International Health 4 (2012) 220–228

Contents lists available at SciVerse ScienceDirect

International Health

journal homepage: http://www.elsevier.com/locate/inhe

Evaluation of a demonstration primary health care project in rural Guatemala: the influence of predisposing, enabling and need factors on immunization coverage, equitable use of health care services and application of treatment guidelines

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ARTICLE INFO

Article history:
Received 25 May 2011
Received in revised form 31 August 2011
Accepted 4 April 2012
Available online 18 August 2012

Keywords:
Primary health care
Guatemala
Needs assessment
Socioeconomic factors
Health services accessibility
Program evaluation

ABSTRACT

In high- and low-resource settings, care is often provided inequitably, with more and higher-quality services being offered to those who need them less. We evaluated the influence of predisposing, enabling and need characteristics on immunization coverage and use of health services in a population-based primary health care model called the Inclusive Health Model in rural Guatemala. We also analyzed providers' application of treatment guidelines for children with pneumonia. A longitudinal cohort design was used from 2006 to 2009 to analyze data from the model's two demonstration sites. We found a significant positive association between families' health risk level and their use of health care services, with the model providing more services to those with greater need. Services are not provided differentially for those families with a higher or lower wealth level or selected sociodemographic characteristics. Distance from a clinic is significantly associated with lower service use, but this constraint decreases with time. Implementation of treatment guidelines does not vary with different provider characteristics. The Inclusive Health Care model's aim of offering care equitably to families living in its catchment area is reflected in these findings. This study offers an approach and conceptual model for tracking equity in service delivery that may be applicable in other settings.

1. Introduction

The inverse care law, which describes inequitable provision of care, with more and higher-quality services being offered to families and individuals who need them less, continues to apply in both high- and low-resource settings.[1] Monitoring equity in health and health care often presents technical challenges.[2] In Guatemala, a country with a history of social exclusion, marked health disparities[3] and inequitable health care coverage and use of health care services,[4] one service delivery model explicitly aims to promote equity in rural communities.

Starting in 2005, the Inclusive Health Model (Modelo Incluyente de Salud) has been implemented as a demonstration project in two sites in rural Guatemala. It is an innovative service delivery model with a system of population-based, proactive care aimed at increasing service use and access, and ensuring a timely response to the population's health problems.

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http://dx.doi.org/10.1016/j.inhe.2012.04.001

Box 1. The Inclusive Health Model compared with standard care in rural Guatemala

Inclusive Health Model
Individual, family and community programs attempt to offer services to the whole population, with curative care on demand and proactive family visits. Primary providers: 14 community auxiliary nurses per 10,000 population with a support and supervision team.

Standard care
Disease-specific health care programs focus on subpopulations (maternal and child health) and offer curative care on demand. Primary providers: one or two auxiliary nurses per health post, with referral to health center staff, or one ambulatory doctor or professional nurse per 10,000 population.

The model was developed by a grassroots coalition of organizations and designed specifically for the Guatemalan population.[5] The three major components of the project are: clinic-based care; family visits; and community programs to organize and mobilize resources. The staffing structure and resources for this new model are different from those employed in standard rural health care in Guatemala. In the Inclusive Health Model, care is provided by community nurse auxiliaries who work in teams of two to four to cover populations of 1000–2000 per team. The auxiliaries are supported by a supervision and referral team consisting of a doctor, a professional nurse, community and family coordinators, and administrative support for each population of 10 000. There is no cost to patients for accessing care, which includes a wide range of preventive services (e.g., immunizations, well-child visits, prenatal and postnatal care, and cervical smears) and curative care. The key characteristics of the Inclusive Health Model and standard care at the primary care level in rural Guatemala are compared in Box 1.

Since 2005, the intervention has been implemented in two sites of approximately 10 000 people each, in the municipalities of Nahualá and Ixtahuacán: Sololá (Site 1) and San Juan Ostuncalco, Quetzaltenango (Site 2). At Site 1, six community clinics serve 21 villages and at Site 2 four community clinics serve 23 villages. The two demonstration sites were funded by the European Union and Medicus Mundi Navarra with support from the Government of Navarra. Starting in 2011 the Guatemalan Ministry of Health has sustained the model and has hired the model's health care providers as government employees. Between 2005 and 2009, the model achieved significant increases in service coverage, utilization, and improvements in quality of care.[6,7] Building on these findings, the purpose of this study is to examine whether the service delivery model also fulfills its aim to achieve equity in access to care.

