issues, frequent falls, and social isolation (Agarwal, Pirrie, et al., 2019; Bennett, Yuen, & Merrell, 2018; Cannuscio et al., 2016; Mahmuda et al., 2018). Other contributing factors are lack of alternative services, difficulty accessing primary care, lack of case managers, and inaccessible behavioral health services (Mahmuda et al., 2018). Older persons and those with mobility problems are a subset of individuals who call 911 frequently for a lift assist or help to get up from a fall but do not require ED transportation (Agarwal, Pirrie, et al., 2019; Leggatt et al., 2017). Specific health conditions have also been documented for frequent 911 callers, with the most common being hypertension, hypercholesterolemia, esophageal reflux, history of falls, diabetes, obesity, chronic pain, congestive heart failure, mental health disorders, asthma, COPD, history of MI, chronic pain, and tobacco use disorder (Scharf, Bissell, Trevitt, & Jenkins, 2019). Many individuals have multiple comorbid conditions and require interventions outside of the traditional EMS care delivery (Scharf et al., 2019). Social, economic, educational, and environmental factors play a central role in health outcomes and EMS utilization; concurrently, these disadvantaged individuals suffer disproportionately from

uncoordinated health care delivery (Georgiev et al., 2019; Heiman & Artiga, 2015).

Qualitative data collected from interviews with low-acuity and frequent 911 callers showed callers were angry with the health system for not solving their health problems and others called in times of desperation (Mahmuda et al., 2018). Other 911 callers attributed their EMS utilization to barriers associated with inaccessible primary care appointments, inadequate behavioral health resources, lack of transportation, and financial hardships (Leggatt et al., 2017).

A standard definition of frequent EMS and ED utilization does not exist. One study defined frequent 911 callers as individuals who make three or more calls in 6 months, have called for at least one lift assist, or were referred by other EMS providers (Agarwal, Pirrie, et al., 2019). Researchers from urban North Texas defined frequent utilizers as those needing greater than four ED transports per year for nonemergent conditions who had the mental capacity to follow medical advice, willingness to engage, and ability to proactively seek resources outside of the ED (Nejtek, Aryal, Talari, Wang, & O'Neill, 2017). Another study with San Francisco's homeless population defined frequent users of EMS as those who call four or more times per month (Tangherlini et al., 2016). Taken together, it appears that the definition of frequent utilization varies based on the target patient population, resource capabilities, and identified program priorities (Agarwal, Pirrie, et al., 2019; Nejtek et al., 2017; Tangherlini et al., 2016).

Although the precise definition of a high-frequency and low-acuity 911 caller has yet to be established, the utilization of 911 for low-acuity medical calls continues to grow (Mahmuda et al., 2018). Identifying the interrelated factors contributing to the frequent use of 911 illuminates the fact that these individuals have complex care needs and are a highly vulnerable population.

Program Designs

MIH/CP program designs vary widely and are dependent on local resources and target

population needs (Choi et al., 2016; Wilcoxson, 2016). In the United States, generally, three major MIH/CP models exist (Wilcoxson, 2016). The first model involves using EMT basic providers to contact patient's in their home setting, complete a basic assessment, and relay information to the care provider (Wilcoxson, 2016). The second model uses higher-level trained EMT paramedics who have additional training in chronic disease management and preventative care (Choi et al., 2016; Wilcoxson, 2016). These community paramedics perform a more advanced assessment, complete a medication review, obtain ECG, draw blood, and relay this information back to the primary care team (Choi et al., 2016; Pang et al., 2019; Wilcoxson, 2016). The third model augments traditional EMS by pairing nontraditional providers, such as registered nurses (RNs), advanced practice RNs, physicians assistants, social workers, case managers, behavioral health specialists, and others with EMS personnel; together, the team responds to low-acuity 911 calls, proactively contacts frequent users, provides whole-person assessment, completes home visits, performs safety checks, makes referrals, and provides ongoing care management (Choi et al., 2016; Sanko et al., 2019; Wilcoxson, 2016). By pairing EMS personnel with nontraditional providers, MIH/CP programs are able to leverage the interdisciplinary skillset and holistically approach complex patient care needs (Georgiev et al., 2019; Rasku, Kaunonen, Thyer, Paavilainen, & Joronen, 2019). This collaboration allows EMS providers to provide integrated patient-centric care by connecting the patient to health and social care networks within the community (Bronsky et al., 2017).

