The Use of Mobile Healthcare Clinics to Expand Access to Underserved Populations: A Rapid Review

Alejandro Jimenez
Central Washington University, alejandro.jimenez0313@gmail.com

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The Use of Mobile Healthcare Clinics to Expand Access to Underserved Populations: A Rapid Review

Alejandro Jimenez

Senior Capstone

Submitted in Partial Fulfillment of the Requirements for Graduation from The William O. Douglas Honors College of Central Washington University

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Accepted by:

Committee Chair (Rebecca Pearson, Ph.D., Public Health)

Committee Member (Bernadette Jungblut, PhD, Political Science)

Committee Member (Shawn Reichert, Ph.D., Institutional Research)

Director, William O. Douglas Honors College (Anne Cubilie, Ph.D.)
Access and utilization of health care is essential for the maintenance of overall health and prevention of chronic diseases. Several factors contribute to healthcare access disparities, including race, ethnicity, poverty, and rurality. Mobile healthcare clinics can be used to travel to medically underserved areas and reduce healthcare disparities. This rapid review examined the scope and impact of mobile healthcare units, and their use in reducing healthcare disparities. The exploration was done in 4 stages (1) identification of existing and relevant research studies, (2) selection of studies using prespecified eligibility criteria, (3) extraction of data from collected studies, and (4) summarization and interpretation of results. The rapid review located 54 articles, which were later reduced to 26 after screening and criteria checks. The review indicated that mobile healthcare clinics provide a variety of health care services, such as preventative medicine, primary care, screening services, dental services, and health education. These clinics also increase access and utilization rates to medically underserved communities. Finally, mobile clinics reduce the number of preventable emergency department visits as well as having significant other cost-saving impacts through the other preventative services provided.

**Keywords**  Mobile Healthcare Clinics • Mobile Clinics • Healthcare Disparities • Underserved
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INTRODUCTION

Understanding and addressing disparities in health care is essential to establish a solution that ensures everyone has equal access to healthcare. An individual’s health can be maintained and improved using the health care system in the United States. Other factors that affect the health of an individual are lifestyle and behavior choices, including diet, exercise, and avoidance of bad habits such as smoking or drug use.\textsuperscript{1} All these factors contribute to maintaining one’s health and limiting the chances of developing a chronic disease. The most common causes of illness, disability, and death in the United States are chronic diseases, which include heart disease, cancer, diabetes, and stroke.\textsuperscript{2} Regular utilization of preventative medicine is linked to improvements in overall health and reduction of chronic disease.\textsuperscript{3}

Preventative Medicine

A goal of preventative medicine is to prevent the occurrence of further disease, by reducing complications of existing diseases; it can also reduce the risk of developing a disease.\textsuperscript{4} A significant factor in the success of preventative medicine is the involvement of the individual to maintain motivation and practice their own prevention.\textsuperscript{4} A possible method to help ensure the individual is continually practicing preventative medicine is the active involvement of their primary care provider.\textsuperscript{4} However, individuals who have limited access to their primary care provider on a regular basis are at a significant disadvantage when compared to those who can consistently consult with their provider. Having proper access to and using health care is essential in the prevention, management, and care of diseases. Therefore, any factors that limit an individual’s ability to access and utilize health care will be likely to affect their health. Some possible factors that limit access to health care are race, ethnicity, poverty, and rurality.\textsuperscript{3,5–7}
Racial/Ethnic Health Disparities

Despite the drastic improvements in healthcare over time, certain U.S. populations still experience gross disparities in healthcare access and utilization. “Racial and ethnic minority populations often receive poorer quality of care and face more barriers in seeking care, including preventive care and chronic disease management, than do non-Hispanic whites.” 2 The increased barriers that racial and ethnic minorities face when seeking health care can lead to poor health outcomes and higher costs of healthcare. 2

Systemic racism and other issues may lead to this limited access. Whatever the contributing factors to such increased barriers, without the ability to regularly communicate with a health care provider, people are not able to obtain timely medical advice and intervention to otherwise preventable diseases. This lack of routine communication may contribute to disparities seen in the overall health of marginalized groups compared to the white population in America. Some of these disparities can cause the disproportional amounts of chronic diseases, mortality, and adverse health outcomes between this nation’s racial/ethnic minorities and white Americans. 5 Racial and ethnic minorities also face language and cultural barriers that prevent them from utilizing healthcare, even when they have access. These disparities further emphasize the importance for minorities to be able to have regular communication with their healthcare provider since it is shown that regular communication between patient and provider can aid in the management of chronic diseases. 8

