

Quantifying the reduction in nonmedical costs after the introduction of a rural county hospital in Ecuador

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ABSTRACT

Objective. *This study attempts to quantify the impact of the introduction of local second-level health services on nonmedical costs (NMCs) for residents of the rural Ecuadorian county of La Maná.*

Methods. *NMCs for patients accessing second-level health care were assessed by using a quasi-experimental pre- and postintervention study design. In 2007, before local second-level health care services existed, and then in 2008, after the introduction of second-level health care services in the form of a county hospital, 508 patients from the county who sought second-level health care were interviewed.*

Results. *Mean NMCs per patient per illness episode were US\$ 93.58 before the county hospital opened and US\$ 12.62 after it opened. This difference was largely due to reductions in transport costs (US\$ 50.01 vs. US\$ 4.28) and food costs (US\$ 25.38 vs. US\$ 7.28) (P < 0.001 for each category).*

Conclusions. *NMCs can be decreased sevenfold with the introduction of a county hospital in a rural province previously lacking second-level health care. Introduction of rural second-level health care reduces financial barriers and thus may increase access to these health services for poorer patients in rural communities.*

Key words

Rural communities; rural hospitals; personal expenditures; cost savings; health expenditures; Ecuador.

Nonmedical costs (NMCs), both direct and indirect, are found in practically all health care delivery systems in the

world. These costs include, but are not limited to, expenses such as transportation, time spent traveling, food, and lodging that are attributed to patients' and their family's health care needs (1). NMCs have been shown to be substantial components of patients' health care costs and are thus barriers to accessing health care for some patients. Yet these costs are often overlooked by insurance schemes, health care workers, and health system planners (1–7). This can result in a high financial burden, defined in the literature as spending more than 10% of the family income on health care, which

can result in patients making difficult decisions about their treatment options that may adversely affect their health outcomes (1, 2).

Less is known about NMCs for rural populations in low-income countries, as much of the research on quantifying these costs has been done on oncology patients in the United States of America (1).

ECUADOR HEALTH SYSTEM BACKGROUND

The Ministry of Public Health (MOH) of Ecuador provides greater than 50% of

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all health care services and the National Institute of Social Security provides another 20% to 25% to the Ecuadorian population. Other providers include the private sector, military, police, municipalities, nongovernmental organizations, and other semiprivate institutions. As of 2007, there are more than 3 100 nonhospital health care facilities, presumably dedicated generally to primary health care for the total Ecuadorian population of 14.2 million (8). This suggests that primary care coverage is better than in many other low-income countries. There are about 90 MOH second-level hospitals, predominantly in rural areas (8). However, many of them struggle to function as hospitals because of financial and human resource limitations. As is true in many low-income countries, rural areas, which are home to roughly 40% of Ecuadorians, are high-priority targets for improving health in Ecuador because of much higher levels of poverty (80% of inhabitants are considered poor in rural areas vs. 40% in urban areas) and worse health indicators (such as a disproportionate prevalence of short height for age and malaria) than in urban areas (9).

IMPORTANCE OF SECOND-LEVEL HEALTH CARE SERVICES IN RURAL ECUADOR

The study focused on NMCs resulting from patients seeking second-level health care. Second-level health care was chosen because in La Maná, and presumably in other rural areas in Ecuador and other low-income countries, first-level health care services are generally more accessible than second-level services (10). For the purposes of this study, second-level health care services were defined as the basic inpatient medical, surgical, and obstetric-gynecologic services typically offered in a rural hospital. These services include intravenous drug administration, skilled nurse monitoring, and basic elective and urgent abdominal surgery, including cesarean sections. Specialist outpatient care and day procedures also fit this definition of second-level health care, but they were not included because they were not present at the facility being researched.

This study attempts to quantify the NMCs incurred by patients and their families from the rural Ecuadorian county of La Maná who were seeking

second-level health care services. NMCs between two groups are compared: one group of patients without access to second-level care in their county and a second group of patients in the same county who later gained access to this type of care.