In studying access, a primary framework in health services research is the model developed by Ronald Andersen known as the 'Behavioral model of health services use'.[8] The model has been adapted but its primary contribution remains consistent: use of care can be studied using factors categorized as predisposing (characteristics of individuals and families, such as education and work), enabling (system or structural characteristics, such as wealth), and need (biological difference in the population) components.[9] Andersen's concept of equitable utilization is when need is the primary driver of service use, and predisposing and enabling factors, which reflect constraints to accessing health services, are less influential determinants.[10] In a study in Bangladesh, which applied the Andersen model, a principal finding was that a household's relative poverty status, as measured by a wealth index, was a major determinant in health-seeking behavior, indicating that care was not provided equitably according to poverty status.[11] Other studies in low- and middle-income countries have found that the inverse care law persists, and that there are pro-rich inequities in service use and in health outcomes.[12–15] Others have analyzed the level of equity in a health care system by assessing patterns of utilization in relation to level of need.[16]

The conceptual model for the Guatemalan project is shown in Figure 1 and incorporates key components of the Andersen model. The Inclusive Health Model is expected

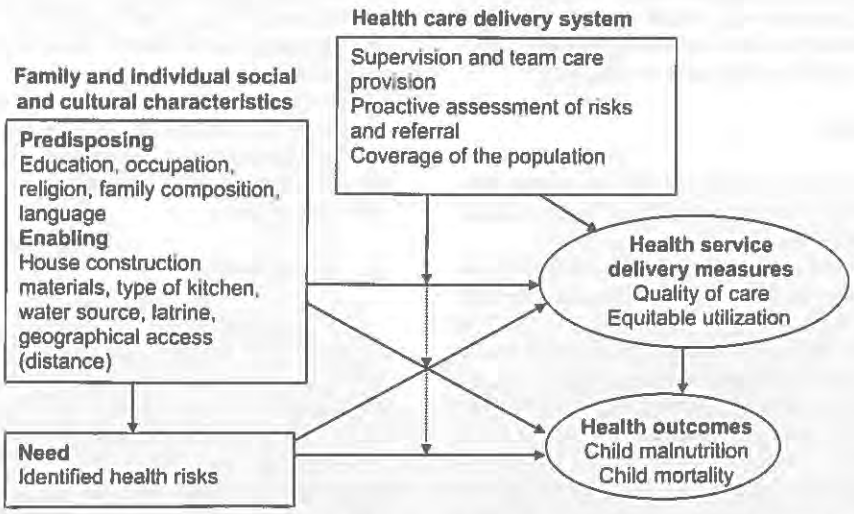

Figure 1. Conceptual model for evaluation of the Inclusive Health Model at two sites in rural Guatemala.

to have improved use, coverage, and quality of care results through its staffing structure, proactive assessment of risks and referral, and its attempt to reach the entire population in the designated catchment area. For the analysis presented in this article, the influence of individual and family social and cultural characteristics (shown on the left side of the conceptual model) is assessed to determine the extent to which utilization is equitable.

In the Inclusive Health Model, the aspects of the intervention that most closely approximate need are risk indicators captured during scheduled family visits. During these visits, community auxiliary nurses conduct a health assessment to categorize families as high, medium or low risk. Design of the risk assessment tool was based on the experiences of family health programs in other countries, including Cuba[17] and Costa Rica,[18] and adapted to the Guatemalan context.

We expected that need variables would explain more of the variation in service use over time, while the predisposing and enabling factors would explain less variation. We also hypothesized that the professional characteristics of community nurse auxiliaries would not explain variation in the application of treatment guidelines—a measure of quality of care—because of routine supervision by doctors and nurses.[19,20]

2. Methods

To test hypotheses, the study used a 2006–2009 longitudinal prospective cohort design to explain the variability in quality and coverage, and to determine the extent to which the use of health care services was increasingly based more on families' health needs rather than predisposing and enabling factors, and was not determined by provider characteristics.

The data source was the project's data base, which contained population information linked to clinical records for all preventive and curative care offered at the community clinics, and family program records gathered during family visits from 2006 to 2009. Medical records and census data were reported and linked through codes at family and individual levels. The database was constructed in Microsoft Access and transferred for statistical analysis to Intercooled Stata v.10 (StataCorp LP, College Station, TX, USA).

2.1. Outcome variables

The outcome variables for this study were immunization coverage, average level of family utilization of services, and application of treatment guidelines.

Annual vaccination coverage was defined as complete or incomplete, on the basis of the immunization schedule for different groups set out by the Ministry of Health. For women aged 15–49 years, complete immunization coverage was defined as having had three doses of tetanus toxoid by the end of the year; completeness was assessed for each year of the cohort design. For children aged 1 year, complete immunization coverage was defined as: one dose of BCG, one dose of measles, mumps, rubella vaccine (MMR), three doses of DPT + influenza type b + hepatitis B and three doses of polio vaccine.

