

Analysis of Annual Costs of Mobile Clinics in the Southern United States

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Abstract

Introduction: Mobile clinics provide an efficient manner for delivering healthcare services to at-risk populations, and there is a need to understand their economics. This study analyzes the costs of operating selected mobile clinic programs representing service categories in dental, dental/preventive, preventive care, primary care/preventive, and mammography/primary care/preventive. **Methods:** The methodology included a self-reported survey of 96 mobile clinic programs operating in Texas, North Carolina, Georgia, and Florida; these states did not expand Medicaid and have a large proportion of uninsured individuals. Data were collected over an 8-month period from November 2016 to July 2017. The cost analyses were conducted in 2018, and were analyzed from the provider perspective. The average annual estimated costs; as well the costs per patient in each mobile clinic program within different service delivery types were assessed. Costs reported in the study survey were classified into recurrent direct costs and capital costs. **Results:** Results indicate that mean operating costs range from about \$300 000 to \$2.5 million with costs increasing from mammography/primary care/preventive delivery to dental/preventive. The majority of mobile clinics provided dental care followed by dental/preventive. The cost per patient visit for all mobile clinic service types ranged from \$65 to \$529, and appears to be considerably less than those reported in the literature for fixed clinic services. **Conclusion:** The overall costs of all delivery types in mobile clinics were lower than the costs of providing care to Medicare beneficiaries in federally funded health centers, making mobile clinics a sound economic complement to stationary healthcare facilities.

Keywords

mobile clinics, survey, operating costs, capital investments, direct costs

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Introduction

Mobile clinics are vehicles customized with medical equipment and staffed to provide health services for populations at risk, enforce disease prevention, and improve access for chronic health management, at reduced costs.¹ There are about 1500 to 2000 mobile clinics in the United States (US) that provide health services to over 5 million individuals.¹ The type of services these programs provide range from primary care, dental care, and mental health care. Mobile clinics can be effective in providing the same healthcare services provided in stationary healthcare facilities. Economic studies show that mobile clinic programs can be cost-effective in providing annual savings of up to \$36 for every \$1 invested compared to emergency room visits.¹ Nonetheless, initial capital investment for a mobile clinic program and operating costs can be significant.²

Other limitations of mobile health clinic programs include financial capacity, information management capacity, and staffing recruitment.³ Further, planning a mobile clinic program can involve multiple stakeholders from the private, non-profit, and public sectors,⁴ adding a level of complexity in the management of these programs not

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commonly found in other sectors.⁵ Consequently, the significant initial investment, such as acquisition costs of equipment⁶ and operating expenses for mobile clinics, needs careful planning,⁷ as well as serious consideration of outcomes and performance evaluation metrics.⁸

The ability to afford and provide healthcare in rural areas is a concern amidst national efforts to provide access to quality healthcare in the US. This is the case particularly in states that did not participate in the Medicaid expansion⁹—many of which are facing rural hospital closures. The use of mobile clinics could help alleviate these issues of access. However, this model has not been studied well enough to warrant the implementation of policies to encourage wider adoption, especially in rural areas. A comprehensive review of the costs associated with the operations of mobile clinics should help inform financial stakeholders and policymakers of the sustainability of mobile clinic programs, especially in areas with a high concentration of populations at risk. Similarly, looking into the economic variation across different programs should provide the basis to identify patterns of optimal management procedures. The goal of the study is to understand the cost structure of selected mobile clinic programs in Texas, Florida, Georgia, and North Carolina. These states did not participate in the Medicaid expansion⁹ and together have about 3 million adults under 65 years of age without healthcare coverage; Texas (26%), followed by Florida (20%), Georgia (11%), and North Carolina (8%).¹⁰

Methods

Study Sample

Data was collected via an online self-reported survey using Survey Monkey¹¹ and sent to program managers, providers, or directors of mobile clinic programs listed in the directory of the Mobile Health Clinics Association, a national advocacy group for mobile health clinics. The sample was of convenience and covered a cross-section of 96 mobile clinic programs in Texas, Georgia, Florida, and North Carolina. Data were collected over an 8-month period from November 2016 to July 2017. Survey responses were stratified into the following service types: dental, dental/preventive, preventive care, primary care/preventive, and mammography/primary care/preventive. The study received expedited review and approval by the Committee for Protection of Human Subjects of the University of Texas Health Science Center. No invasive procedures were involved in data collection. Participants in all the mobile clinic programs agreed to voluntary participation in the survey, and reported data based on their accounting documentation for the mobile clinics in each of the stratified service types. Programs could have multiple or single clinics across any of the service delivery types. The average annual operating costs across the mobile clinics in the programs for each service delivery type were

assessed. The average total operating costs per patient in the programs in each service delivery type was calculated as well. The average number of patients that visited each of the individual clinics in the programs annually was calculated for each service delivery type.