Program Targets

MIH/CP programs are tailored to meet the needs of specific patient populations and typically fall into a few categories: high-frequency and low-acuity 911 callers, high-needs patients, frequent ED utilizers, and patients at risk for hospital admission or readmission (Chan et

al., 2019; Choi et al., 2016). Identifying target populations typically starts with a local community or organizational needs assessment, which allows for a targeted MIH/CP program implementation approach (Choi et al., 2016; Rasku et al., 2019; Wilcoxson, 2016). Several MIH/CP models have been implemented in areas with exceedingly high ED and EMS activation (Bennett et al., 2018; Bronsky et al., 2017; Nejtek et al., 2017; Sanko et al., 2019; Scharf et al., 2019). One county found that 42% of all 911 calls in the community were for nonurgent issues (Bennett et al., 2018). Another analysis highlighted a small proportion of the population who utilized EMS at a rate disproportionate to the rest of the community (Bronsky et al., 2017). Other researchers identified a high-needs group of older adults living in public housing who were calling 911 frequently for low-acuity needs or lift assists (Agarwal, Pirrie, et al., 2019; Leggatt et al., 2017). Some MIH/CP models prioritized patients at risk for hospital readmission based on disease-specific factors and social determinants of health (Georgiev et al., 2019). In Florida, a Medicare population of high-utilizer patients identified by the payer was recruited to engage with an MIH/CP program to provide intensive care coordination (Roeper et al., 2018).

Program Benefits

The primary outcomes of implementing MIH/CP programs are meeting components of the Quadruple Aim: to control healthcare costs, improve population health, improve patient satisfaction, and improve provider satisfaction/engagement (Bodenheimer & Sinsky, 2014; Feeley, 2017; Gregg et al., 2019; Institute for Healthcare Improvement, n.d.). As discussed below, many of the MIH/CP programs have measured positive outcomes in one or more of these areas.

Controlling Healthcare Costs

MIH/CP program implementation has been described as a pathway to help contain

healthcare costs associated with high-needs patient populations (Choi et al., 2016). A systematic review of eight MIH/CP programs in the United States compared an intervention group with preimplementation costs to a control group and showed a significant reduction in ED transports, admission rates, and ED visits (Gregg et al., 2019). These same MIH/CP programs collectively demonstrated shorter lengths of stay and a reduction in 30-day readmission rates (Gregg et al., 2019). One program documented an annual savings of \$18,198 to the healthcare system, whereas another reported \$928,113 in savings to the community through reduced ED and EMS charges (Gregg et al., 2019). Another MIH/CP program examined the cost of program implementation to cost savings and showed a return on investment proportion of 2.97 totaling \$2,407,612 worth of savings compared to \$810,000 for program implementation (Roepert et al., 2018). A more modest report from a rural MIH/CP program documented implementation costs of more than \$90,000 with approximately a 20% return on investment in the first year (Bennett et al., 2018).

Although few economic analyses of MIH/CP models exist, those that are available estimate program costs and care avoidance savings and promote the potential for increased productivity of EMS personnel by decreasing the time emergency units are out of service (Bennett et al., 2018; Gregg et al., 2019). Many studies do not attempt to quantify the cost savings, and therefore the ability of MIH/CP programs to offset costs associated with program implementation remains unclear (Gregg et al., 2019; Rasku et al., 2019). Many of the costs associated with avoidance EMS 911 dispatch are cost avoidance, which means accurate cost predictions of preventative care and utilization are inherently challenging (Bennett et al., 2018; Sanko et al., 2019). Many infer cost savings due to the ability of the MIH/CP to significantly decrease low-acuity 911 utilization, ED transportation, and unnecessary ED visits (Agarwal, Angeles, et al., 2019; Bennett et al., 2018; Georgiev et al., 2019; Gregg et al., 2019; Nejtek et al.,

2017; Pang et al., 2019; Roeper et al., 2018; Sanko et al., 2019). A Colorado Springs MIH/CP program saw a 70% reduction in 911 calls and reported the intervention avoided 331 calls to 911, 144 ED visits, and 52 hospital admissions per month in its population of “super-utilizers” (Bronsky et al., 2017). Another MIH/CP intervention saw total 911 calls decrease by 48.9% and nonemergent calls decrease by 100% in the first year (Bennett et al., 2018).