Rural Health Disparities

The disparities in health are not just affecting racial and ethnic minorities; they are also affecting individuals based on where they live. Rural Americans are about five times more likely to die from chronic diseases than their urban counterparts. 9 As cited by the Centers for Disease
Control and Prevention (CDC), Macrae states that “we have seen increasing rural-urban disparities in life expectancy and mortality emerge in the past few years. CDC’s focus on these critical rural health issues comes at an important time”. Those living in rural areas have a higher tendency to develop chronic diseases and die due to those diseases. “Some rural areas might have characteristics that put residents at higher risk of death, such as long travel distances to specialty and emergency care or exposures to specific environmental hazards”. Many of the deaths due to diseases in rural areas are preventable. When comparing the percentage of deaths that were potentially preventable for those living in rural versus urban areas, those living in rural areas had a higher percentage of preventable deaths. Undoubtedly, the lifestyle of Americans living in urban areas is different from their urban counterparts, and this difference could be one of the primary explanations of the disparities in health among those living in rural and urban regions. Choices in diet, decreased availability of fitness centers, and the distance to healthcare in rural regions all contribute to their poor health.

**Economic Healthcare Disparities**

Individuals who are living in poverty usually have the poorest health of any other group. The factors that contribute to such poor health among those in poverty include racial/ethnic disparities, lack of education, community characteristics, and insurance disparities. It is a combination of these factors that contributes to the increased prevalence of chronic disease among the poor. Those who are economically disadvantaged or who are at or near poverty can be part of any group regardless of race, ethnicity, or region. This means that individuals who have a low income can also be part of other groups that statistically have poorer health, which only further increases the odds of developing a chronic disease. Many of those who are struggling financially lack health insurance, which creates another barrier preventing
timely access to healthcare. “Multiple effects of uninsurance on health care have been reported and include impaired access to preventive services, failure to diagnose chronic disease, poor control of chronic conditions including hypertension, diabetes and hypercholesterolemia, cost-related medication underuse, and increased mortality”. A large proportion of the marginalized population do not have access to health insurance and suffer from all the resulting issues from the lack of coverage.

**Mobile Healthcare Clinics**

All these barriers limit the access of underserved populations. In the face of such barriers, mobile healthcare clinics (MHCs) act as an essential component of the healthcare system. These mobile clinics are customized vehicles that travel to areas with high underserved populations to provide much-needed healthcare services. These services can be provided to the same areas where people live, go to school, and work, making it so the healthcare services they are providing are easily accessible. According to Hill and colleagues, “there are an estimated 1500 mobile clinics, receiving 5 million or more annual visits nationwide”. The MHCs provide those millions access to healthcare that was otherwise not available before. Mobile clinics can “overcome barriers of time, money, and trust, and provide community-tailored care to vulnerable populations.” Since MHCs are taking the initiative and reaching out to underserved populations, they are helping increase trust in the healthcare system by providing services in an informal environment near their homes and schools. Despite the benefits of mobile healthcare clinics, there is limited research that assesses the impact, scope, and cost effectiveness theses clinics have.
RESEARCH PURPOSE

Further research is needed to study the factors affecting how health care is utilized because any barriers that prevent individuals from seeking healthcare can lead to poor health, financial burden, and preventable hospitalizations. A large proportion of the country is suffering from chronic diseases, which, when left untreated, can lead to premature death. It has been shown that chronic disease and complications from chronic diseases are reduced when individuals have regular access to health care and preventative medicine. The purpose of this study was to conduct a rapid review of the literature on the use of mobile healthcare clinics to reduce health care disparities. The specific aims of this study were to determine (1) the effectiveness of mobile healthcare clinics at addressing healthcare disparities; (2) the scope and impact of mobile clinics; and (3) the cost-effectiveness of mobile healthcare clinics within the healthcare system.
STUDY DESIGN