Data Analysis

Costs were analyzed from the provider perspective, which does not include costs such as government reimbursements or direct costs to the patients. Costs reported in the study survey were classified into recurrent direct costs and capital costs. Recurrent costs are variable costs of running the mobile clinic such as maintenance, repair, fuel, and salaries. Capital costs include acquisition costs of equipment, and vehicle.⁶ To compare survey results, reported cost data was organized into costs statement-like forms used for identifying similar line items for variable costs of operations (labor and maintenance) across programs. Fringe benefits were estimated using a 29% rate as reported by the Bureau of Labor Statistics.¹² Given the wide differences in operations between mobile clinic programs, indirect costs (ie, overhead) were not solicited in the survey and were not included in the analysis.

Annual depreciation expenses for capital equipment and vehicles was calculated using mean acquisition costs and estimated useful life years.¹³ Since the survey collection period was through 2016 to 2017, total annual operating costs were inflation-adjusted to 2018 dollars using the medical cost inflation calculator.¹⁴ Annual operating cost per patient was calculated based on the number of patients per year reported by each mobile clinic program.

Results

A total of 17 responses were received representing a response ratio of 18%. However, due to incomplete data, only 15 programs were included in the analysis. The respondents reported operating a total of 49 mobile clinics representing the 4 states in the Southern US. These mobile clinic programs are summarized by state and service type in Table 1. Five programs reported providing dental services exclusively and operating a total of 27 mobile clinics. One program based out of Georgia operated 18 dental mobile clinics. Two programs provided dental and preventive services, and operating a total of ten mobile clinics. Eight programs offered preventive and primary care/preventive services, with the use of eleven clinics, and only 1 program reported providing mammography/primary care/preventive care using 1 mobile clinic. Considering program state location, 6 programs were based in Texas, 4 in Florida and North Carolina, respectively, and 1 program in Georgia. A total of 18 mobile clinics operated in Texas, 18 in Georgia, 7 in Florida, and 6 in North Carolina. Most of the clinics (78%) were medium in length (30'–40').

Table 1. Number of Mobile Clinics in the Study by Program, State, and Service Type.

Program number	State location of the program	Service type					Total
		Dental	Dental/ Preventive	Preventive	Primary care/ Preventive	Mammography/ Primary care/ Preventive	
1	Georgia	18					18
2	Texas	3					3
3	North Carolina	3					3
4	Florida	2			2		4
5	Texas	1					1
6	Texas		9				9
7	North Carolina		1				1
8	North Carolina			1			1
9	Florida			1			1
10	Florida			1			1
11	Texas				3		3
12	Texas				1		1
13	North Carolina				1		1
14	Florida				1		1
15	Texas					1	1
Total		27	10	3	8	1	49

Table 2. Estimated Total Annual Operating Costs and Percentage Breakdown by Main Line Item (2018 USD).

	Service type—mobile clinic programs				
	Dental	Dental/ Preventive	Preventive	Primary care/ Preventive	Mammography/ Primary care/ Preventive
Labor costs					
Program average	82%	80%	91%	92%	65%
Program minimum cost	69%	39%	75%	0%	65%
Program maximum cost	84%	84%	91%	92%	65%
Maintenance costs					
Program average	7%	7%	4%	3%	10%
Program minimum cost	18%	1%	14%	17%	10%
Program maximum cost	5%	8%	3%	3%	10%
Depreciation costs					
Program average	11%	13%	5%	5%	25%
Program minimum cost	13%	60%	11%	83%	25%
Program maximum cost	11%	8%	6%	4%	25%
Total operating costs					
Program average	\$2257587	\$2449655	\$479092	\$821586	\$304890
Standard deviation	\$4043699	\$2823700	\$344172	\$913167	NA
Program minimum cost	\$76196	\$452998	\$87736	\$612	NA
Program maximum cost	\$9430765	\$4446312	\$710258	\$2314494	\$304890

The summary of the estimated annual costs of operating a mobile clinic program by service type is presented in Table 2. A percentage breakdown by line item is also included. The highest annual operating costs involved dental and dental/preventive services with averages ranging between \$2.3 and \$2.5 million. Preventive and primary

care/preventive showed average costs between \$479 000 and \$822 000. Mammography/primary care/preventive showed the lowest annual average at \$300 000 per year. For all service types, the largest cost line item was labor costs, followed by depreciation and maintenance costs. Labor costs for preventive and primary care/preventive had the

Table 3. Estimated Annual Cost per Patient Visit and by Mobile Clinic Service Type (2018 USD).