Average family utilization of health care services was defined as the count of the total number of services used by all family members in a 12-month period. The data source for this outcome was the program's medical records database. We adjusted for the number of family members in the regression analysis.

Application of treatment guidelines was defined as providing amoxicillin for pneumonia for children below 5 years of age, as specified in the Ministry of Health manual for first-level health care facilities.[21] The researchers captured this measure through record review only for children who received clinical care at a community clinic.

2.2. Independent variables

The predisposing factors were education, work, religion, family type and language. Education was categorized as: no primary school, some primary school, completed primary school. Work was categorized as skilled or unskilled. Religion was categorized as Catholic, Protestant or no religion. Family type was categorized as nuclear, extended, single-parent or other. Language was categorized as speaking exclusively a Mayan language (Mam or K'iche) or speaking both a Mayan language and Spanish.

The enabling factors were a wealth index and distance from a community clinic. A wealth index was created using the latent variable method.[22] The variables used to estimate the wealth index were: wall and floor construction materials, type of kitchen, and latrine. A probit analysis was modeled to estimate the wealth index, which also included the head of household's education, age and sex, and household density. Once the probit model was estimated, wealth index scores were divided into tertiles: low, medium and high. Distance was categorized as being in: the same community as a clinic, a community at a medium distance from a clinic (approximately 1–5 km), or a community far from a clinic (approximately 5 km or more).

Need was approximated by high, medium and low risk levels captured during proactive, routine household visits in which providers assigned a risk classification for the family using a screening tool with a routine formula for predetermined risks. This included detection of acute illness, pregnancy and related risks, psychosocial problems, and environmental conditions.

For the application of treatment guidelines analysis, the following provider characteristics were included in the analysis, in addition to patient characteristics: age, sex, residence, and education and work experience before working with the project.

2.3. Data analysis

We conducted diagnostic procedures outlined by McKnight et al. to determine how to classify missingness.[23] We classified the data to be missing at random and carried out multiple imputation using Stata 10 statistical software. The wealth index had the largest amount of missing data (26% in Sololá and 17% in Quetzaltenango). Ordered logit was used to estimate wealth index using the following variables: religion, family type, education, language, work, tetanus and childhood immunization status, and number of

services used. Five imputed datasets were generated.[24,25] Complete case analyses were also conducted. These analyses had results similar to the multiple imputation estimates and therefore are not presented here.

The generalized estimating equation (GEE) method was then used for years 2006–2009, with robust standard errors to test the hypotheses; uncertainty was estimated across the datasets.[26] GEE was used to correct for the correlated structure of the data with individuals from the same families, clustering on family as the larger cluster group.[27]

For the regression analyses, a priori models were defined and all co-variates included simultaneously. For immunization coverage and application of treatment guidelines, we used logistic regression, and results are presented as odds ratios. For the utilization analysis, we used negative binomial regression and results are presented as incidence rate ratios. To determine whether there were differences in the outcomes over time for enabling and need variables, the analyses included three interactions with the year of program implementation (distance*year, wealth index*year, and family risk*year interactions). For the analysis of the application of treatment guidelines, the logistic regression model was run first only with patient characteristics and then re-run adding in provider characteristics.

Clinics were included in the immunization coverage and utilization regression analyses as a fixed effect to account for similarities among those who attend the same clinic. For the quality of care analysis, providers present an additional layer of clustering in which families are not nested. To account for this additional, non-nested level of clustering a correction was made to the variance matrix to calculate confidence intervals.[28]

For the analysis of immunization coverage and utilization, the sites were analyzed separately because of differences between the two site populations. For the analysis of treatment guidelines, the two sites were pooled because of the low number of providers in the project overall, with 40 being the recommended lower limit of clusters for GEE analysis.

3. Results

The sociodemographic characteristics of the heads of household in the patient populations are shown in Table 1. Comparing the two sites, because of the large number of families included in the analysis, differences are significant at $p < 0.05$. However, neither site is consistently higher or lower than the other for the characteristics of interest, and both have lower than average social development when compared to the national average. In both sites, more than half of the heads of household have no primary school education. The populations in both sites are considered to be indigenous and speak a Mayan language, but the sites differ with respect to the populations' ability to speak Spanish.

Table 2 presents characteristics of the community auxiliary nurse providers in the Inclusive Health Model who worked at some point between 2005 and 2009. Each site employs 14 providers, giving a total of 28 working with the project at any given time. Between 2005 and 2009, a total of 43 people served in the post of community auxiliary nurse. More than half were female, and 35% lived within the catchment area; with regard to education, almost half had high school equivalence, while only 21% had previous work experience.