A rapid review was conducted to investigate these questions further. A rapid review is a variation of a systematic review that balances time constraints with considerations of bias.\textsuperscript{14} It is similar to a systematic review but is often completed in a shorter timeframe, and is less resource-intensive, but can still be used to assess and synthesize available research. It also differs from a systematic review, which is both time and resource-intensive and usually seeks to access the effectiveness of treatments or interventions.\textsuperscript{14,15} The rapid review is an ideal method for mapping key concepts within a research area, for identifying primary sources and types of evidence, and for identifying any gaps in the existing literature.\textsuperscript{15} The exploration was done in four stages: (1) identification of existing and relevant research studies; (2) selection of studies using prespecified eligibility criteria; (3) extraction of data from collected studies, and (4) summarization and interpretation of results.
METHODOLOGY

Definition

Based on a brief literature search, there is some disagreement on the definition of a mobile healthcare clinic (MHC), and there are many different interpretations of what a mobile clinic encompasses. The definition that was accepted for the purposes of the review was provided by the California Legislative Information, which describes a mobile healthcare clinic as “a special purpose commercial coach” that “provide[s] medical, diagnostic, and treatment services, in order to help ensure the availability of quality health care services for patients who receive care in remote or underserved areas and for patients who need specialized types of medical care provided in a cost-effective way”. That definition also stated that a mobile healthcare clinic does not include “a modular, relocatable, or transportable unit that is designed to be placed on a foundation when it reaches its destination”. According to the definition, a mobile health clinic does not include mobile hospitals or health camps. For this review, only mobile healthcare units that are on a vehicle that cannot be placed or transferred onto a foundation were considered. Emergency medical service vehicles such as ambulances and fire engines will also not be considered because they do not provide the services under the chosen definition.

Literature Search

A search was performed for electronically published literature and was also supplemented with a grey literature search. Keyword combinations, including MHU, mobile healthcare unit, mobile healthcare clinic(s), mobile clinic, traveling clinic, mobile medical clinic, mobile outreach clinic, and mobile wellness clinic were used. The literature search was conducted using PubMed, Academic Search Complete, MEDLINE, Cochrane Library,
PsycARTICLES, PsychINFO, and Google Scholar. The search was restricted to the English language, full-text articles, and literature made available between 2000 and the present. This review may not be comprehensive because only electronic literature was searched within the chosen databases and timeframe; it is likely that there is work published on this topic non-electronically, in other databases and prior to the year 2000.

**Eligibility Criteria**

Studies must fit the chosen definition of a mobile health care clinic. Studies that do not fit the definition will be excluded for review.

**Types of studies.** Both primary studies and systematic reviews were included, with studies given priority based on the following: (1) controlled before and after studies; (2) discussion of the impact of MHCs on healthcare disparities; (3) comparison of mobile healthcare clinic modes; and (4) discussion of the cost-effectiveness and cost-benefit of MHCs. Other studies were also included for consideration, in case no studies with study designs as described above in 1-3 could be found. The studies were initially selected provided that they described mobile healthcare clinics in relation to their impact on healthcare disparities.

**Types of participants.** The types of participants were not restricted, and the level of analysis could be individual, geographic, or organizational.

**Types of interventions.** The types of interventions used were not limited. Studies that evaluated the use of MHCs to expand access to underserved populations affected by healthcare disparities were included.

**Types of outcomes.** The studies must discuss the scope and impact of mobile health clinics on at least one healthcare disparity: (1) racial/ethnic disparity; (2) rural disparity; and (3) poverty disparity.
Text and geography. Peer-reviewed full-text publications in the English language from any year after 2000 were included. Studies included were limited to those conducted in the United States of America.

Screening Process

The screening and review processes were adapted from the Cochrane Handbook for systematic reviews. A single reviewer began the review process by conducting a literature search using the predetermined keywords in the chosen databases. The articles were included in the first stage of review based on their titles and abstracts. All relevant articles were stored on a sharable folder in Zotero (a bibliographic management software), and duplicates were removed. After the first reviewer compiled all relevant literature, a team of two reviewers independently screened a random sample of full-text reports, using the predetermined criteria above, in order to assess the reliability of the first reviewer.

The table shown in the Appendix details the articles that were included in the review and screening process.