METHODS

Setting

La Maná is a rural, subtropical region with a population of about 17 276 in the western part of Cotopaxi province, Ecuador (11). It was chosen because a new MOH county hospital providing second-level health care services opened there in March 2008, making it an ideal setting to conduct a pre- and post-intervention study on the impact of the new hospital. As in other rural areas in Ecuador, most people in La Maná did not own automobiles and relied on taxis and public buses to access second-level health care services in other regions of the country.

Data collection

The study used a quasi-experimental pre- and post-intervention design. Data were collected with a questionnaire to patients from La Maná who had accessed second-level care before and after the MOH hospital opened there. Cost data for the pre-intervention group were collected between June and August 2007 from patients who had to travel outside of La Maná to access second-level health care during the previous 24 months. The questionnaire was administered to 254 patients in their homes by local MOH workers who identified eligible participants by door-to-door canvassing in each of the major population centers that would be served by the new La Maná County hospital. The second round of data collection was performed in September–December 2008 with 254 patients who had accessed second-level care at the new MOH county hospital in La Maná instead of traveling to another city. These 254 patients were interviewed upon discharge from the hospital. The number 254 was used because it was the number of patients interviewed in 2007. The study attempted to make the 2007 and 2008 groups as comparable as possible by keeping the proportion of patients from each population area equal.

Costs considered

NMCs for patients and their caregivers were the main direct costs analyzed. Caregivers were defined as family members, or other people related to the patient, who were involved in caring for the patient at the hospital during the illness episode; health professionals employed by the hospital who were caring for the patient were excluded from this definition. Medical expenses were not analyzed because there are no user fees in MOH facilities in Ecuador. Measured NMCs included monetary NMCs, such as transportation, shelter, food, and clothing costs for patients and their caregivers. Transportation costs were defined as all cash expenses incurred by patients and their caregivers to travel to and from the hospital during the patient's illness episode. Shelter costs were defined as all cash expenses incurred by patients and their caregivers for lodging in the community where they sought medical treatment during the illness episode. As some patients traveled to distant cities to receive care for an extended period of time, these costs could be quite high. Food costs were defined as all cash expenses incurred by patients and their caregivers to purchase food during the illness episode. As many second-level health care facilities in Ecuador do not provide food, patients hospitalized far from their homes often have to buy food from restaurants. Clothing costs were defined as all cash expenses incurred by patients and their caregivers to purchase new clothes during the illness episode. New clothing was often necessary for patients who sought treatment in a major highland city close to La Maná, such as Latacunga or Quito, as temperatures there are much lower than in the tropical lowlands.

In addition to analyzing transportation, shelter, food, and clothing costs, two nonmonetary NMCs for patients and their caregivers were included in the analysis—specifically, the amount of time traveled and number of days away from home. Time traveled was defined as the amount of time to travel one way to the hospital by public bus, which was the most common mode of transportation used by the patients in this study to access second-level health care. The number of days away from home was defined as the number of days spent

traveling plus the number of days of hospitalization for the patient.

To gain some perspective on the relative magnitude of these NMCs, a patient's financial position was estimated in two ways. The first estimate used monthly household expenditure, which was derived from patients' self-reported monthly expenditures. Monthly household expenditure has been shown to be a more accurate and stable predictor of wealth than monthly income for farmers and rural laborers because of seasonal changes in their incomes (12). The second estimation technique used national data on average monthly rural household expenditures from the 2005 National Survey of Living Standards in Ecuador (13). All monetary costs were measured in United States dollars, as that is the official currency of Ecuador (14).

