

**Understanding the context of health care utilization in Ecuador:**

**A multilevel analysis.**

Daniel F López-Cevallos\*

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\* Address correspondence to Daniel López-Cevallos, Oregon State University, Department of Public Health, 254 Waldo Hall, Corvallis, OR 97331; Tel. +1 541 908 0267; Fax. +1 541 737 4001; E-mail: [lopezced@onid.orst.edu](mailto:lopezced@onid.orst.edu).

## **Understanding the context of health care utilization in Ecuador: A multilevel analysis.**

### **Abstract**

This study examines the context in which utilization of health services in Ecuador takes place, focusing on the provision of services and health outcomes. The main dataset used in this study is the 2004 National Demographic and Maternal & Child Health Survey (ENDEMAIN). Moreover, province-level data was obtained from the Ecuadorian System of Social Indicators (SIISE) and the Institute of Statistics and Census (INEC). Statistical analysis included spatial and multilevel modeling of utilization and health outcomes. Spatial autocorrelation scores revealed no significant spatial clustering of provider measures by province, excepting for public practice health personnel. In multilevel models, public practice health personnel were found to be associated with use of preventive care (positively) and antiparasitic medicines (negatively). The density of public inpatient clinics was positively associated with solution of the second reported health problem. From a policy perspective, the strengthening of the public health care delivery system should be a priority since it appears it could significantly impact people's ability to find a solution to their health needs (particularly when there is more than one health problem).

**Key words:** Ecuador, health care provision, use of health services, socioeconomic factors, multi-level analysis.

## **1. Introduction**

Over the past few years Ecuador has slowly emerged from a deep political, economic, and social crisis that has had a heavy impact on all sectors, with vulnerable groups being the hardest hit. The main political and social problems that have a direct impact on the health situation include high levels of poverty (40% of the population, over 70% among indigenous groups), limited access to institutional health services (70-80%), and low insurance coverage (20%) (Pan-American Health Organization 2001). This is due in part to the lack of a national health system structured as indicated in the National Constitution. In 2000, the Ecuadorian Congress approved a major health reform law that incorporated a variety of mechanisms in order to establish a “true” National Health Care System (NHCS). Although, there are important pieces missing (such as how to finance Universal Health Insurance (UHI); connection with local and regional services, etc.), it provided a basic agreement to work on for the future of a NHCS. In its report about Health Reform in Andean Countries, Pan-American Health Organization (PAHO) mentions that Ecuador has not shown evidence that the current reform influenced any indicators selected to evaluate access or use of health care resources (PAHO 2002). Moreover, the political instability present since 2001 has caused problems in governance, administrative stability, and continuity in public management, which in turn has affected the health sector reform process (PAHO 2007).

From an ecological perspective –which guides much of the research and interventions in public health– it is important to analyze contextual factors affecting the use of health services at the community, institutional and policy levels (National Cancer Institute 2005). During the last 40 years, Andersen’s Health Care Utilization Behavior model has been adapted to consider more

system-level measures, focusing on the availability, organization and financing of services (Aday and Andersen 1974; Aday et al. 2004). Therefore, it is acknowledged that besides predisposing, enabling and need factors, the environment and provider-related factors also affect healthcare utilization (Aday and Awe 1997). From a programmatic and policy perspective, connecting peoples' perceptions of health services and health care delivery system characteristics would allow understanding of utilization behavior in a more comprehensive manner. In a systematic review of the literature, Phillips et al. (1998) found that the majority of studies that included environmental variables measured only urban/rural location, or region, which may be imprecise proxies for more specific measures such as supply of services. Hence, characteristics such as *physician supply* and *availability of physicians in the community* would be important contextual variables to be considered within the health services utilization model (Andersen and Davidson 1996). Similarly, Andersen (1995) and Aday and Awe (1997), highlight the importance of including health outcomes measures in these types of analyses. In other words, health and well being (quality of life) is a fundamental achievement of any medical care system (Aday et al. 2004). Infant mortality is an indicator that has been used in the past to analyze health care services utilization (Dammert 2001).

There are few studies that have looked at the context of health care utilization in Latin America. Most studies have analyzed the relationship between income inequality and health outcomes (Subramanian et al. 2003; Larrea and Kawachi 2005; De Maio 2007), and food poverty (Farrow et al. 2005). Interestingly, Larrea and Kawachi (2005) pointed out that, in Ecuador, the strongest relationship between income inequality and stunting operated at the province level.