Evidence Synthesis

Literature results and characteristics will be described narratively. The studies’ characteristics and results will also be organized into tables to better represent the synthesized studies. A meta-analysis of the results will not be conducted.
RESULTS

General Description of Studies

The literature search yielded 54 articles, which were screened using the predetermined inclusion criteria. The screening process resulted in 26 articles that were reviewed. The overall themes and characteristics of the studies were then analyzed and placed into categories, with some overlapping, as seen in Figure 1. Of the 26 included articles most (N=17, 65.4%) were providing primary care services. Some of the other articles discussed the use of specialized care (N=6, 23.1%) provided by mobile healthcare clinics, which included services such as dental, wound care, drug addiction interventions, and treatment for specific illnesses.
Mobile clinics that provided screening services (N=4, 15.4%) were discussed by a small number of the included articles. A few articles (N=2, 7.7%) discussed the cost effectiveness of mobile clinics. Most (N=19, 73.1%) of the mobile clinics provided care to individuals of all ages, while about a quarter (N=7, 26.9%) of the articles targeted pediatric and prenatal care.

**Key features of mobile healthcare clinics**

The mobile clinics in the included studies provided a large variety of services with only a very few providing a single specialized treatment. *Table 1* summarizes the services provided, populations served, and key findings of the included articles. Many articles reported that mobile clinics had a positive effect on access among underserved populations. 17

<table>
<thead>
<tr>
<th>Study</th>
<th>Services Provided</th>
<th>Population (s) Served</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gupta et al.</td>
<td>Immunizations</td>
<td>Underserved children</td>
<td>The lean principle can improve immunization administration efficiency in mobile clinics.</td>
</tr>
<tr>
<td>Hill et al. (2014)</td>
<td>Primary care</td>
<td>Underserved populations</td>
<td>Mobile clinics provide high quality, low cost care to vulnerable populations. Should partner with hospitals and health systems to improve care and lower costs.</td>
</tr>
<tr>
<td>Hill et al. (2012)</td>
<td>Primary care, preventative care, and screening services</td>
<td>Underserved populations</td>
<td>Delivers cost-effective prevention activities, to control health care costs and reduce health disparities.</td>
</tr>
<tr>
<td>Isler et al.</td>
<td>HIV screening and treatment</td>
<td>Underserved populations</td>
<td>Mobile clinics have been shown to be useful in extending healthcare services.</td>
</tr>
<tr>
<td>Kahn et al.</td>
<td>STD screening and treatment</td>
<td>Underserved populations</td>
<td>Mobile clinics are useful for screening and treatment of STDs</td>
</tr>
<tr>
<td>Luque et al.</td>
<td>Primary and preventative care.</td>
<td>Migrant and seasonal farm-workers</td>
<td>Mobile clinics are a successful model to improve access and utilization of health services by migrant and seasonal farm workers.</td>
</tr>
<tr>
<td>Mdege et al.</td>
<td>Antiretroviral therapy (ART)</td>
<td>Underserved populations</td>
<td>There is limited studies on the effectiveness and cost of mobile clinics using ART services.</td>
</tr>
<tr>
<td>Study</td>
<td>Services Provided</td>
<td>Population(s) Served</td>
<td>Outcomes</td>
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<tr>
<td>---------------------</td>
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</tr>
<tr>
<td>Misra et al.</td>
<td>Weight management counseling and treatment.</td>
<td>Overweight and obese underserved children</td>
<td>Mobile clinics provide a solution to reach underserved children, but further research is required.</td>
</tr>
<tr>
<td>Morano et al. (2014)</td>
<td>Latent tuberculosis screening and treatment.</td>
<td>Foreign-born populations</td>
<td>Screening and treatment services provided by a mobile clinic successfully identifies high risk Hispanic and uninsured populations.</td>
</tr>
<tr>
<td>O'Connell et al.</td>
<td>Prenatal care</td>
<td>Underserved population</td>
<td>Prenatal mobile clinics improved both access and level of care of the mothers who utilized the mobile clinics.</td>
</tr>
<tr>
<td>Oriol et al.</td>
<td>Primary care</td>
<td>Underserved populations</td>
<td>The Family Van had a return of investment of $36 for every $1 invested in the program.</td>
</tr>
<tr>
<td>Peek et al.</td>
<td>Mammogram screening</td>
<td>Underserved women</td>
<td>Compliance with follow up care of women using mobile mammography services is low.</td>
</tr>
<tr>
<td>Pitt et al.</td>
<td>Pneumonia treatment</td>
<td>Underserved children</td>
<td>Mobile clinics are not more effective at providing pneumonia treatment to children than stationary clinics.</td>
</tr>
<tr>
<td>Robinowitz et al.</td>
<td>Wound care</td>
<td>Underserved populations</td>
<td>Mobile wound care clinics can be implemented successfully at relatively low costs.</td>
</tr>
<tr>
<td>Roscnblum et al.</td>
<td>Primary care</td>
<td>Underserved and homeless population</td>
<td>Preliminary results showed reductions in drug use, homelessness, and health complaints.</td>
</tr>
<tr>
<td>Sherrill et al.</td>
<td>Primary care, and Preventative services</td>
<td>Underserved population</td>
<td>The mobile clinic was successful in increasing access to primary and preventative services among underserved populations.</td>
</tr>
<tr>
<td>Song et al.</td>
<td>Blood pressure screening and treatment</td>
<td>Underserved population</td>
<td>Mobile clinic use showed a reduction in both measured blood pressures of its patients and emergency department use.</td>
</tr>
<tr>
<td>Vashishtha et al.</td>
<td>Dental services</td>
<td>Underserved populations</td>
<td>Mobile dental clinics increase access and affordability to underrepresented populations.</td>
</tr>
<tr>
<td>Yu et al.</td>
<td>Primary care and Preventative services</td>
<td>Underserved populations</td>
<td>Mobile clinics provide a cost effective health care delivery model that improves health outcomes in underrepresented populations.</td>
</tr>
</tbody>
</table>
Addressing Healthcare disparities