Online supplementary Figures 1A–D summarize the change over time in adult female and 1-year-old immunization coverage, service utilization, and application of treatment guidelines for children with pneumonia

Table 1
Characteristics of the patient populations (defined by heads of households) at two sites in rural Guatemala in 2006

Patient characteristics	Sololá (Site 1) n (%)*	Quetzaltenango (Site 2) n (%)*	Difference (p)
No. of families	1723	1279	
Mean no. of family members	6.20 (SD: 2.92)	7.15 (SD: 3.34)	<0.001
Head of household characteristics			
Highest level of education achieved			χ^2: p<0.001
No primary education	899 (52.98)	772 (62.97)	
Some primary education	551 (32.47)	371 (30.26)	
Complete primary education	247 (14.56)	83 (6.77)	
Primary labor activity			χ^2: p<0.001
Skilled labor	1211 (76.36)	867 (80.95)	
Religious preference			χ^2: p<0.001
Catholic	593 (35.66)	180 (15.10)	
Non-Catholic Christian	763 (45.88)	750 (62.92)	
None or other	307 (18.46)	252 (21.98)	
Language spoken			χ^2: p<0.001
Mayan language only	921 (54.53)	157 (12.81)	
Mayan language and Spanish	768 (45.47)	1069 (87.19)	
Dirt floor	1143 (83.07)	712 (63.23)	χ^2: p<0.001
Distance			χ^2: p<0.001
Same community as health clinic	963 (55.89)	573 (44.80)	
Mid-distance	647 (37.55)	526 (41.13)	
Farthest distance	113 (6.56)	180 (14.07)	

* Percentages are calculated for households with data. Because data are missing for some variables, percentages are not based on the total number of households.

Table 2
Characteristics of health care providers in a study to evaluate the Inclusive Health Model at two sites in rural Guatemala

Provider characteristics	n (%)
Total no. of providers	43
Average age (years)	33.30 (SD: 7.32)
Female	25 (58)
Lived within the project catchment area	15 (35)
Education before working with the project	
Completed primary school	6 (14)
Completed middle school	11 (26)
Health high-school equivalent	20 (46)
Other high-school equivalent	6 (14)
Work experience before working with the project	
No prior experience	13 (30)
Volunteer experience	21 (49)
Paid work experience	9 (21)

between 2006 and 2009. Immunization coverage for 1-year-olds increased steadily during that period, increasing from 64% to 96% in the site in Sololá and from 76% to 93% in the site in Quetzaltenango. Service use increased from an average of less than one visit per family member in 2006 to greater than one by 2009. The percentage of clinic visits in which children received the correct antibiotic was under 60% in both sites in 2006 and increased to more than 90% in 2009. For the four outcomes, the test for trend is significant over time.

The regression results for immunization coverage of women and children are shown in Table 3. For the analysis of tetanus toxoid coverage in women aged 15–49 years, 10219 person-years were analyzed in Sololá and 8354 person-years in Quetzaltenango. For the analysis of immunization coverage of children aged 1 year, 1226 individuals were included in Sololá and 938 in Quetzaltenango.

Table 3
Regression results of factors influencing immunization coverage at two sites in rural Guatemala applying the Inclusive Health Model