Improving Population Health

MIH/CP programs have demonstrated improvements in care coordination and connection to community resources (Bennett et al., 2018; Roeper et al., 2018). One study of high 911 and ED utilizers reported that after the intervention, participants began accessing care that more appropriately matched their needs; these same participants had substantial improvement in disease-specific measures, such as fasting blood glucose and blood pressure measurements (Agarwal, Angeles, et al., 2019; Bennett et al., 2018). A systematic review of MIH/CP program descriptions found that health outcomes were not always well tracked due to the variability in documentation requirements (Chan et al., 2019). The ability of MIH/CP programs to interact with individuals in their natural environments makes them uniquely positioned to address many of the social and environmental determinants of health (Georgiev et al., 2019; Rasku et al., 2019). Some MIH/CP providers act as patient advocates and help to target the loneliness that can lead to frequent ED visits in frail older people (Rasku et al., 2019).

MIH/CP providers can improve health outcomes by assisting on-call primary care providers (PCP) (Chellappa, DeCherrie, Escobar, Gregoriou, & Munjal, 2018). Many medically frail and older persons will call the PCP for advice, but due to the limited ability to perform a medical assessment over the phone, the patient is often instructed to call 911 (Chellappa et al., 2018). Chellappa et al. advocate using MIH/CP services to support on-call PCPs and avoid

unnecessary ambulance transportation to EDs. Many frail elderly persons call 911 frequently for lift assists after sustaining a noninjury fall, and because EMS personnel frequently respond to these calls, replacing the response with MIH/CP services could potentially serve as an early warning system and more appropriately intervene to avoid future falls (Leggatt et al., 2017).

Patient Satisfaction

Several EMS-based MIH/CP programs report high levels of patient satisfaction with patients agreeing strongly that they received high-quality services and the services provided were extremely appealing (Bennett et al., 2018; Gregg et al., 2019). Most patients reported that they would use the MIH/CP program again, refer a friend, or that they would have sought care in the ED had there not been another option (Gregg et al., 2019; Roeper et al., 2018). An MIH/CP program targeting older adults living in subsidized public housing who called 911 frequently reported improvements in quality-adjusted-life-years (Agarwal, Angeles, et al., 2019). A scoping review found that a majority of MIH/CP participants reported better health, were satisfied with care delivery, and desired to stay home when possible (Rasku et al., 2019).

Care Provider Satisfaction

The fourth aim of process improvement, increasing provider satisfaction, is not well documented in the literature. Many researchers voiced concerns about EMS- and ED-provider burnout related to increasing utilization of low-acuity 911 calls, ED overcrowding, and use of EDs for nonemergent needs (Cannuscio et al., 2016; Gregg et al., 2019). Most researchers discussed the potential for MIH/CP programs to alleviate this increased utilization, thereby naturally increasing provider satisfaction (Gregg et al., 2019). Interviews with EMS highlighted firefighters' growing concerns regarding the changing nature of the 911 system (Cannuscio et al., 2016). The authors found EMS personnel voiced frustration with their ability to adequately

address the needs of low-acuity medical 911 callers and that adaptations to training and response models are necessary.

Barriers, Gaps, and Equity

A lack of standardization, training, and services offered has been a challenge associated with MIH/CP program implementation (Chan et al., 2019). One opinion article argued that MIH/CP programs aimed at diverting ambulance transfers away from EDs are a public safety concern, stating these programs will disproportionately affect the critically ill, elderly, and economically disadvantaged (Sawyer & Coburn, 2017). Additionally, some programs with aims at reducing 30-day readmission for patients with heart failure increased mortality rates (Gregg et al., 2019). However, the capabilities of an MIH/CP program to assist populations suffering from mental illness and substance use disorders are less well documented. Scarcities in services capable of addressing mental health and substance use will leave limited options other than transportation to ED (Sanko et al., 2019).