The purpose of the present study is to analyze the context in which utilization of health services in Ecuador (Figure 1) takes place, focusing on the provision of services and health

outcomes. Two research questions are posed: 1) What is the relationship between provider measures and health outcomes at the province level in Ecuador?; 2) What is the influence of provider measures (adjusting for predisposing, enabling, perceived need, and utilization of health care services) in reported health outcomes in Ecuador?



**Figure 1. Map of Ecuador.** At the time of the study Ecuador had 22 provinces. ENDEMAIN sampling frame divided the country in 15 provinces and two regions (Oriente and Galapagos).

## 2. Methods

### 2.1. Data

The main dataset utilized in this study was the 2004 Demographic and Maternal & Child Health Survey (2004 ENDEMAIN) (CEPAR 2005). Various provider measures at the province level were extracted from the Ecuadorian System of Social Indicators (SIISE), including: a) Public practice physicians, b) Private practice physicians, c) Public practice health personnel, d) Private practice health personnel, e) Public inpatient clinics, f) Private inpatient clinics, g)

Outpatient clinics, per 10 000 inhabitants (Ministerio de Bienestar Social 2005). From the Ecuadorian Institute of Statistics (INEC), the following province level health outcomes were included: 1) Infant Mortality, 2) General Mortality, and 3) Maternal Mortality (INEC 2007).

Table 1 presents a summary of province level measures.

**Table 1. Descriptive statistics of province level measures.**

<b>Variable</b>	<b>n</b>	<b>Mean</b>	<b>SD</b>
<b><i>Provider measures</i><sup>†</sup></b>			
Public practice physicians	22	8.401	2.352
Private practice physicians	22	5.450	4.243
Public practice health personnel	22	26.044	16.179
Private practice health personnel	22	7.239	6.171
Public inpatient clinics	22	0.277	0.242
Private inpatient clinics	22	0.305	0.176
Outpatient clinics	22	3.919	1.762
<b><i>Health Outcomes</i></b>			
Infant Mortality <sup>‡</sup>	22	18.791	6.092
General Mortality <sup>§</sup>	22	4.032	1.202
Maternal Mortality <sup>††</sup>	21	112.138	52.633

<sup>†</sup> Per 10 000 inhabitants.

<sup>‡</sup> Per 1000 live births. <sup>§</sup> Per 1000 inhabitants. <sup>††</sup> Per 100 000 live births.

Following the proposed research questions, this study was divided in two components. First, an ecological analysis of provider measures and health outcomes at the province level was conducted; including an analysis of spatial patterns. Second, a multilevel analysis of the relationship between provider measures and individual health care utilization and outcomes was conducted. Using 2004 ENDEMAIN, Andersen's model of health care utilization served as a framework to classify predictors of health care utilization in three categories: predisposing (demographic), enabling (socioeconomic), and need factors. Predisposing factors included age (years), sex (male, female), ethnicity (mestizo, indigenous, others) and marital status (married,

single, living with a partner, separated/divorced, widow). For use of antiparasitic medicines, household head sex and marital status were included. Enabling factors consisted of area of residence (urban, rural), assets quintile (1 to 5), consumption quintile (1 to 5), educational level (none, elementary, high school, college, doesn't know/answer), and health insurance affiliation (insured, uninsured). For use of antiparasitic medicines, household head educational level was included. Perceived need was defined as the reported number of health problems during the last 30 days (0, 1, 2). Health care utilization was measured by use of preventive services (yes/no); use of antiparasitic medicines (yes/no); curative care visits during the last 30 days: First problem curative visit (yes/no), Second problem curative visit (yes/no); and hospitalization during the last 12 months (yes/no). In terms of individual health outcomes, three were extracted from ENDEMAIN 2004. Two variables for curative care: 1) First health problem solved (yes/no), 2) Second health problem solved (yes/no); and one for hospitalization: problem solved (yes/no). ENDEMAIN 2004 did not collect information on outcomes for use of preventive services or antiparasitic medicines. Consequently, use constituted the outcome variable in their respective models. Table 2 summarizes the predictors included in the analysis for use of preventive care, first health problem solved, second health problem solved, and hospitalization problem solved. Table 3 summarizes the predictors included in the analysis for use of antiparasitic medicines.