	Sololá (Site 1)						Quetzaltenango (Site 2)					
	Tetanus (women) No. observations = 10219			Completed schedule (1-year-olds) No. observations = 1226			Tetanus (women) No. observations = 8354			Completed schedule (1-year-olds) No. observations = 938		
Variables	Odds ratio	p-value	95% CI	Odds ratio	p-value	95% CI	Odds ratio	p-value	95% CI	Odds ratio	p-value	95% CI
Age	1.05	<0.001	(1.04, 1.06)				1.02	<0.001	(1.02, 1.03)			
Female				1.12	NS	(0.82, 1.53)				0.96	NS	(0.66, 1.40)
Religion												
Catholic	1.00			1.00			1.00			1.00		
Non-Catholic Christian	0.95	NS	(0.78, 1.16)	0.75	NS	(0.46, 1.20)	1.00	0.975	(0.79, 1.25)	1.16	NS	(0.62, 2.18)
No religion	0.70	0.011	(0.53, 0.92)	0.72	NS	(0.40, 1.30)	0.71	0.010	(0.54, 0.92)	1.35	NS	(0.67, 2.72)
Family type												
Nuclear	1.00			1.00			1.00			1.00		
Extended	0.82	0.008	(0.71, 0.95)	1.33	NS	(0.61, 1.39)	0.88	NS	(0.78, 1.01)	1.15	NS	(0.73, 1.80)
Single parent	0.62	0.003	(0.45, 0.85)	1.52	NS	(0.79, 2.86)	0.98	NS	(0.71, 1.29)	0.71	NS	(0.29, 1.74)
Language												
Mayan and Spanish	1.00			1.00			1.00			1.00		
Mayan only	0.95	NS	(0.78, 1.16)	1.56	0.024	(1.06, 2.29)	1.20	NS	(0.99, 1.46)	0.69	NS	(0.37, 1.31)
Education												
No primary	1.00			1.00			1.00			1.00		
Some primary	1.04	NS	(0.86, 1.27)	0.92	NS	(0.61, 1.39)	0.75	0.003	(0.62, 0.90)	0.67	NS	(0.40, 1.12)
Complete primary	1.36	0.033	(1.02, 1.81)	1.51	NS	(0.79, 2.86)	0.82	NS	(0.63, 1.06)	1.07	NS	(0.38, 3.00)
Work												
Skilled labor	1.00			1.00			1.00			1.00		
Unskilled labor	1.09	NS	(0.83, 1.44)	1.28	NS	(0.65, 2.54)	1.00	NS	(0.77, 1.30)	0.76	NS	(0.24, 2.46)
Wealth index												
Lowest	1.00			1.00			1.00			1.00		
Mid-level	1.01	NS	(0.74, 1.37)	0.83	NS	(0.34, 2.01)	0.89	NS	(0.63, 1.28)	0.88	NS	(0.27, 2.88)
Highest	0.93	NS	(0.67, 1.27)	0.47	NS	(0.19, 1.12)	1.09	NS	(0.74, 1.62)	0.87	NS	(0.29, 2.63)
Distance												
Same community	1.00			1.00			1.00			1.00		
Mid-distance	1.15	NS	(0.89, 1.49)	0.56	NS	(0.26, 1.19)	1.04	NS	(0.75, 1.45)	1.83	NS	(0.76, 4.42)
Farthest	0.53	0.010	(0.33, 0.86)	0.53	NS	(0.16, 1.77)	0.76	NS	(0.47, 1.21)	0.49	NS	(0.17, 1.43)
Year	1.62	<0.001	(1.51, 1.74)	2.08	<0.001	(1.54, 2.82)	1.83	<0.001	(1.67, 2.01)	1.76	0.001	(1.25, 2.49)
Clinic fixed effects												
Clinic 1	1.00			1.00			1.00			1.00		
Clinic 2	1.09	NS	(0.78, 1.51)	0.56	NS	(0.27, 1.16)	1.56	0.002	(1.18, 2.07)	2.49	0.017	(1.17, 5.28)
Clinic 3	0.62	0.007	(0.44, 0.88)	0.54	NS	(0.26, 1.13)	1.28	0.047	(1.00, 1.63)	0.97	NS	(0.55, 1.73)
Clinic 4	0.75	NS	(0.52, 1.07)	0.42	0.022	(0.20, 0.88)	0.57	<0.001	(0.44, 0.74)	1.04	NS	(0.57, 1.93)
Clinic 5	0.57	0.003	(0.40, 0.83)	1.05	NS	(0.45, 2.42)						
Clinic 6	0.40	<0.001	(0.29, 0.57)	1.21	NS	(0.56, 2.63)						
Interactions												
Mid-level wealth*year	1.00	NS	(0.91, 1.09)	0.91	NS	(0.56, 1.47)	1.01	NS	(0.90, 1.12)	0.92	NS	(0.57, 1.49)
Highest-level wealth*year	0.99	NS	(0.90, 1.09)	1.26	NS	(0.81, 1.97)	0.97	NS	(0.87, 1.08)	1.07	NS	(0.70, 1.64)
Mid-level distance*year	0.89	0.002	(0.83, 0.96)	1.33	NS	(0.93, 1.89)	1.02	NS	(0.94, 1.12)	0.83	NS	(0.58, 1.20)
Farthest-distance*year	1.13	NS	(0.98, 1.31)	1.37	NS	(0.80, 2.35)	1.24	0.006	(1.07, 1.45)	1.02	NS	(0.66, 1.58)

NS = non-significant at $p < 0.05$.