Data analysis

Data from the questionnaires were scored and input into an electronic spreadsheet for analysis. Data were analyzed with SPSS statistical software (SPSS version 17.0, Chicago, Illinois, United States of America). Patients for whom only one NMC was recorded were removed from the total NMC analysis, totaling 67 of the 508 patients. Non-recording occurred when patients did not recall precise costs or when a relative or friend had paid costs, which were unknown to those present at the interview. Patients who did not incur costs were scored as a zero, not as a nonresponse. NMCs from the 2007 and 2008 samples were compared by using Mann-Whitney U tests. For the combined samples, correlations between the total monetary NMCs (transportation costs + food costs + clothing costs + shelter costs), travel time, and monthly expenditure were examined using Spearman nonparametric correlation coefficients. Linear regression models were used to predict total monetary NMCs in the combined samples. For the regression analyses, the non-normally distributed outcome variable (total monetary NMCs) was log-transformed to approximate distributional normality.

We also created a subgroup of patients from the post-intervention group who had diagnoses equal to those of patients from the pre-intervention group. Because the 2008 post-intervention group's major diagnostic difference compared with the 2007 pre-intervention group was a sub-

stantially higher proportion of childbirths (i.e., labor and delivery), the proportion of childbirths in the 2008 group was adjusted down to the same proportion as in the 2007 group. The weight of each childbirth observation of the 2008 group was reduced so that the total effective proportion of childbirths was equal in the 2007 and 2008 groups.

RESULTS

Table 1 shows a detailed comparison of demographic and income data collected for the 2007 and 2008 groups. The two groups differed in some demographics, including monthly expenditure and diagnosis type. The mean monthly expenditure for the 2007 group (US\$ 217.30) was almost significantly greater than the mean monthly expenditure of the 2008 group (US\$ 169.70, Mann-Whitney U test, $P < 0.09$). Additionally, the 2008 group had a higher percentage of obstetric diag-

noses and a lower percentage of surgical diagnoses than the 2007 group. The response rate for the 2008 group was nearly 100%, with only one patient declining to participate. However, the number of potential subjects who declined to participate in the 2007 round of data collection was not recorded by the MOH workers conducting the surveys, and thus a response rate for the 2007 group could not be calculated.

Table 2 shows a detailed comparison of NMCs for the 2007 and 2008 groups. Total mean illness-related, monetary NMCs decreased sevenfold from US\$ 93.58 to US\$ 12.62 after the district hospital opened. Because of non-normal distribution of the data, median costs were lower than mean costs. In comparison, median total monetary NMCs decreased from US\$ 40 to US\$ 6. These illness-related monetary NMCs were composed of four cost subcategories: transportation, food, shelter, and new clothing costs. The reductions in the

TABLE 1. Comparison of demographic and income data for patients from La Maná, Ecuador, accessing second-level health care before (2007) and after (2008) construction of a county hospital in La Maná

Category	2007 (n = 230)	2008 (n = 211)
Mean age (years)	35.5 (range 0–93)	30.5 (range 0–87)
Percent female	64	78
Mean household size (people)	5	5
Type of second-level health care service received		
Surgical (%)	60	20
Medical (%)	30	31
OB/GYN ^a (%)	10	49
Monthly self-reported household expenditure (US dollars) ^b	213.70	169.70
National average monthly rural household expenditure (INEC) ^c (US dollars) ^b	408	408

^a OB/GYN = obstetric-gynecologic.

^b Official Ecuadorian currency is the US dollar (14).

^c INEC = National Institute of Statistics and Census (Ecuador). Data from INEC (13).

TABLE 2. Comparison of nonmedical costs for patients from La Maná, Ecuador, accessing second-level health care before (2007) and after (2008) construction of a county hospital in La Maná

Category	2007 (n = 230)			2008 (n = 211)		
	Mean	Median	25th to 75th percentile	Mean	Median	25th to 75th percentile
Transportation (US dollars) ^a	50.01	20	4–50	4.28	2	1–5.5
Food (US dollars) ^a	25.38	10	0–30	7.28	2	0–10
Shelter (US dollars) ^a	11.73	0	0–0	0.27	0	0–0
Clothing (US dollars) ^a	6.75	0	0–5	0.84	0	0–0
Total nonmedical costs (US dollars) ^a	93.58	40	12–110	12.62	6	1.88–18
Travel time to hospital (hours) (one-way distance by bus)	2.2	1	0.5–4	0.5	0.33	0.167–0.667
Time away from home (days)	11.3	4	2–15	2.3	2	1–3