Policy and Sustainability

Some policy level limitations must be considered prior to the MIH/CP program implementation (Chellappa et al., 2018; Choi et al., 2016; Wilcoxson, 2016). Scope of practice regulations for traditional EMS providers may need to be reexamined depending on specific MIH/CP program designs (Wilcoxson, 2016). Sustainability and reimbursement models must align with MIH/CP implementation; limitations exist because many traditional EMS systems only received reimbursement for services after a patient is transported (Chellappa et al., 2018; Huang, Ma, Sabljak, & Puhala, 2018; Wilcoxson, 2016). Many suggest the solution to sustainability requires aligning community stakeholders to collectively fund these programs (Huang et al., 2018; Pang et al., 2019). The geographic setting must also be considered in the

context of MIH/CP program implementation, as significant reductions in ED utilization in some rural areas may affect the community hospital's bottom line, leading to financial stress (Gregg et al., 2019).

Summary

There is a growing utilization of EMS and ED visits for low-acuity and nonemergent needs (Sun et al., 2018). Implementing targeted MIH/CP models with current EMS operations has been proposed to meet the needs and growing demand for low-acuity and high-frequency 911 callers (Choi et al., 2016). The fundamental goals of MIH/CP models are to provide optimal care and increase efficiency, thus, connecting the patient to the right care with the right provider at the right time (Kizer, Shore, & Moulin, 2013).

High-frequency utilizers and low-acuity 911 callers are not well defined, but patterns have been identified to help describe the conditions and barriers these individuals face (Agarwal, Pirrie, et al., 2019; Nejtek et al., 2017; Tangherlini et al., 2016). It has been well documented across many communities that a small number of individuals account for a significant amount of EMS utilization (Agarwal, Pirrie, et al., 2019; Bennett et al., 2018; Cannuscio et al., 2016; Mahmuda et al., 2018). These individuals are disproportionately affected by chronic disease, have multiple comorbid conditions, are older, have mobility issues, and are more socially isolated (Agarwal, Pirrie, et al., 2019; Bennett et al., 2018; Cannuscio et al., 2016; Mahmuda et al., 2018). These populations also suffer social, economic, and environmental disadvantages, which all play a major role in their health outcomes and utilization (Georgiev et al., 2019).

This review found that MIH/CP models vary widely in their composition, services, and target populations. This is in large part due to the local needs assessments used to guide the MIH/CP program intervention. The majority of MIH/CP programs document improvement in

one or more of the Quadruple Aim measures of process improvement. Due to the novelty of MIH/CP care models, the data is somewhat limited and heterogenous, but it strongly suggests the potential for reduction in costs, decreased reliance on EMS for low-acuity needs, decreased ED utilization, and high patient satisfaction. What is less clear are the precise economic impacts, objective patient outcome data, and provider satisfaction.

Purpose Statement

The purpose of this DNP project was to develop an MIH service for GFES to maintain EMS resources, improve EMS efficiency, and better address the unmet medical, social, and behavioral needs of the community's vulnerable population. To develop this new service, project partners developed a strategic proposal utilizing current evidence-based literature, subject matter experts, local experience and knowledge, and local 911 caller data. This proposal was drafted and presented to the Gresham City Council for consideration and implementation.

Methods

This program development project utilized a mixed-methods approach to data collection. Qualitative data was derived from key stakeholders, subject matter experts, focus groups, and one-on-one semi-structured interviews on an ongoing basis. The sessions were used to explore and identify the needs of the organization through combination of in-person, virtual, telephone, and email communications. A quantitative analysis of the past 3 years of local 911 caller data was conducted to identify trends and community-specific needs for GFES service area.

Project Setting

The primary setting was at the GFES Training Center and using virtual meeting sessions. This project was conducted in conjunction with GFES personnel. GFES provides fire and EMS services to Gresham city residents and contracting districts for residents living in Fairview,

Troutdale, Wood Village, and unincorporated Eastern Multnomah County (City of Gresham Oregon, 2020).

Organizational Readiness

The DNP student served as Project Lead. GFES Leadership expressed an authentic desire to make meaningful change to increase efficiencies and match EMS services to the needs of the community. The GFES leadership has extensive experience in developing, implementing, and scaling MIH services. GFES was permitted to use 3 years of 911 caller data from the region to establish priorities of the MIH service.