Table 4
Regression results of factors influencing service use at two sites in rural Guatemala applying the Inclusive Health Model

Variables	Sololá (Site 1)			Quetzaltenango (Site 2)		
	IRR	p-value	95% CI	IRR	p-value	95% CI
Religion						
Catholic	1.00			1.00		
Non-Catholic Christian	0.90	0.024	(0.82, 0.99)	1.07	NS	(0.95, 1.21)
No religion	0.95	NS	(0.85, 1.05)	1.13	NS	(1.00, 1.28)
Family type						
Nuclear	1.00			1.00		
Extended	0.97	NS	(0.89, 1.05)	1.04	NS	(0.97, 1.11)
Single parent	1.16	NS	(0.98, 1.38)	0.98	NS	(0.84, 1.14)
Language						
Mayan and Spanish	1.00			1.00		
Mayan only	1.11	0.002	(1.04, 1.19)	0.95	NS	(0.90, 1.01)
Education						
No primary	1.00			1.00		
Some primary	0.96	NS	(0.89, 1.04)	1.17	0.001	(1.06, 1.30)
Complete primary	1.08	NS	(0.97, 1.22)	1.35	<0.001	(1.17, 1.56)
Head of household's work						
Skilled labor	1.00			1.00		
Unskilled labor	1.10	NS	(0.95, 1.27)	0.96	NS	(0.81, 1.13)
Wealth index						
Lowest	1.00			1.00		
Mid-level	1.08	NS	(0.93, 1.24)	0.81	0.035	(0.67, 0.99)
Highest	1.07	NS	(0.92, 1.24)	0.84	NS	(0.70, 1.02)
Distance						
Same community	1.00			1.00		
Mid-distance	0.56	<0.001	(0.49,0.64)	0.96	NS	(0.82, 1.13)
Farthest	0.40	<0.001	(0.33, 0.50)	0.61	<0.001	(0.48, 0.77)
Family risk						
Low	1.00			1.00		
Medium	1.02	NS	(0.80, 1.29)	1.64	<0.001	(1.32, 2.04)
High	1.55	0.001	(1.19, 2.03)	1.86	<0.001	(1.38, 2.49)
Year	1.05	NS	(0.95, 1.15)	1.15	<0.001	(1.07, 1.24)
Clinic fixed effects						
Clinic 1	1.00			1.00		
Clinic 2	0.91	NS	(0.79, 1.05)	0.83	0.023	(0.70, 0.97)
Clinic 3	0.79	0.001	(0.68, 0.91)	0.76	<0.001	(0.67, 0.86)
Clinic 4	0.76	<0.001	(0.66, 0.87)	0.69	<0.001	(0.60, 0.80)
Clinic 5	0.85	0.044	(0.72, 0.99)			
Clinic 6	0.85	0.027	(0.73, 0.98)			
Interactions						
Mid-level wealth*year	0.99	NS	(0.95, 1.04)	1.04	NS	(0.98, 1.09)
Highest-level wealth*year	0.97	NS	(0.93, 1.02)	1.03	NS	(0.98, 1.08)
Mid-level distance*year	1.13	<0.001	(1.09, 1.18)	0.98	NS	(0.94, 1.03)
Farthest-distance*year	1.23	<0.001	(1.15, 1.31)	1.09	0.008	(1.02, 1.16)
Medium risk*year	1.04	NS	(0.95, 1.14)	0.96	NS	(0.90, 1.03)
High risk*year	0.98	NS	(0.88, 1.08)	1.04	NS	(0.95, 1.14)

NS = non-significant at $p < 0.05$ level.

Among the predisposing variables, age is the only variable consistently associated with tetanus toxoid immunization coverage for both sites (OR: 1.05 in Sololá and OR: 1.02 in Quetzaltenango), with older women being more likely to have complete coverage. In Sololá, women from extended (OR: 0.82) and single-parent (OR: 0.62) households are significantly less likely to have complete coverage but this relationship was not observed for Quetzaltenango. In both sites, women from families classified as not having a religion were significantly less likely to have complete coverage (OR: 0.70 in Sololá and OR: 0.71 in Quetzaltenango). The two enabling variables, wealth index and distance, are not significant consistently across sites and immunization groups. For tetanus coverage in the Sololá site, distance is significant (OR: 0.53, $p = 0.01$) when comparing families at the farthest distance from the clinic with those living in the same community as the clinic. The odds ratio for project year is significantly greater than one at the $p = 0.001$ level or lower for both sites and both types of immunization, indicating increasing coverage over time. The interaction terms are not consistently significant across sites and immunization groups.