	Service type				
	Dental	Dental/ Preventive	Preventive	Primary care/ Preventive	Mammography/ Primary care/ Preventive
Total costs					
Program average	\$2257587	\$2449655	\$479092	\$821586	\$304890
Standard deviation	\$4043699	\$2823700	\$344172	\$913167	NA
Program minimum cost	\$76196	\$452998	\$87736	\$612	NA
Program maximum cost	\$9430765	\$4446312	\$710258	\$2314494	\$304890
Number of patient visits per year					
Average per mobile clinic	67482	10328	2782	3956	4705
Program minimum patient visits*	500	1300	1200	135	NA
Program maximum patient visits*	1620000	101979	6000	15000	NA
Total operating costs per patient					
Program average	\$123	\$225	\$243	\$150	\$65
Standard deviation	\$148	\$258	\$248	\$124	NA
Program of minimum cost	\$5	\$43	\$81	\$5	NA
Program of maximum cost	\$309	\$408	\$529	\$326	\$65

*The programs with minimum and a maximum number of patient visits might not be the same as those programs with the minimum and maximum cost per patient visit.

largest percentage amounting to more than 90% of total costs. Dental and dental/preventive labor costs represented 80% of the total, while mammography/primary care/preventive had only 65%. The highest percentage for depreciation costs was seen in the mammography/primary care/preventive with 25% costs. In comparison, dental and dental/preventive showed up to 13% of total costs, while preventive and primary care/preventive services had only 5% of total costs as depreciation. This variation in percentage depreciation costs likely reflects differences in the level of capital equipment carried by service types. For example, mammography's 25% of depreciation costs likely correspond to onboarding expensive screening equipment. A similar argument applies to maintenance costs. The percent of total costs attributable to maintenance was 10% for mammography/primary care/preventive, followed by dental and dental/preventive with 7%, and preventive and primary care/preventive at 3%. Given the small sample size at the state level, a comparison of costs between states and by mobile clinic program type was not considered.

The estimated total annual operational costs per patient visit in 2018 dollars by a mobile clinic service type is represented in Table 3. The highest average annual operating cost per patient visit (\$243) was for preventive services, while the lowest average cost (\$65) was for mammography/primary care/preventive delivery services. Surprisingly, the cost per patient visit for dental services was \$123 which is considerably lower than the \$225 cost per patient reported by programs offering dental/preventive services. Nonetheless, preventive services showed an average cost

per patient visit of \$243 suggesting an overall high cost for prevention programs. The cost per patient visit was estimated from survey responses taking into account reported annual patient visits (Table 3). The lowest average annual number of patient visits per mobile clinic (2782) was reported by preventive service programs, which could explain the overall high cost per patient visit discussed previously. Programs offering primary care/preventive services reported an average annual of almost 4000 patient visits per clinic, while dental/preventive programs reported an average of over 10000 visits per year. Surprisingly, the average annual patient visits for dental programs were over 67000 which are significantly higher than other programs. However, the range of reported patient visits per year was considerably varying between 500 visits per year to over 1.6 million. A similar spread is seen for dental/preventive (1300 visits per year to 102000).

Discussion

We present a cost analysis of operating selected mobile clinic programs for 5 service categories, dental, dental/preventive, preventive care, primary care/preventive, and mammography/primary care/preventive. Costs were aggregated estimates and do not reflect the accounting practices of a particular mobile clinic program. Higher average operational costs were seen in dental and dental/preventive service types, compared to the other 3 service types. Regarding the reported number of patient visits, however, dental and mammography/primary care/preventive showed the lowest

cost per patient visit. This is even though these programs indicated a higher investment in capital equipment. For both service types, the relatively high number of annual patient visits appears to be the main factor of cost per visit. However, the large number of reported annual patient visits by dental mobile clinic programs does create concern regarding the reliability of cost estimates per visit. It is possible that respondents confused an annual number of patient visits per mobile clinic with a total number of visits for the entire mobile clinic program.