^a Official Ecuadorian currency is the US dollar (14).

mean (median) values for these subcategories were US\$ 50.01 (US\$ 20) to US\$ 4.28 (US\$ 2) for transportation costs, US\$ 25.38 (US\$ 10) to US\$ 7.28 (US\$ 2) for food costs, US\$ 6.75 (US\$ 0) to US\$ 0.84 (US\$ 0) for clothing costs, and US\$ 11.73 (US\$ 0) to US\$ 0.27 (US\$ 0) for shelter costs (Mann-Whitney U tests, all $P < 0.001$). For the non-monetary NMCs, the difference in total travel time between the 2007 and 2008 groups was statistically significant (Mann-Whitney U test, $P < 0.001$). Patients in the 2008 group also spent less time away from home than the 2007 group. The 2007 group spent a mean time away of 11.3 days versus 2 days away for the 2008 group.

To test whether the differences in diagnoses between the two groups, such as the elevated proportion of childbirths in 2008, significantly affected the observed difference in NMCs, the study adjusted the 2008 data to make a weighted proportion of childbirths equal to the 2007 proportion of childbirths, which effectively equalized the proportion of childbirths in each group. Equalizing the proportion of childbirths in the 2008 group to the 2007 group had virtually no effect on the reduction in total NMCs (data not shown).

The study also used linear regression modeling with total monetary NMCs regressed on travel time and monthly expenditure. The regression results revealed that the only significant predictor of total monetary NMCs was travel time ($P < 0.001$). Monthly expenditure was not a statistically significant predictor of monetary NMCs ($P = 0.237$) when travel time was included as a predictor.

DISCUSSION

Cost results

The 2008 group had significantly lower costs of accessing second-level health care than the 2007 group. The NMC savings were largely due to the reduced transportation and food costs incurred by the 2008 group, likely stemming from reduced travel times. This reduction in costs occurred largely because the patients in the 2008 group were able to satisfy their health care needs much closer to home, which meant they did not have to spend as many resources on transport to get to and from the hospital. By receiving medical care closer to home, the 2008 group was also able to save resources by eating meals brought

from home instead of buying food at restaurants.

Mean values, in general, exceeded median values. Although there are likely to be many factors underlying this non-normal distribution, one potential contributing factor is the observation that as the hospitalization time for patients increases, the number of family members who visit the patient often also increases. Thus, as hospitalization time is prolonged, or when care is sought at a faraway urban center, the NMCs incurred by patients and their caregivers increase simply because there are more total caregivers or more frequent visits from caregivers. Further study is required to assess the impact of substantial NMCs on patient financial stability and well-being.

These results demonstrate that, even in a publicly funded system such as Ecuador's with no user fees, NMCs are potentially a large proportion of a patient's monthly income, which can put patients at financial risk and act as a barrier to accessing health care. Another cost not measured in this study is the cost of care for children and other dependents left at home when patients and their caregivers are away from the domicile seeking health care in another city or region. Reducing NMCs through the creation of local hospitals in rural areas could thus increase health care access, particularly for poorer patients.

The linear regression of total monetary NMCs versus travel time and monthly expenditures was done to analyze whether patients from the 2007 group, who on average were wealthier than the 2008 group, incurred larger monetary NMCs simply due to their being wealthier and having an inherent ability to spend more money. If this were the case, the decrease in monetary NMCs seen in the 2008 group might be attributable simply to the fact that it is a poorer population with a more limited spending ability compared with the wealthier 2007 group. However, the fact that travel time, and not the wealth of the patient, was the only significant ($P < 0.001$) predictor of monetary NMCs makes this hypothesis much less likely.