**Table 2. Unweighted descriptive statistics for use of preventive care and self-reported health outcomes.**

	Level	Sample N=33387	Use of preventive care N=1528*	Self-Reported Health Outcomes		
				First health problem solved N=8585*	Second health problem solved N=1092*	Hospitalization problem solved N=784*
<b><i>Predisposing factors</i></b>						
Age in years: mean (SD)	Individual	35.4 (18.5)	35.5 (0.5)	35.7 (0.2)	44.0 (0.6)	41.1 (0.7)
Sex (%)						
Male	Individual	49.2	37.7	46.8	41.5	46.6
Female		50.8	62.3	53.2	58.5	53.4
Ethnicity (%)						
Mestizo	Household	85.7	88.2	87.5	90.4	88.1
Indigenous		8.6	4.5	7.4	4.9	6.0
Others		5.7	7.3	5.1	4.7	5.9
Marital status (%)						
Living w/ partner		15.5	13.8	16.4	17.6	18.2
Married	Individual	37.2	42.7	38.5	42.5	46.8
Separated/divorced		5.2	5.0	5.6	9.4	7.7
Widow		4.1	4.1	4.4	9.2	4.9
Single		37.9	34.4	35.1	21.3	22.4
<b><i>Enabling factors</i></b>						
Area of residence (%)						
Urban	Census segment	51.6	67.6	54.9	57.0	57.3
Rural		48.4	32.4	45.1	43.0	42.7
Assets quintile (%)						
1		22.5	8.2	20.1	19.3	15.2
2		20.5	13.6	20.9	23.2	19.4
3	Household	19.0	19.0	19.8	22.8	22.3
4		18.8	22.0	20.1	19.0	21.3
5		19.2	37.2	19.1	15.7	21.8
Consumption quintile (%)						
1		23.0	9.2	20.7	21.0	17.1
2		20.5	11.9	19.5	19.3	18.9
3	Household	19.4	17.3	20.4	20.7	20.9
4		19.0	26.3	20.8	22.0	21.4
5		18.0	35.3	18.6	17.0	21.7

	Level	Sample N=33387	Use of preventive care N=1528*	<i>Self-Reported Health Outcomes</i>		
				First health problem solved N=8585*	Second health problem solved N=1092*	Hospitalization problem solved N=784*
<b>Educational level (%)</b>						
None		8.3	3.7	8.2	11.4	9.7
Elementary	Individual	45.0	31.2	43.4	47.4	43.7
High School		35.5	44.8	37.1	31.9	33.7
College		11.2	20.2	11.2	9.0	12.9
Doesn't know/answer		.1	.1	.1	.3	.0
<b>Insurance (%)</b>						
Insured	Individual	22.6	35.3	23.2	23.9	29.5
Uninsured		77.4	64.7	76.8	76.1	70.5
<b><i>Need</i></b>						
<b>Health problems (%)</b>						
No problems	Individual	52.8	52.3	N/A	N/A	48.5
One problem		40.1	40.0	N/A	N/A	40.9
Two problems		7.1	7.7	N/A	N/A	10.6
<b><i>Utilization</i></b>						
<b>First health problem curative visit (%)</b>						
Yes	Individual	16.0	N/A	33.3	N/A	N/A
No		84.0	N/A	66.7	N/A	N/A
<b>Second health problem curative visit (%)</b>						
Yes	Individual	2.1	N/A	N/A	31.6	N/A
No		97.9	N/A	N/A	68.4	N/A

N/A = Not applicable.

\* Subsamples include only those individuals who answered "Yes" to use of preventive care services, first health problem solved, second health problem solved and hospitalization problem solved, respectively.

## 2.2. Statistical Analysis

First, for the ecological analysis, Global Moran's I statistic was used to assess spatial autocorrelation. Also, univariate LISA (Local Indicator of Spatial Autocorrelation) maps were produced to assess specific spatial patterns of province level variables. Moreover, Bivariate Pearson correlation coefficients were calculated for all province level measures. Second, for the multilevel analysis, the various levels present in ENDEMAIN sampling frame<sup>1</sup> made necessary to use multilevel models to examine the relationship between provider level measures and individual health outcomes (adjusting for various relevant predisposing, enabling and need factors, and utilization of health care). In doing so, this study explicitly accounted for clustering in such a complex sample design (Rodriguez and Goldman 1995; Rodriguez and Goldman 2001; Subramanian et al. 2003a). Failing to recognize relationships existing at these levels –by aggregating or disaggregating data– could incur in ecological, or individualistic fallacy; and statistical issues (Subramanian et al. 2003a). Furthermore, multilevel modeling offered the possibility of merging provider measures at the province/region level to the analysis.<sup>2</sup>

Models were built in a sequential manner (Subramanian et al. 2003b), starting with a *non-conditional* (empty) model to partition variance across levels and assess its statistical significance (Duncan et al. 2003). Models were fitted using the iterative generalized least squares maximum likelihood estimator. Since all outcome variables were dichotomous, the marginal

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<sup>1</sup> The highest level consisted of 17 strata which included two regions (Amazon and Galapagos Islands) and 15 provinces (10 from Sierra region and 5 from Costa region). Consequently, this paper used the term province/region to refer to this particular level of analysis.