Anticipated Facilitators, Barriers, and Challenges

Facilitators of this project included Mitch Snyder the GFES Fire Chief, DNP student as the Project Lead, and two GFES personnel: Josh Butler the GFES Training Division Battalion Chief and Jay Cross the GFES Training and Safety EMS Officer. Other key facilitators included Brian Monberg, a member of the Gresham Policy Leadership team who conducted the 911 data analysis and MIH program implementation subject matter expert from Puget Sound Regional Fire Authority, Adam Davis. Mitch Snyder and Adam Davis had extensive experience with planning, implementing, scaling, and sustaining MIH-CP programs. Barriers and challenges included aligning goals of the MIH service between strategic and operational level planners, ensuring clear communication with multiple stakeholders, and developing a unified vision between stakeholders. Other challenges included managing timelines and receiving timely feedback. Clarifying roles, establishing goals, and developing a shared vision helped to mitigate these challenges. Additionally, the Project Lead utilized techniques of clear communication, eliciting feedback, and initiating frequent collaboration to overcome these barriers.

Participants

Participants of this project included GFES personnel volunteers: fire chief, training battalion chief, medical officer, and Gresham city data analysis staff. Lessons learned and guidance was provided by Puget Sound Regional Fire Authority—a successful and tenured MIH program. This project team began engaging with local potential future community stakeholders, including American Medical Response Ambulance Services, Legacy Health Mt. Hood, Oregon Health and Science University I-CAN network, and leadership from local Oregon Health Plan.

Implementation Procedures

Both an organizational needs and data analysis were conducted to inform the development of the GFES MIH service. A professional project development outline was used to draft the multiple components necessary for the MIH project proposal. The final deliverable product is a Gresham Fire Cares MIH implementation plan and a PowerPoint presentation delivered to the Gresham City Council in December, 2020.

Organizational Needs Analysis

A organizational needs and readiness assessment was conducted using guidance from the Health Resources and Services Administration framework (United States Department of Health and Human Services, n.d.). The purpose of the organizational needs and readiness analysis was multifactorial and paramount to successful program development and ultimately implementation. The assessment examined the current infrastructure and operations of GFES, identified the needs of the organization and organizational readiness, and determined potential barriers to successful MIH service implementation. The needs analysis was used to establish the planning and development team, identify responsibilities, and strengthen relationships. The needs analysis

helped identify supporters and stakeholders within the broader community. Several questions were addressed, including:

- What is the challenge and why does it exist?
- When did this become significant and what is the extent of this challenge?
- Who or what is causing it?
- Who is affected by this problem?
- What is currently being done?
- Has anything been effective?
- What resources are available to help with this problem?

The needs analysis was used to determine and predict initial GFES MIH service implementation model. Ongoing interviews and group discussions were used to identify the following:

- What is the minimum viable MIH service for Gresham Fire Department?
- How will the MIH service be integrated into the organizational structure?
- What will be the MIH personnel workflow and job description?
- What tools will be necessary for delivering this MIH service?
- What potential metrics of success will be tracked?

Data Analysis

911-caller data from the GFES service area was analyzed to guide the MIH service intervention. Data comprising 3 years of 911 calls from January 2017 to November 2019 was scrutinized by Brian Monberg and Mitch Snyder to help target MIH services based on community needs. The data analysis helped identify potential trends for the following:

- Monthly and yearly call volume and growth;
- Call volume by hour of day;
- Volume of calls by priority or acuity;
- Frequency and proportion of 911 calls classified as low-acuity;
- Individuals with a high frequency of calls;
- Specific locations with high-frequency calls;
- Reason for the call and primary impression;
- Final destination of callers.

The success of this program development project was defined as producing a GFES MIH service implementation plan that meets the identified goals of project planners and is acceptable for presentation to the members of Gresham City Council.

Costs

Costs related to the Project Lead completing this project development project are minimal. The costs associated with staffing and deploying an initial GFES MIH service were calculated for the proposed plan for Gresham City Council review. Calculating these costs required creating a budget for the initial MIH service and providing an itemization of expenses related to MIH personnel salaries, benefits, training, equipment, response vehicle, IT solutions, etc. The potential to make cost-comparisons between implementation of GFES MIH service with traditional “heavy-asset” EMS response systems exists; this potential was explored during team project development discussions.