Our cost analysis is consistent with other mobile clinic cost studies.^{1,2,6,7} The cost per patient visit differences between service types is also similar to those reported in the literature. For example, a publication from the Medical Expenditure Panel (MEP) data showed 2014 mean health-care expenses for a national sample of about 271 million people of all ages, being less in dental services (\$696) compared to other ambulatory services (\$2389).¹⁵ As calculated, the cost per patient visit for all mobile clinic service types appears to be considerably less than those reported in the literature for fixed clinic services. A study by Mukamel et al,¹⁶ looked at claims data from Medicare beneficiaries (65 years and older) in Florida, North Carolina, and Texas and identified that total median annual costs (both out of pocket and Medicare payments) per beneficiary was \$2370 in federally funded health centers, \$2667 for physician offices, and \$3580 for outpatient clinics. The total median annual costs per beneficiary for beneficiaries less than 65 years was \$2396 in federally funded health centers, \$2638 in physician offices, and \$3380 in outpatient clinics.⁷ Considering that the sample of our mobile clinic study was composed of children and adults, and 1 of the states, Georgia, was not in the Mukamel et al¹⁶ study, the costs per patient from all 5 mobile clinic delivery types were less than the total annual median costs reported by Mukamel et al,¹⁶ with the highest annual mean costs reported by the mobile clinics being in the preventive category of \$243.

When the costs were broken down into primary and non-primary care (considered specialty care) in the Mukamel et al¹⁶ study, the total median annual costs per beneficiary, for beneficiaries 65 years and older in primary care was [federally funded health centers (\$560), physician offices (\$472), outpatient clinics (\$861)] and that of beneficiaries less than 65 years was [federally funded health centers (\$573), physician offices (\$478), outpatient clinics (\$745)]. In non-primary care, the total median annual costs per beneficiary for beneficiaries 65 years and older was [federally funded health centers (\$1753), physician offices (\$2123), outpatient clinics (\$2567)] and that of beneficiaries less than 65 years was [federally funded health centers (\$1879), physician offices (\$2240), outpatient clinics (\$2661)].¹⁶ These costs were still more expensive than the highest costs of \$243 in the preventive category in the mobile clinics.

The percent breakdown of costs by line item provides a consistent illustration of cost structure by mobile clinic program type and reflects the relative importance of labor, equipment, and maintenance costs. As expected, labor costs are the largest line item for mobile clinic programs showing the lowest percentage for those programs with larger capital investments as illustrated by depreciation costs (eg, the mammography program having a 25% in depreciation and 65% in labor costs). These differences in cost structure also reflect the degree of importance line items should receive in the strategic planning of mobile clinic resources. For example, mobile clinics programs offering preventive care are likely to devote more resources for human resource capacity building, whereas, dental mobile clinic programs appear to need to plan more critically for the maintenance procedures of their equipment and capital resources.

Limitations

Selection bias is likely to be a limitation in the study since the sample used in the analysis was of convenience. The fact that Georgia had only 1 organization represented with 18 clinics, which were all dental, is a limitation of the study. This poses an issue of external validity which needs to be considered in understanding the findings of this work. Recall bias from the self-reported survey is another limitation to be considered. The sample size for the study was small, and therefore there were categories of direct costs with no reported data. Additionally, how the costs were reported may be a limitation as they were self-reported estimates from organizations that may have different approaches for defining costs. Additionally, the survey did not include a section on indirect costs, and this line item was not included in the analysis. Information on fringe benefits for staff was estimated using secondary data.

Conclusion

The mobile clinic healthcare delivery model has the potential of providing access to populations at risk, at apparent low cost. Annual operating costs varied by clinical service type with the major cost drivers attributable to labor (salaries and fringe benefits) costs. Given its relatively low-cost, the mobile clinic model appears to be a sound economic complement to stationary healthcare facilities. Not only will the model help fill a current healthcare access gap, but could help mitigate the negative impact of the growing number of rural hospital closures in rural areas in America where the need for healthcare is the direst.

Authors' Note

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Authors' contributions

Each author made substantial contributions to the conception, design, analysis, and interpretation of data, as well as approve the submission.

Declaration of Conflicting Interests

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Ethical Approval and Consent to participate

The study received expedited review and approval by the Committee for Protection of Human Subjects of the University of Texas Health Science Center. No invasive procedures were involved in data collection. Participants agreed to voluntary participation in the survey.

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