Mobile clinics provide healthcare services to the communities that have the poorest access to healthcare. Most of the patients seen by the mobile clinics do not have health insurance and cannot afford healthcare. The Health Wagon, which operates in the rural region of Central Appalachia reported that 61% of their patients had neither health insurance nor the ability to pay for it. One of the major demographic populations that utilize the services provided by mobile clinics is non-dominant racial group: 37% of the patients identified as non-white, and 43% identified as Hispanic or Latino. This finding is also supported by the findings of the study regarding the Family Van, whose authors reported that of the 13,272 patients that visited the mobile clinic during the years 2006 through 2009, 80% were non-white and 28% did not speak English as their first language. Most of the articles about clinics that provided screening services found that a significant percentage of their patients identified as a racial/ethnic
minority. The authors of an article that analyzed a mobile clinic that provided complementary and alternative medicine suggested that the use of alternative medicine is significantly higher in minority populations due to their limited access to standard medical care.\textsuperscript{21} A community-based STD mobile clinic that held numerous screening events in the greater Baton Rouge area had a majority (93\%) of the patients identify as black.\textsuperscript{22}

Some mobile clinics target only underserved populations — such as migrant and seasonal workers a largely Hispanic group. Luque and Castaneda’s report on mobile clinics that aid only underserved populations, suggested that mobile clinics improved access to healthcare services and reduced the number of healthcare complaints.\textsuperscript{23} Rosenblum and colleagues shared findings of a study regarding a mobile clinic targeting the homeless population in New York showed a reduction in health complaints, drug use, and homelessness.\textsuperscript{24}

The MOMmobile described by O’Connell and colleagues is a medical van that provides prenatal care to undocumented and uninsured mothers.\textsuperscript{25} This medical van was also shown to improve birth outcomes as well as earlier access to adequate prenatal care to underserved mothers.\textsuperscript{25} Robinowitz and colleagues reported the findings of a mobile wound care clinic, that suggested the mobile healthcare model can be effectively implemented to increase patient access and utilization.\textsuperscript{26}

A couple of studies incorporated public health education as one of the services provided to their mostly underserved patient population. Mobile clinics that incorporate health education can increase access to primary and preventative services as well as improve the health status of the community through needed illness care or other treatment.\textsuperscript{27} The Family Van included education on health literacy and coaching about cardiovascular health to 96\% of their patients.\textsuperscript{28} A large proportion of the patients also received nutritional counseling (89\%) and discussed
obesity prevention (49%). The authors of a study of another program utilizing a mobile clinic to provide health education and counseling also reported that, with further research to optimize the program, it could help reduce obesity in uninsured children.