Ethical Considerations

Although this project did not include implementation of a GFES MIH service, there remains a theoretical potential for a mismatch between provided services of the future MIH

service and the expectations or needs of the 911 caller. The program development team worked directly with the GFES medical officer and dispatch operations to give thoughtful attention to this potential. A plan for mitigation of this potential risk was drafted as part of the project development plan. The 911 caller data analysis had significant support from city-data personnel, Brian Monberg who compiled the data. No raw data, protected health information, or patient identifiers were accessible to Project Lead.

Implementation of the Project

Evolution of the Project Over Time

Assessment of organizational readiness and needs progressed smoothly. Gresham Fire Department (FD) personnel were motivated to change and improve care delivery within the EMS model. This program's primary goals were identified, including 1) enhance the quality of services for the community and 2) address inefficiencies within the FD care delivery model. The momentum to move forward with drafting this project proposal was propelled by supportive leadership with a long tenure of implementing mobile integrated healthcare (MIH) programs within fire departments. This project was also part of the Gresham City Council work plan. Bimonthly meetings were arranged with the Project Team to discuss development and track progress. Communication was primarily through in-person, virtual, email, and phone collaborations.

The Project Team desired this project proposal and implementation model to be data-driven. The Project Team met multiple times to discuss the data analysis goals and determine what information would be useful from data analytics. The trends that the Project Team were most interested in identifying included:

- How many 911 calls are occurring in the Gresham area annually?

- Has the call volume increased over time?
- What are the call volume trends daily, monthly, yearly?
- What are the call percentages when divided by priority (code 1, code 3, NULL)?
- What percentage of calls are priority NULL, aka, do not require transportation?
- Are there any individuals who call 911 greater than thirty times over 3 years?
- Are there any individuals who call 911 greater than fifty times over 3 years?

Once the Project Team identified what would be beneficial to extract from the data, Mitch Snyder, worked closely with Brian Monberg to complete the data analysis. Nearly three years of data, from January 2017 to November 2019 was reviewed and presented to the Project Team.

Later, a second data analysis was completed by Gresham Fire personnel, Jay Cross, and Josh Butler using 911 call data from 2019. This second analysis's specific purpose was to drive the proposed deployment model for the initial MIH response. Once the Project Team determined which lower-acuity 911 call types would be appropriate for the alternative response, the proposal document could produce an anticipated impact on the local EMS services. The Proposal Team used call types to determine what hours, days, and staffing requirements would be most effective for initial implementation. One of the project goals was to improve efficiency and increase the Fire Department and emergency units' availability. This secondary data review allowed the Project Team to project the MIH service's value by calculating the number of minutes added back to the emergency response units if the MIH units were to intercept these lower-acuity 911 call types. The Project Team determined this numerator would be incredibly impactful for the City Council to consider.

Modifications

Due to the COVID-19 pandemic, modifications were made between collaborating partners. Initially, the project meetings were conducted on a bi-weekly basis and in-person in Gresham Fire Department buildings. Once Oregon State and School of Nursing initiated lockdown orders to decrease the corona virus spread, the Project Team quickly transitioned to virtual meetings, email, and phone interactions. The Project Team also recognized that pandemic would likely impact the Gresham City Council agenda and the ability of the City to allocate funding for this program. Regardless of this challenge and unknowns related to the pandemic, the Project Team decided to continue with plans to draft the proposal and presentation for City Council.

Unintended Consequences

A critical component of the Gresham Fire Cares MIH proposal was drafting a program expense and budget. To highlight the cost-effectiveness of this model of care delivery, the Project Team prepared a cost-comparison. This compared the costs associated with implementing the alternative MIH response vs. the traditional fire department model of fire engines and firefighter personnel. As expected, the expenses related to operating the alternative MIH model was significantly less than the traditional Fire Department response. The Project Team felt this was a compelling reason for the Gresham City Council to fund the alternative MIH response. However, it was soon realized that making this comparison may have unintended negative consequences on the Gresham Fire Department. At one of the group planning meetings, representatives from Gresham Fire's labor union joined the Project Team. Upon reviewing our cost-comparison, it was highlighted that Gresham Fire has been understaffed and facing challenging budget cuts for many years. While all members acknowledged that the MIH response is projected to help mitigate unsustainable call volume growth, the Team did not desire

to present the proposal to City Council as a binary option to fund the alternative response vs. traditional emergency units. As a result, a detailed cost-comparison was not included in the final proposal. The Project Team may revisit this if the MIH program is able to demonstrate objective data on the impact of implementing the alternative response unit.