<sup>2</sup> Since ENDEMAIN 2004 reduced the *Oriente* provinces (Sucumbios, Orellana, Napo, Pastaza, Morona Santiago, and Zamora Chinchipe) to a single stratum, an average was calculated for each *Oriente* provider measure to be included in the multilevel models.

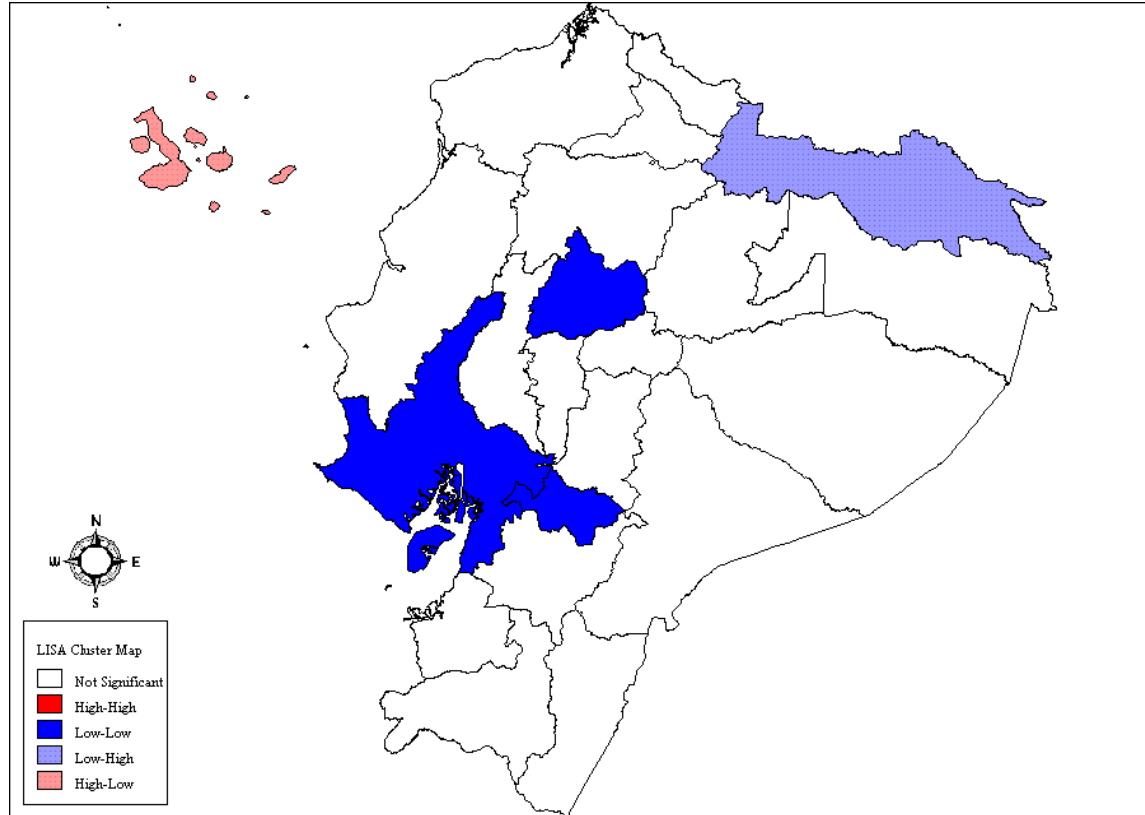
quasi likelihood approximation with a first order Taylor linearization procedure was applied (Subramanian et al. 2003b). For each outcome variable, predictors were assigned to each significant level (as they were originally collected) to build various *conditional* models. For provider measures, preliminary bivariate multilevel analyses determined the variables significantly associated (at  $p < 0.1$ ) with the outcomes of interest. Only these provider measures were utilized in further analyses. The multivariate multilevel models adjusted for predisposing, enabling, need factors, and health care utilization. Stata MP v9.2 was used for data preparation, descriptive statistics, and merging (StataCorp 2007). GeoDa 0.9.5-i5 was used to calculate the Global Moran's I and LISA functions (Anselin 2003). MLwiN 2.02 was used to fit all multilevel models (Rasbash et al. 2004).