Rural residents, especially those of non-dominant or minority groups, rarely get the opportunity to participate in clinical trials. In an article that described the use of a mobile healthcare unit to increase the participation of rural minorities in an HIV clinical trial, Isler and colleagues state that mobile clinics are a successful method of increasing representation of minority members living in a rural area in clinical trials.

Some healthcare disparities are associated with the distrust of health care systems by those who are underserved. Patients described the Family Van as having a welcoming atmosphere that reduced the uncertainty and intimidation they felt when seeking healthcare. A patient in this study reported that “anyone could just walk in, you know. Just walk off the street, if you’re sick or you need a little help or something”. Those patients saw this sense of welcome and were able to overcome the fear that would typically prevent them from utilizing healthcare services.

Not all studies described mobile clinics that were successful at providing better outcomes and access to underserved populations. For example, Abdel-Aleem and colleagues reported that children receiving asthma care at a mobile clinic did not show a significant improvement in asthma outcomes when compared to other children receiving the same treatment at a stationary clinic. In situations where the mobile clinic was not associated with improved outcomes, authors tended to report a need for future research.
Screenings Services

Many of the included studies showed that mobile clinics provided valuable screening tools and were at least minimally effective at providing screening services. The Family Van provided screening services for conditions such as hypertension (elevated blood pressure), hyperglycemia (elevated blood glucose), and hyperlipidemia (elevated cholesterol). Of the patients that received screening, 60% were diagnosed with previously undetected hypertension, 14% with previously undetected hyperglycemia, and 38% with previously undetected hyperlipidemia.\(^\text{20}\)

The Community Health Van mobile clinic, which screened for the presence of a latent tuberculosis infection showed that 25.6% of the eligible patients received a new diagnosis of latent tuberculosis infection.\(^\text{33}\) Of those individuals who tested positive, 57.2% were Hispanic, 60.5% were foreign-born, and 37.5% were undocumented.\(^\text{33}\) Over half (57.9%) of the individuals who were screened did not have health insurance.\(^\text{33}\)

Some studies that compared the effectiveness of mobile healthcare units with stationary clinics revealed that a mobile community-based STD screening service showed higher rates of diagnosed STDs among underserved populations when compared to a similar non-mobile screening program.\(^\text{22}\) Another study assessed whether mobile mammography testing paired with health education could increase cancer screening rates when compared to a stationary clinic providing the same services.\(^\text{32}\) The study’s authors found that women who utilized the mobile clinic were more likely to undergo follow up screening and treatment than those screened in the stationary clinic.\(^\text{32}\)

In a separate study, the Family Van provided blood pressure screening and education upon the first visit and had patients return for follow up in order to track any changes associated
with the suggested dietary and lifestyle changes.\textsuperscript{28} Of the 1,134 patients that returned for additional healthcare services, 237 presented with hypertension.\textsuperscript{28} After the follow-up visits, it was observed that patients with high blood pressure had an average of 10.7mmHg improvement to their systolic pressure.\textsuperscript{28}

Not all studies on mobile clinics reported a positive result on the effectiveness of mobile clinics using screening services. A mobile clinic who provided screening services to mostly racial/ethnic minorities (84.9\%) reported that there was a low (N=128, 20.1\%) follow-up rate among the women who had abnormal results.\textsuperscript{34} A study that compared the effectiveness of pneumonia screening and treatment between mobile clinics and a fixed clinic stated that there was not sufficient evidence to show that mobile clinics were more effective, but that there was an increased rate of care-seeking at the mobile clinic when it made daily visits.\textsuperscript{35}

\textbf{Cost-Effectiveness}

Mobile medical clinics have the ability to reduce costs to the healthcare system. A study that measured the cost-effectiveness of the Family Van suggested that the mobile clinic had an annual cost saving of $3,125,668 based on reducing the number of preventable emergency department (ED) visits.\textsuperscript{36} It also stated that $17,780,000 of annual saving from its preventative services, for a total yearly cost saving of $20,339,968.\textsuperscript{36} Oriol and colleagues reported that the cost of operating the Family Van for a year is approximately $567,700, which results in a return of investment of $36 for every $1 invested.\textsuperscript{36}