Details of Missing Information

The 911 call data was obtained at the end of 2019 and included the dates from January 2017 through November 2019. Thus, it did not have 911 call data from December 2019 and was one month short of completing three years of call data.

Key Findings

From January 2017 to November 2019, there were a total of approximately 47,000 cases, averaging 15,000 per year. The Project Team observed several critical findings through the 911 call data analysis to plan the alternative MIH unit implementation strategy discussed below.

Call Volume

The data mirrored national trends that describe EMS systems facing unsustainable call volume growth. This project's data analysis found that 911 call-volume has grown year after year. The monthly average climbed by about 150 calls per month over the nearly three years of 911 call data, and the peak monthly average was 1,451 cases in 2019. This was an increase from a monthly average of 1,297 cases in 2017.

Call Trends

The Project Team used data to help determine the hours of operation that may be most appropriate for implementing the alternative response MIH unit. The monthly average increased over time, with spikes each year in January, March, July, and August. The peak hours for all 911 calls occurred between 8:00 am and 8:00 pm daily.

Priority Data

Priority data tells us how and if the 911 caller required transportation to an emergency department, and the calls are then coded into the identifiers of Code 1, Code 3, and NULL. Code 1 means that the 911 caller was transported to the hospital, just without lights and sirens; Code 3 means that the caller required rapid transportation with lights and sirens; NULL is that EMS responders did not transport the 911 caller at all. The data over three years revealed that 68% of all 911 calls were transported as Code 1, 3 % were transported as Code 3, and 26% were not transported (NULL). The most significant finding for the Project Team was the NULL code of 26% of calls not requiring transportation to a medical facility.

High-Frequency Callers

The data did not support the perception that a small group of individuals in the Gresham area calls 911 frequently for lower-acuity needs, as discussed in the ‘Expected and Observed Results’ section. This remained even after the data analytics personnel attempted to match differences in names used, spelling, and unique addresses. Over the three years of 911 call data, there were about 24,000 unique names used. Of that, about 1,000 individuals represented 20% of all cases. Sixteen individuals had over 30 cases, and two people had over 50 cases during these nearly three years of data collection. The Project Team reviewed the nature of the 911 calls to determine if these high-volume callers were calling for lower-acuity needs. For the individuals calling greater than 30 and 50 times over three years, it was determined that these calls for EMS would not be appropriate for a lower-acuity response by the MIH unit. More likely, this would be an opportunity for proactive engagement and case management which could potentially decrease reliance on crisis intervention and emergency 911 utilization.

Outcomes

Comparison of the Findings to Literature

Qualitative data supports the primary desired outcomes of developing and implement MIH services. Gresham Fire Department aims to improve the community's outcomes, control costs of providing EMS care, improve caller satisfaction with the care they receive, reduce care provider and EMS personnel fatigue, and improve efficiencies within EMS systems to maintain emergency resources. All of these findings and benefits of EMS MIH models are reinforced in the published literature that overwhelmingly supports the MIH's ability to meet the Quadruple Aim of healthcare improvement (Bodenheimer & Sinsky, 2014; Feeley, 2017; Gregg et al., 2019; Institute for Healthcare Improvement, n.d.).

The literature also supports the notion that EMS systems nationwide face unsustainable increases in the volume of lower-acuity 911 calls (Cannuscio et al., 2016; Sanko et al., 2019). The 911 call data review supports this increased call volume growth as a local challenge, specific to the Gresham Fire department. Additionally, the data revealed that 26% of all 911 calls did not require transportation suggesting a significant number of calls are lower-acuity in nature.

Expected and Observed Results

An observed challenge with the large-volume data set was encountered with data analytics, precisely when determining if a small population of individuals engaged and called 911 frequently for lower-acuity needs. Qualitative information gained by the Project Team and subject matter experts describe this phenomenon—that a small subgroup of individuals calls 911 repeatedly for lower-acuity needs. This occurrence has been described in the literature and by other urban fire departments implementing alternative response units to address the inefficiencies

and lack of resources for their high-needs and vulnerable community members (Agarwal, Pirrie, et al., 2019; Leggatt et al., 2017).