**Table 3. Unweighted descriptive statistics for use of antiparasitic medicines.**

	Level	Sample N=16416	Use of antiparasitic medicines N=9765*
<b><i>Predisposing factors</i></b>			
Age in years: mean (SD)	Individual	7.1 (4.2)	7.6 (0.04)
Sex (%)			
Male	Individual	50.4	49.8
Female		49.6	50.2
Ethnicity (%)			
Mestizo	Household	83.2	85.4
Indigenous		10.6	8.2
Others		6.2	6.4
Household Head Sex (%)			
Male	Household	85.1	85.0
Female		14.9	15.0
Household Head Marital status (%)			
Living w/ partner	Household	26.6	27.0
Married		58.5	58.3
Separated/divorced		7.4	7.6
Widow		4.9	4.6
Single		2.6	2.5
<b><i>Enabling factors</i></b>			
Area of residence (%)			
Urban	Census segment	47.7	49.7
Rural		52.3	50.3
Assets quintile (%)			
1	Household	26.7	23.7
2		23.1	23.2
3		19.8	19.8
4		16.8	17.9
5		13.6	15.4
Consumption quintile (%)			
1	Household	28.7	24.9
2		22.9	22.9
3		19.7	20.5
4		16.6	17.4
5		12.1	14.3
Household Head Educational level (%)			
None	Household	8.3	7.2
Elementary		55.8	52.9
High School		26.0	28.2
College		9.9	11.6
Doesn't know/answer		.1	.1
Insurance (%)			
Insured	Individual	11.7	12.1
Uninsured		88.3	87.9
<b><i>Need</i></b>			
Health problems (%)			
No problems	Individual	54.9	53.8
1 problem		41.9	42.7
2 problems		3.2	3.5

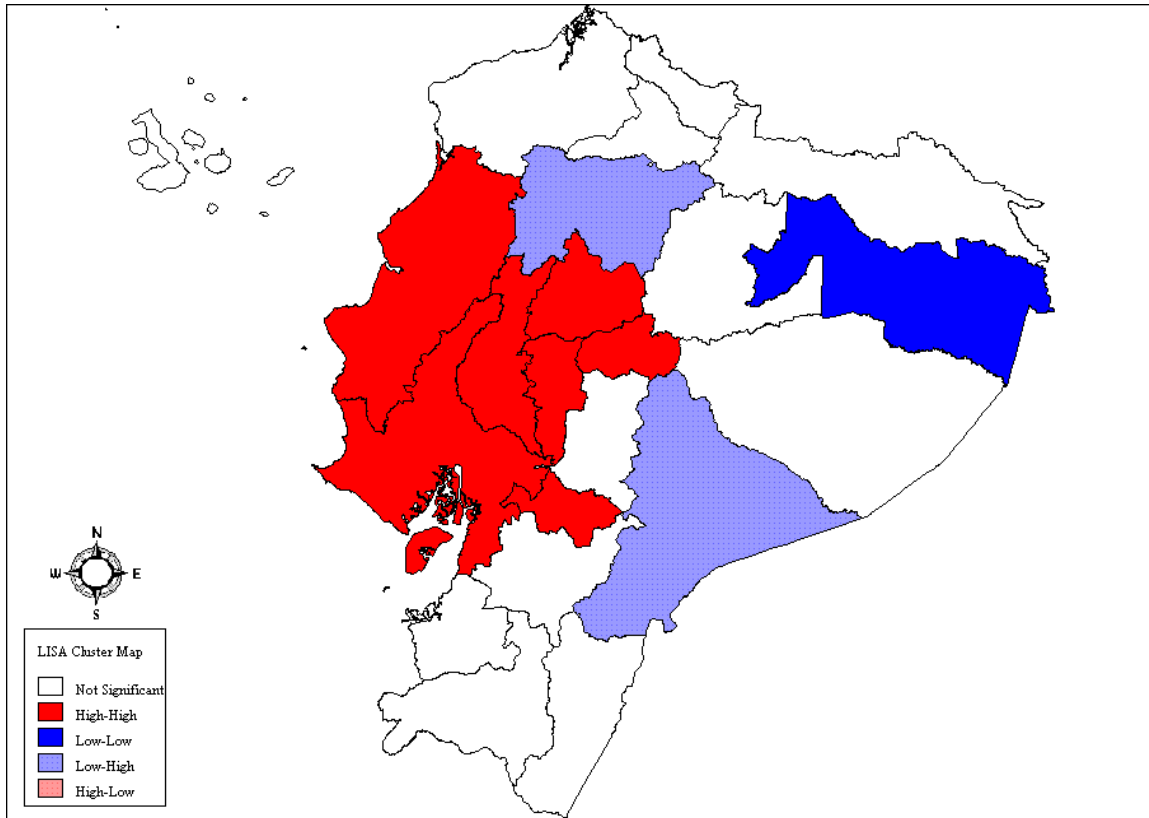
\* Subsample includes only those individuals who answered "Yes" to use of antiparasitic medicines.