A methodology that is commonly used to increase immunization administration efficiency, save time, and resources, was applied to a pediatric mobile clinic to determine if mobile clinic efficiency can be improved in the same way as standard clinics.\textsuperscript{37} The methodology (lean principle) used was able to significantly reduce wait times and the time spent on patients,
thus improving the efficiency of the pediatric mobile clinic.\textsuperscript{37} A mobile wound care clinic in Baltimore, Maryland also demonstrated that the services provided by mobile clinics could lower costs associated with the average cost of each visit, when compared to similar services provided by a facility.\textsuperscript{26} Mobile dental clinics increased dental service access to underserved communities, due to their more affordable costs.\textsuperscript{38}

A few studies showed that mobile clinics were not as cost-effective as their stationary counterparts, such as the case in a mobile mammography clinic where the cost of screening was slightly higher than at a regular mammography clinic.\textsuperscript{32} It is also suggested that in cases where mobile clinics are providing specialized care such as antiretroviral therapy which is commonly used to treat HIV, these clinics are less cost-effective than health facility-based treatment centers.\textsuperscript{39}
DISCUSSION

Increasing Healthcare Access

Many studies show that mobile health clinics are effective in addressing health care disparities and facilitating access to health care services. Part of the reason that mobile clinics can reach higher rates of medically underserved patients is due to their ability to circumvent many barriers to healthcare access.\textsuperscript{17,27} Since mobile clinics can travel to areas with high concentrations of medically underserved groups, they are able to remove most transportation barriers present. The majority of the mobile clinics that were included for review provided free or reduced health care services to those who are uninsured and undocumented, which helped remove most economic barriers patient’s face. A large percentage of the patients seen by mobile clinics belong to a group affected by healthcare disparities, which demonstrates the ability of such clinics to reach those that are generally unreachable. The model and structure of mobile clinics allow them to overcome most healthcare barriers that limit access to health care.\textsuperscript{17}

The included articles contain a vast array of mobile clinics that are providing services aimed at specific populations and diseases. As described in many of the articles, mobile clinics can be tailored to meet the needs of the community. A mobile clinic that was providing wound care treatment to those that have a history of IV drug use and homelessness was successful in part because the program was designed to help that specific community and serve their needs.\textsuperscript{24,26} By identifying the needs of the community affected by healthcare disparities, mobile clinics are better prepared for, and capable of meeting the needs of those patients.

Mobile clinics’ ability to drive to the patient also allows them to reach out and offer patient help, instead of waiting for patients to come to them. Paired with the more welcoming environment of a mobile clinic, such outreach means that patients who usually are untrusting of
the healthcare systems are now more likely to accept and continue using the services provided.\textsuperscript{31} The increased trust between patient and provider will therefore also increase the frequency of patients adhering to behavior and follow up recommendations made by the healthcare provider. Patients’ ability to obtain and follow recommendations from providers has provided more opportunities for them to learn to properly manage their health and have healthier lifestyles.\textsuperscript{27}

**Improving Health Outcomes**

The review was able to determine that mobile clinics can improve health outcomes in underserved populations. Some studies demonstrated that the screening services that were provided were able to identify and diagnose patients with conditions and disease they were unaware they had. Patients who were made aware of the conditions they had, whether it was hypertension, diabetes, or an STD were also given health education and counseling services to teach them how to manage their disease or condition. There was evidence showing that those who were diagnosed with new cases of hypertension showed reductions in their blood pressure seen in their follow up appointments.\textsuperscript{28} It was also shown that mobile clinics improve the health outcomes of underserved mothers and their children. The authors of a study regarding mammography services provided by a mobile clinic suggested that medically underserved mothers were more likely to get mammography screenings than at a stationary clinic.\textsuperscript{32} Increased screenings lead to earlier detection of breast cancer, which provides more treatment options and increases favorable outcomes. There was also evidence that showed that a mobile clinic providing prenatal care was able to provide earlier access to care and led to better birth outcomes than those seen in mothers of the same demographic group that relied on a regular clinic to provide prenatal care.\textsuperscript{40} The mobile health model has shown the ability to improve the overall
health of the community through its increased access to screening services, health education, and
disease management counseling.