Comparison of demographics for the 2007 and 2008 groups

As noted above, the 2007 and 2008 groups differed demographically in

many ways. Household size appears to be the only similar demographic. The 2008 group appears to consist of a younger, poorer population seeking second-level care for a greater proportion of obstetric-gynecologic conditions (mostly labor and delivery) instead of surgical conditions. The presence of a disproportionate number of obstetric-gynecologic patients in the 2008 group did not appear to change the results or impact of the 2008 data, as indicated by the analysis of a subgroup of the 2008 patients that was weighted to have equal proportions of obstetric-gynecologic diagnoses as the 2007 group (data not shown).

Study limitations

This study has several limitations and biases. Collecting information only from patients who accessed the health care facility introduces a selection bias whereby patients who could not access care because of its high costs (direct and indirect) were excluded. Interviewing the 2007 group in their homes and the 2008 group in the hospital created an environmental bias. Interviewer and language biases might have also existed, as the 2007 interviews were conducted by Ecuadorians from La Maná while the 2008 interviews were conducted by two Americans, for whom Spanish is a second language. The study was also highly susceptible to recall bias because the study design relied on patients' abilities to accurately recall details of events that might have occurred up to two years prior. The interview method was chosen to collect study data in order to mitigate the effects of this bias. Finally, although subjects in both groups came from the same population centers in La Maná, subjects in 2007 were selected based primarily on convenience (i.e., if they were present when MOH interviewers arrived) and thus only approximate the population served by the new hospital.

As this study was performed in the Ecuadorian subtropical district of La Maná, it may be difficult to generalize to other areas of Ecuador or to other countries. For example, clothing costs were important in this study because of the large altitude changes that occur when traversing the Andes mountain range. Additionally, Ecuador has poorly maintained roads, which added signifi-

cant travel time and costs. Whether other rural populations share similar conditions will determine this study's applicability.

Conclusion

Through a quasi-experimental, pre- and post-intervention study design in one community in rural Ecuador, we

demonstrated that significant reductions in NMCs are achieved when a second-level hospital is introduced. This study focuses on the cost to patients in the community and not costs to the health care system. Further investigation is recommended to compare the cost savings of patients in a community with the costs incurred by the health care system to expand second-level health services where

first-level health care services are generally available.

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RESUMEN

Cuantificación de la reducción de los costos no médicos mediante la apertura de un hospital en un cantón rural del Ecuador

Objetivo. Este estudio tiene por objeto cuantificar la repercusión de la introducción de servicios de salud locales de segundo nivel sobre los costos no médicos para los residentes del cantón rural ecuatoriano de La Maná.

Métodos. Se evaluaron los costos no médicos de los pacientes que tuvieron acceso a atención médica de segundo nivel mediante un estudio cuasiexperimental de análisis previo y posterior a la intervención. En el 2007 (antes de que existieran servicios locales de este tipo) y en el 2008 (después de la introducción de atención médica de segundo nivel representada por el hospital del cantón) se entrevistaron a 508 pacientes del cantón que requirieron atención médica de segundo nivel.

Resultados. Los costos no médicos medios por paciente y por episodio de enfermedad fueron de US\$ 93,58 antes de la apertura del hospital local y de US\$ 12,62 después de la inauguración del establecimiento. Esta diferencia se debió en gran parte a la reducción de los costos de transporte (US\$ 50,01 frente a US\$ 4,28) y de los costos de alimentación (US\$ 25,38 frente a US\$ 7,28) ($P < 0,001$ para cada categoría).

Conclusiones. Es posible reducir los costos no médicos a una séptima parte mediante la apertura de un hospital local en una zona rural que anteriormente carecía de atención médica de segundo nivel. La introducción de atención médica de segundo nivel en una zona rural reduce los obstáculos financieros y, por lo tanto, podría aumentar el acceso a estos servicios de salud para los pacientes más pobres en las comunidades rurales.

Palabras clave

Asentamientos rurales; hospitales rurales; financiación personal; gastos en salud; ahorro de costo; Ecuador.