### 3. Results



**Figure 2. LISA Cluster Map of Public Practice Health Personnel density in Ecuador, by province.** The low-low locations suggest clustering of similar values of public practice health personnel.

Spatial autocorrelation (Moran's I) scores revealed no significant spatial clustering of provider measures by province, excepting for public practice health personnel. For this provider measure, although the initial Global Moran's I showed no clustering ( $I=-0.18$ ,  $p<0.05$ ), it became somewhat clustered when the provinces of Galapagos and Sucumbíos were excluded ( $I=0.09$ ,  $p<0.05$ ). Moreover, LISA analysis showed there was a significant ( $p<0.05$ ) cluster of low public practice health personnel in Guayas, Cañar, and Cotopaxi (Figure 2). In terms of province-level health outcomes, only general mortality was significantly clustered ( $I=0.13$ ,  $p<0.05$ ). LISA analysis showed there was a significant ( $p<0.05$ ) cluster of high general mortality in the provinces of Manabí, Los Ríos, Guayas, Cotopaxi, Tungurahua, Bolívar, and Cañar (Figure 3).



**Figure 3. LISA Cluster Map of General Mortality Rate in Ecuador, by province.**  
The high-high locations suggest clustering of similar values of general mortality.

The correlation matrix (Table 4) revealed that the density of outpatient clinics had a significant negative correlation with both infant and general mortality ( $r=-0.39$ , and  $r=-0.37$ , respectively). However, it had a significant positive correlation with maternal mortality ( $r=0.37$ ). Public inpatient services density had the highest negative correlation with general mortality ( $r=-0.58$ ). Private inpatient services density was negatively correlated with maternal mortality ( $r=-0.46$ ). Inversely to outpatient services, the density of private practice physicians was negatively correlated with maternal mortality ( $r=-0.43$ ). In summary, the preliminary ecological analysis showed that, for the most part, the provision measures were randomly distributed across space. Consequently, multilevel models assumed there was no spatial clustering in the provision of services in Ecuador.

**Table 4. Bivariate Pearson correlation coefficients for province level variables.**

	Infant Mortality	General Mortality	Maternal Mortality	Outpatient Services	Public Inpatient Services	Private Inpatient Services	Public Practice Physicians	Public Practice Health Personnel	Private Practice Physicians	Private Practice Health Personnel
Infant Mortality [per 1000 live births]	1.000									
General Mortality [per 1000 inhabitants]	0.467**	1.000								
Maternal Mortality [per 100 000 live births]	-0.367*	-0.465**	1.000							
Outpatient Services [per 10 000 inhabitants] <sup>†</sup>	-0.393**	-0.371**	0.371**	1.000						
Public Inpatient Services	-0.255	-0.577***	0.271	0.744***	1.000					
Private Inpatient Services	0.347*	0.132	-0.461**	-0.496**	-0.472**	1.000				
Public Practice Physicians	-0.072	-0.216	0.042	0.644***	0.580***	-0.299*	1.000			
Public Practice Health Personnel	0.021	-0.262	0.126	0.482**	0.695***	-0.373**	0.583***	1.000		
Private Practice Physicians	0.319*	0.331*	-0.427**	-0.487**	-0.513***	0.778***	-0.003	-0.295*	1.000	
Private Practice Health Personnel	0.180	0.080	0.054	-0.148	-0.055	0.121	0.150	0.360*	0.320*	1.000

<sup>†</sup> All provider measures have the same denominator.

\* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01.

Table 5 presents the results for use of preventive care, first health problem solved, second health problem solved, and use of antiparasitic medicines. Except for provider measures and age, all explanatory variables were entered in the models as indicator dummy variables. In bivariate analyses, four provider measures were significantly associated with use of preventive care. After adjusting for predisposing, enabling, and need factors, the density of public practice health personnel had a slightly significant positive association with use of preventive care. In other words, for a 1-unit increase in the density of public practice physicians and health personnel, the odds of using preventive care increased 0.9%.