**Reducing Healthcare Costs**

The contributions of mobile clinics have the potential to offer numerous cost-saving
benefits to the healthcare system. The costs of starting and operating a mobile clinic are
substantial, but evidence shows that those costs can be offset by the savings associated with these
clinics. The increased access to healthcare and preventative medicine provided by mobile clinics
to underserved populations has led to reductions in preventable emergency department visits as
well as hospital admissions.\(^{36}\) Patients with low incomes typically have the highest rates of
emergency department visits due to their inability to afford regular doctor visits, barriers
preventing them visiting a primary care provider, and gradual exacerbation of a chronic
disease.\(^{17}\) The ability for mobile clinics to remove many of those barriers reduces the need for
patients to have preventable emergency department visits, which also frees up the resources of
the ED for patients needing emergent services. Multiple studies have shown that there is a
reduction in costs to both the patient and the healthcare system, due to the improved detection
and management of chronic disease provided by mobile medical units.\(^{17,36}\)

**Limitations of the Mobile Clinic Model**

Although there are many studies that support the strengths and potential of mobile
healthcare clinics, there have also been some limitations of the mobile model that have been
pointed out. Many mobile clinics struggle to obtain steady funding to continue providing
consistent care to those who need it. Lack of funding results in inconsistency in availability
resulting in decreased use of the services a clinic provides. Although it has been shown that the
return on investment is high, starting a mobile clinic can still be challenging and expensive. Due
to the limited size and staff of mobile clinics, there are also limitations to the speed, quality, and variety of services they can provide, compared to other more extensive health facilities. As the mobile clinics are not integrated into the healthcare system, referral to specialists, or follow up for further treatment, can also be challenging. Staffing a mobile clinic can be a challenge, given that most rely on volunteers; ensuring a mobile clinic always has a physician that can provide services to those of different races and cultures can be particularly difficult.

**Limitations of the Study**

A rapid review, as opposed to a systematic review, was conducted due to limitations in time and resources. A rapid review is not as thorough and omits part of the methodology involved in a systematic review, potentially leading to the exclusion of studies that fit the criteria for the review. This study was also limited to studies that were electronically published in the chosen databases, leading to the likely exclusion of eligible studies found in other databases. Due to limited resources, only studies that had free access to their full text were included, which excluded multiple studies that fit the inclusion criteria. Language is another limitation as only articles published in the English language were considered. The rapid review used a modified methodology obtained from Cochrane systematic reviews, where only a single reviewer screened and reviewed most of the articles that were included for the study. In order to reduce bias associated with a single reviewer, a team of two other independent reviewers was used to screen random sample selections of the screened studies to assess the reliability of the reviewer. A final limitation is due to the limited research found that directly assesses the impact mobile clinics have on health care disparities.
CONCLUSIONS

This rapid review suggests that mobile healthcare models have been shown to be valuable assets in providing healthcare services to underserved populations throughout the nation. The included literature also supports the claim that mobile clinics are a cost-effective and successful healthcare model. Through the careful planning and assessment of the needs of the community, mobile clinics can assist the community in ways other healthcare models cannot. The ability to drive to the patient has been shown to increase trust between patients and providers among those who are most vulnerable. Mobile clinics have also been shown to improve the overall health of underserved populations when compared to patients seeking care at other facilities. Continuous research is needed to address the limitations of mobile healthcare clinics so that the scope and capacity of these clinics can be improved. Integration of mobile clinics into existing healthcare systems, can help address and reduce their limitations, allowing them to combat the healthcare disparities that affect this nation.
ACKNOWLEDGEMENTS

Throughout the writing of this capstone project I have received a great deal of support and assistance. I would first like to thank my committee mentor, Dr. Rebecca Pearson for support, mentorship, and useful discussion.

I would also like to thank my committee members, Dr. Shawn Reichert and Dr. Bernadette Jungblut for the assistance in the review process. As well as for the assistance and direction provided.
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39. Mdege ND, Chindove S. Bringing antiretroviral therapy (art) closer to the end-user through mobile clinics and home-based art: systematic review shows more evidence on the effectiveness and cost effectiveness is needed. *Int J Health Plann Manage.* 2014;29(1):e31-e47. doi:10.1002/hpm.2185

## APPENDIX

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