The regression results of service utilization are shown in Table 4. There were 7141 observations of annual family service use in Sololá and 5258 in Quetzaltenango. Among the predisposing variables, there are no consistent associations across sites. In Sololá, for families in which the head of household speaks only a Mayan language, service use is significantly higher (IRR: 1.11) compared to households where Spanish is also spoken. In Quetzaltenango, households with some (IRR: 1.17) and complete (IRR: 1.35) primary education had significantly higher use of services

Table 5
Regression results of factors influencing treatment guideline application for children under 5 years of age with pneumonia at two sites in rural Guatemala applying the Inclusive Health Model

	Patient characteristics only			Characteristics of patients and providers[a]		
Variables	Odds ratio	p-value	95% CI	Odds ratio	p-value	95% CI
Age	0.80	<0.001	(0.728, 0.885)	0.80	<0.001	(0.732, 0.879)
Female	0.99	NS	(0.808, 1.220)	0.99	NS	(0.812, 1.208)
Family type						
Nuclear	1.0			1.0		
Extended	1.15	NS	(0.877, 1.499)	1.11	NS	(0.860, 1.442)
Single parent	1.74	NS	(0.843, 3.586)	1.62	NS	(0.782, 3.369)
Work						
Skilled labor	1.0			1.0		
Unskilled labor	1.59	NS	(1.167, 2.170)	1.58	NS	(1.146, 2.178)
Religion						
Catholic	1.0			1.0		
Non-Catholic Christian	0.89	NS	(0.636, 1.257)	0.89	NS	(0.609, 1.301)
No religion	1.41	NS	(0.987, 2.014)	1.41	NS	(0.975, 2.048)
Language						
Mayan and Spanish	1.0			1.0		
Mayan only	1.68	<0.001	(1.314, 2.151)	1.55	0.001	(1.195, 2.015)
Education						
No primary	1.0			1.0		
Some primary	0.73	0.01	(0.568, 0.939)	0.75	0.03	(0.575, 0.967)
Complete primary	0.71	0.03	(0.519, 0.968)	0.75	NS	(0.533, 1.055)
Wealth index						
Lowest	1.0			1.0		
Mid-level	1.08	NS	(0.634, 1.823)	0.99	NS	(0.551, 1.791)
Highest	1.40	NS	(0.722, 2.719)	1.23	NS	(0.612, 2.463)
Distance						
Same community	1.0			1.0		
Mid-distance	1.07	NS	(0.470, 2.444)	1.01	NS	(0.412, 2.470)
Farthest	1.82	NS	(0.563, 5.883)	1.55	NS	(0.422, 5.730)
Year	4.78	<0.001	(2.141, 10.669)	4.78	<0.001	(1.983, 11.507)
Provider characteristics		NS			NS	
Interactions	0.84	NS	(0.558, 1.261)	0.86	NS	(0.563, 1.326)
Highest-level wealth*year	0.77	NS	(0.493, 1.201)	0.82	NS	(0.514, 1.291)
Mid-level distance*year	0.88	NS	(0.438, 1.785)	0.87	NS	(0.419, 1.789)
Farthest-distance*year	0.73	NS	(0.305, 1.748)	0.77	NS	(0.296, 2.016)

NS = non-significant at $p < 0.05$.
[a] Provider characteristics included in the regression were age, female, education, work experience and residence; estimates for each provider variable are not presented in the table.

compared to households with no primary schooling. Of the two enabling variables, only distance was significant in explaining variation in utilization. For the distance variable, there is a trend at both sites for families that live further away from community clinics to have lower rates of utilization. For those farthest from clinics, the IRR is 0.40 in Sololá and 0.61 in Quetzaltenango, with $p < 0.001$. The interaction of distance*year is significant for the farthest category. With each year, the rate of use increases for those living farthest away (1.23 times in Sololá and 1.09 times in Quetzaltenango). Families classified as high risk have a rate of use that is 1.55 times that of low-risk families in Sololá, and 1.86 times that of low-risk families in Quetzaltenango. In Quetzaltenango, the rate of use is also significantly higher for medium-risk versus low-risk families, with an IRR of 1.64. Incidence rate ratios for year-by-wealth index and year-by-risk interactions were not significantly different from 1.

Table 5 presents the regression results of treatment guideline application for children below 5 years of age with pneumonia. The analysis included 3364 observations. Among predisposing variables, age was significantly associated with treatment, with older children being less likely to receive the appropriate medication. For children in households where only a Mayan language is spoken, the odds of having the correct medication provided were significantly higher than for families speaking both Spanish and a Mayan language. Families in which the head of household had no primary education were more likely to receive the appropriate treatment. The two enabling variables are not significant. The odds of prescribing amoxicillin significantly increase with program implementation (OR: 4.8). The interaction terms are not significant at $p = 0.05$.

After adding community nurse auxiliary characteristics to the model, the odds ratios for the patient characteristics remained virtually unchanged for all variables with the exception of wealth index and distance. For each of these variables, one category changed more than 10% with the addition of provider characteristics to the model (OR for the highest category of wealth index changed 12.4%, from 1.4 to 1.2 and for the farthest distance category changed 14.6% from 1.8 to 1.6) but both wealth index and distance were still not significant. The five provider characteristic

variables (age, sex, education, experience, residence) were not significant at $p < 0.05$.