To the surprise of the Project Team, this project's data analysis did not find a distinct group of individuals who call 911 frequently for lower-acuity needs. As the data analysis personnel relayed, this discrepancy in observed experiences from fire personnel and the data is likely due to coding and data input errors by the EMS first-responders. For example, variances in name spelling, addresses, using different last names, and not obtaining full names. Brian Monberg, who conducted the data analysis, attempted to mitigate these discrepancies and match the input data's variances, but this still did not amount to finding several individuals in the area who call 911 frequently for lower-acuity needs.

Impact of Project on System

The Project Team was able to make projections on the impacts associated with implementing an alternative MIH response. The immediate impacts of interest included those of the Gresham Fire Department and AMR, an allied ambulance organization. The Project Team used the hours of operation for the initial MIH deployment model to determine approximately how many lower-acuity call types would be intercepted by the MIH units. Then the Project Team used the data to determine how much time the Fire Department and ambulance service spent on these lower-acuity calls. This allowed the Team to quantify how many minutes would be added back to the emergency unit's availability if the MIH unit responded. In the EMS domain, there is a national standard that Fire Departments and EMS systems meet to ensure vital public resources are available in times of need. Using annual data from 2019, the Project Team projected that Gresham Fire would gain 22,383 minutes back to emergency unit availability per year, and the

ambulance service would gain 101,136 minutes per year if the MIH service were dispatched to these lower-acuity calls.

This project proposal included a cost analysis of implementing the alternative MIH response unit. The MIH unit deployment model's expenses included an annual expenditure of \$512,320 with initial capital costs of \$220,898 for vehicles and equipment. The total MIH program implementation total costs were \$733,218. Of note, this expense is significantly less than the costs associated with purchasing and staffing new fire engines to meet the call volume demand and improve availability standards of the emergency units. Because the Project Team decided that a cost-comparison may imperil Gresham City Council's plans to fund the traditional fire response units, the direct cost-comparison was not included in the final proposal.

Practice Related Implications

This program development project explores and describes the current state of the 911 services offered by the Gresham Fire Department. This includes the infrastructure and operational status of the emergency response units. Through qualitative and quantitative data, the Project Team made impact projections of implementing an alternative response MIH unit to address unsustainable 911 call growth, specifically for lower-acuity and high-needs callers. This included the cost of implementation and the expected impact at a community level. Outcome data from implementing this type of service can be obtained through published literature. However, for Gresham City Council to support and direct funding for this program, it was necessary to use local data to describe the expected impact of implementing this alternative service.

Through cost-comparison, the Project Team learned that implementing an alternative response unit instead of relying on emergency units for lower acuity calls is a cost-conscious

strategy. Although implementation was not part of this project, a future inquiry may desire to use the project metrics to measure outcomes, impact, and cost-effectiveness after implementation. Outcome data of interest may be the number of 911 calls the MIH unit can intercept, time spent with callers, trends on repetitive 911 call use for high-frequency callers, and overall 911 call volume. A comprehensive cost-savings and cost-comparison inquiry would be valuable to describe the economic impacts of implementing this service type.

To ensure sustainability, subsequent work to establish community partnerships with the broader care networks may improve this service's quality and help ensure sustainability through cost-sharing opportunities. Work may be done to explore how the Fire Department can integrate MIH services with local police, hospital systems, behavioral health care providers, primary care providers, public health resources, and long-term care facilities.

Summary and Next Steps

This DNP project developed an MIH model for the Gresham Fire Department as a practical, useful, and cost-conscious strategy to address the unsustainable 911 call volume growth and improve the quality of services provided. The addition of Gresham Fire Cares MIH will be an upstream intervention anticipated to have multiple positive impacts. These include improving emergency unit availability and response times, reducing costs associated with unnecessary EMS utilization, improving access to care, and providing an opportunity for the fire department to ensure their communities' most vulnerable 911 callers receive services that correctly match their needs.

The implementation of this project is at the discretion of the Gresham Fire department and Gresham City Council. Once approved by City Council, the Fire Department team will use the project implementation plan to implement the Gresham Fire Cares MIH response units. This

includes data tracking, ongoing quality improvement, and continued work toward building partnerships within the broader community care networks.

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