**Table 5. Odds Ratios (and 95% confidence intervals) of the association between selected provider measures and health outcomes.**

Provider measures	Preventive care*	First health problem solved†	Second health problem solved†	Antiparasitic medicines*
Public practice physicians	1.06 (0.99 – 1.13)			
Private practice physicians	0.99 (0.97 – 1.02)			
Public practice health personnel	1.01 (1.00 – 1.02)			0.99 (0.97 – 1.00)
Private practice health personnel	1.00 (0.99 – 1.01)			
Outpatient clinics		0.93 (0.86 – 1.01)		
Public inpatient clinics			3.64 (1.19 – 11.09)	

\* Adjusted for predisposing, enabling, and need factors.

† Adjusted for predisposing, enabling, and utilization factors.

The density of outpatient clinics had a negative association with *first health problem solved* (OR=0.90, 95%CI=0.82 – 0.99). This relationship was not statistically significant when adjusting for predisposing, enabling, and utilization factors. Surprisingly, the use of curative services for the first reported health problem had a strong negative association with having the problem solved (OR=0.69, 95%CI: 0.62 – 0.77). Compared to the richest 20% of households, the poorest 20% were less likely to have their first health problem solved (OR<sub>assets quintile 1</sub>=0.73,

95%CI: 0.62 – 0.87;  $OR_{\text{consumption quintile 1}}=0.86$ , 95%CI: 0.74 – 1.01). Similarly, compared to males, females were less likely to solve their first health problem (OR=0.91, 95%CI: 0.84 – 0.98). The constant for *first health problem solved* represents a mestizo man, aged 40, who is married and lives in an urban area, belongs to the highest assets and consumption quintile categories, with college education and health insurance, and did not have a curative visit for the first reported health problem. This reference group had an 85.4% probability of having their first health problem solved.<sup>3</sup> The density of public inpatient clinics was significantly associated with *second health problem solved* (OR=2.85, 95%CI: 1.01 – 8.06). This strong positive relationship was statistically significant even after adjusting for predisposing, enabling, and utilization factors. While age had a significant (although small) negative association with the outcome of interest (OR=0.99, 95%CI: 0.98 – 0.99), being a widow had a strong positive association with having a second health problem solved (OR=1.36, 95%CI: 1.02 – 1.82). The constant for *second health problem solved* represents a married man, aged 48, who lives in an urban area, with college education and health insurance, and did not have a curative visit for the second reported health problem. This group had a 62.3% probability of having their second health problem solved.<sup>4</sup> Given that there was no statistically significant variation at the province level, no provider measures could be entered for *hospitalization problem solved*.

For use of antiparasitic medicines, the null model revealed statistically significant variation at the household, census segment, and province/region levels.<sup>5</sup> Bivariate analysis

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<sup>3</sup> If the reference group used curative care, the probability of solving their first health problem was 80.2%.

<sup>4</sup> If the reference group used curative care, the probability of solving their second health problem was 62.4%.

<sup>5</sup> Particularly for use of preventive services and antiparasitic medicines, most variation was concentrated at the household level, even after adjusting for other factors. Consequently, there might be other household-level relevant factors not included in the models (which may constitute a source of bias).

showed that the density of public practice health personnel was slightly significantly associated with use of antiparasitic medicines (OR=0.99, 95%CI: 0.98 – 1.00). This negative relationship was confirmed in the multivariate model. For a 1-unit increase in the density of public practice health personnel, the odds of using antiparasitic medicines decreased 1.4%.

#### **4. Discussion and conclusions**

Overall, this paper finds initial evidence of a statistically significant relationship between availability of health services, and individual utilization of such services and health outcomes. Indeed, preliminary ecological analysis conducted at the province level showed that increasing the density of outpatient clinics could decrease infant and general mortality; while increasing the density of private practice physicians could decrease maternal mortality. Although this analysis did not control for the influence of the other provider predictors (or socioeconomic factors), it demonstrated that (at least in the Ecuadorian context) the province level required further consideration (Larrea and Kawachi 2005). Consequently, this study used a multilevel framework to advance our understanding of the context of health care utilization by incorporating provider measures and reported health outcomes (Phillips et al. 1998; Diez Roux 2001). Except for *hospitalization problem solved*, all other outcome variables had significant variation at the province level in non-conditional models, which in turn permitted to assess the influence of provider measures in reported health outcomes.