4. Discussion

The first hypothesis that we tested was whether, as a result of implementing the model, families' need for services increasingly explained use of health care services. In the main model, there is an association between risk classification and service use, with families classified as having greater need having higher odds of using more services as compared to those classified as low risk. This relationship is similar across years. The risk assessment performed during family visits is likely to be the driver of this association, as higher risk families are encouraged to use services the model provides, and these families receive more frequent follow-up visits.

There are strong and consistent year effects in all models, suggesting that the intervention resulted in improvements in coverage, utilization, and quality over time.

The predisposing variables are not consistently significant across sites and outcomes. This suggests that the program is not providing differential care on the basis of characteristics such as education and language spoken. Among the enabling variables, the wealth index is not an influential variable in coverage, use or quality; this indicates the project achieved its aim of providing equitable care regardless of poverty status. Distance to a clinic is influential in explaining utilization, with those living in the farthest-out communities being less likely to use services. However, a significant distance*year interaction counteracts this relationship, as the constraint of distance decreases over time. This change is probably attributable to the program's implementation in 2008 of strategies to reach the farthest-away communities. For immunization coverage and quality, distance is not significant, with the exception of tetanus coverage in Sololá when comparing women living in communities farthest away from the clinic with those living in communities where the clinic is based; the reason for this significant result in Site 1 but not in Site 2 is probably that distances in the farthest category in Sololá are on average greater than those in Quetzaltenango.

The second hypothesis tested was that provider characteristics would not be associated with treatment guideline implementation for children with pneumonia. This hypothesis was supported, because none of the provider characteristics is significant, and the inclusion of provider characteristics in the model left patient characteristics virtually unchanged. While the analysis was conducted for only one illness, this finding is of interest given that the community auxiliary nurses are a new cadre of health worker with different levels of education, prior work experience, and with some residing directly in the communities that they serve while others do not. We suggest additional quality analysis be conducted on this topic to confirm the findings presented in this paper. All providers who have continued with the Inclusive Health Model received accreditation in 2009 from the National School of Nursing for having achieved equivalence as nurse auxiliaries. Such accreditation is important, especially in low resource settings, to scale up the health workforce.[29]

Our analysis has a number of limitations. It presents observed associations and does not measure causal relationships. For some variables, because both study sites are located in poor, rural parts of the country, there may not have been sufficient variability in the characteristics of the study populations to allow differences to be captured. Also, the quality of care analysis was limited in scope. It did not include adherence to taking medication, was for only one disease outcome, and only included children who presented for care. An analysis capturing other aspects would assess more comprehensively the influence of provider characteristics.

At the end of 2010, the Ministry of Health made the decision to financially sustain the model in the two original sites and to extend it to at least three additional sites. This Ministry of Health adoption of the Inclusive Health Model presents an opportunity for communities in rural Guatemala. Care is being provided equitably on the basis of need, regardless of families' predisposing and enabling characteristics. The model's aim of offering care equitably to families living in its catchment area is reflected in these findings. The one exception is that distance to a clinic was associated with lower service use, although this association decreased over time.

As the model is implemented in new sites, the continued tracking of equity of service delivery, in addition to overall trends of coverage, use, and quality, will be important as a way of ensuring that those families most in need are receiving care and that care is not being preferentially offered to the easiest-to-reach families. If the model is to be implemented in urban areas or parts of the country with more variation in wealth, education, and access to resources, the challenge of providing services equitably to the population may be greater.

The approach of using family surveillance to assess risk has been demonstrated to promote equity in other settings and is an important strategy for low-income countries.[30] For example, Brazil's family health strategy has achieved higher service use for older adults and for those who are less educated.[31]

To conclude, we find that in the catchment area of the Inclusive Health Model, families' health risk level shows a significant positive association with service use, providing more services to those with greater need. Services are not provided differentially for those families with a higher or lower wealth level or selected demographic characteristics. And the application of treatment guidelines does not vary for different provider characteristics, which suggests that training and supervision compensates for differences existing between providers when they start work with the project.

Authors' contributions: MPF designed the conceptual framework and was responsible for conducting the analyses and writing the manuscript. DG provided conceptual and methodological guidance for the study. PH provided methodological oversight and reviewed statistical analyses. DG, PH, SL and MAM conducted critical revisions of the

article and contributed to the content. All authors gave final approval for the version to be published. MPF is guarantor of the paper.

Funding: None.

Competing interests: None declared.

Ethical approval: The study was approved by the University of Washington's Institutional Review Board.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.inhe.2012.04.001.

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