After adjusting for various predisposing, enabling, and need factors, public practice health personnel density was slightly associated with use of preventive care (positively) and antiparasitic medicines (negatively). From all provider measures included in the multilevel models, the positive relationship between public inpatient clinics and solution of the second

reported health problem was the strongest. The probability of solution increased 23.4% with a one unit increase in the density of public inpatient clinics. From a policy perspective, the strengthening of the public health care delivery system should be a priority since it appears it could significantly impact people's ability to find a solution to their health needs (particularly when there is more than one health problem). However, the negative relationship between first problem curative visit and having a solution to their reported health problem points out that, regardless of health insurance status and other factors, people in Ecuador may turn to other options when a health need arrives. In fact, only 17.5% used curative care, while 20.8% used over-the-counter-drugs, and 5% did nothing (CEPAR 2005). The same is applicable to use of antiparasitic medicines. This may be related to poorly staffed and equipped health services (particularly in the public sector) which in turn may affect the provision of adequate care (Gage 2007).

Although it was not the main focus of this study, it is relevant to mention that after adjusting for predisposing, enabling, need, utilization, and provider measures, economic wealth had a significant influence on utilization of health care services and health outcomes.<sup>6</sup> As it can be seen in tables 4-5, it is evident that compared to the highest 20%, households ranking in the lowest 20% (in terms of assets and consumption quintiles) were less likely to use preventive services, antiparasitic medicines, or having a solution to their first reported health problem. This situation may be exacerbated by what has been labeled as “double epidemiologic overlap” (Waters 2006). In Ecuador, there are high prevalence rates of infectious and chronic diseases, and the urban and rural poor experience a higher burden of both types of diseases. In his article,

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<sup>6</sup> The correlation between provider measures and assets and consumption quintiles, respectively, showed no multicollinearity.

Waters points out that the so-called “modern” (chronic) diseases are particularly sensitive to access to health care and health policy.

The following caveats should be considered in interpreting the empirical findings of this study. First, in terms of data availability, this study relied primarily on secondary survey data (ENDEMAIN 2004). In survey design, an important assumption is that although questions are usually asked about temporal (dynamic) processes, “fixed” populations are studied (Blalock 1993). Second, the presence of facilities and providers was measured at the province/region level. Such level of aggregation prohibits its use for local decision-making.<sup>7</sup> Besides, it does not account for issues such as overlapping coverage, redundant services, potential for overcrowded facilities (mainly in major cities, such as Quito and Guayaquil), and variation in quality of services (Rosero-Bixby 2004). Also, regression model results were affected by the modifiable areal unit problem (MAUP) since space was fragmented in administrative province/regions (Maheswaran and Craglia 2004; Chaix et al. 2005). Third, multilevel analyses only considered main effects (i.e. did not consider specific interactions). Yet, this paper analyzed preliminary data at the province level, calculating Moran’s I (both globally and locally), which provided empirical evidence of spatial randomness in the geographical distribution of provider measures. Concurring with previous research, spatial visualization of provider measures and health outcomes proved to be an important complement to tabular ecological analysis (Farrow et al. 2005). Future research should consider utilizing a more “relational” perspective that may reinforce the idea of a reciprocal connection people-space (Cummins et al. 2007); and refining

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<sup>7</sup> At the time of analysis, there were 22 provinces in Ecuador. However, Ecuadorian Congress recently approved the creation of province "Santo Domingo de los Tsáchilas" (on October 2, 2007); and province “Santa Elena” (on October 16, 2007).

the administrative division (probably at the canton or parroquia levels) to facilitate linkages with provider data at those levels (Phillips et al. 1998), and allow better (and more meaningful) empirical analyses (Chaix et al. 2005; Sridharan et al. 2007).

This study was one of few in attempting to connect utilization of services with both the context in which utilization occurs (by including health care services provision) and the outcome of such utilization (reported health outcomes). This approach acknowledged the important connections between individual behaviors and contextual factors (Dunn and Cummins 2007). In other words, this study went beyond the “population at risk” perspective of the original Andersen’s model, to look into delivery system measures that would permit us to contrast utilization with provision of services (Phillips et al. 1998; Aday et al. 2004). Regionally, this study builds on recent empirical work on health outcomes in Latin America (Subramanian et al. 2003b; Larrea and Kawachi 2005; De Maio 2007; Hertel-Fernandez et al. 2007), by combining preliminary ecological analysis (at the province level) with a multilevel regression framework. Moreover, the present study showed the necessity of building a stronger national health care information system (Rosero-Bixby 2004; Chaix et al. 2005). Ultimately, these efforts would help inform the public and policymakers on the advances of health care reform in Ecuador (Bambas et al. 2005).

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