The Effect Of Costs On Kenyan Households' Demand For Medical Care: Why Time And Distance Matter

By: Matt Kukla, Niccie McKay, **Richard Rheingans**, Jeff Harman, Jessica Schumacher, Karen L Kotloff, Myrone M Levine, Robert Breiman, Tamer Farag, Damian Walker, Dilruba Nasrin, Richard Omore, Ciara O'Reilly, & Eric Mintz

Abstract

In an environment of constrained resources, policymakers must identify solutions for financing and delivering health services that are efficient and sustainable. However, such solutions require that policymakers understand the complex interaction between household utilization patterns, factors influencing household medical decisions, and provider performance. This study examined whether and under what conditions out-of-pocket, transportation, and time costs influenced Kenyan households'choice of medical provider for childhood diarrhoeal illnesses. It compared these decisions with the actual cost and quality of those providers to assess strategies for increasing the utilization of high quality, low-cost primary care. This study analyzed nationally representative survey data through several multinomial nested logit models. On average, time costs accounted for the greatest share of total costs. Households spent the most time and transportation costs utilizing public care, yet were more likely to incur catastrophic time and out-of-pocket costs seeking private care for their child's diarrhoeal illness. Out-of-pocket, transportation, and time costs influenced households'choice of provider, though demand was cost inelastic and households were most responsive to transportation costs. Poorer households were the most responsive to changes in all cost types and most likely to self-treat or utilize informal care. Many households utilized informal care that, relative to formal care, cost the same but was of worse quality—suggesting that such households were making poor medical decisions for their children. To achieve public policy objectives, such as financial risk protection for childhood illnesses and equitable access to primary care, policymakers could focus on three areas: (1) refine financing strategies for further reducing household out-of-pocket costs; (2) reduce or subsidize time and transportation costs for households seeking public and private care; and (3) increase transparency of costs and quality to improve household decisions.

Kukla M, McKay N, **Rheingans R**, et al. The effect of costs on Kenyan households' demand for medical care: why time and distance matter. Health Policy and Planning. 2017;32(10):1397-1406. Publisher version of record available at: https://academic.oup.com/heapol/article/32/10/1397/4345785

The effect of costs on Kenyan households' demand for medical care: why time and distance matter

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Abstract

In an environment of constrained resources, policymakers must identify solutions for financing and delivering health services that are efficient and sustainable. However, such solutions require that policymakers understand the complex interaction between household utilization patterns, factors influencing household medical decisions, and provider performance. This study examined whether and under what conditions out-of-pocket, transportation, and time costs influenced Kenyan households' choice of medical provider for childhood diarrhoeal illnesses. It compared these decisions with the actual cost and quality of those providers to assess strategies for increasing the utilization of high quality, low-cost primary care. This study analyzed nationally-representative survey data through several multinomial nested logit models. On average, time costs accounted for the greatest share of total costs. Households spent the most time and transportation costs utilizing public care, yet were more likely to incur catastrophic time and out-of-pocket costs seeking private care for their child's diarrhoeal illness. Out-of-pocket, transportation, and time costs influenced households' choice of provider, though demand was cost inelastic and households were most responsive to transportation costs. Poorer households were the most responsive to changes in all cost types and most likely to self-treat or utilize informal care. Many households utilized informal care that, relative to formal care, cost the same but was of worse quality—suggesting that such households were making poor medical decisions for their children. To achieve public policy objectives, such as financial risk protection for childhood illnesses and equitable access to primary care, policymakers could focus on three areas: (1) refine financing strategies for further reducing household out-of-pocket costs; (2) reduce or subsidize time and transportation costs for households seeking public and private care; and (3) increase transparency of costs and quality to improve household decisions.

Keywords: Costs, quality of care, health financing, diarrhoea, economic evaluation, health care seeking behavior, health services research

Key Messages

- Out-of-pocket, transportation, and time costs all influence households' choice of medical provider for diarrhoeal care, even though demand is cost inelastic; the poor are most responsive to changes in costs, households are most responsive to changes in transportation costs, and time costs account for the greatest share of total costs.
- Many households utilize informal care for their child's diarrhoea that, relative to formal care, costs the same but is of worse quality—suggesting that such households are making poor medical decisions.
- To stimulate demand for primary and child health services as well as formal medical providers, particularly among the poor, policymakers should identify strategies for reducing or subsidizing time and transportation costs.
- Improving transparency of out-of-pocket costs, time costs, transportation costs, and quality of care among providers can improve household medical decisions and health system efficiency.

Introduction

Low- and middle-income countries (LMICs) have become increasingly aware of the important role that efficient and equitable health systems play in enhancing economic and social development. Yet in many developing countries, particularly those in sub-Saharan Africa, governments face daunting economic, social, and political challenges as well as fragmented and weak health care systems. They frequently lack the institutional capacity and resources to effectively govern and implement health system reforms (Savedoff and Gottret 2008; Kutzin *et al.* 2010). Health outcomes, financial risk protection, public satisfaction, as well as equitable access to high-quality health services are therefore among the worst in the world (Roberts 2008).

Over the past decade Kenya has undergone health financing and delivery system reforms in response to a changing political landscape, a global push towards universal health coverage (UHC), and poor health system indicators (Obare *et al.* 2014; Wagstaff *et al.* 2015; McIntyre and Kutzin 2016; WHO 2016a,b). Notable policies include refinements to the National Hospital Insurance Fund (NHIF), expansion of public-private partnerships in health service delivery, investments in its private health insurance (PHI) market, and the elimination of public sector user fees (Cotlear *et al.* 2015; Maina and Kirigia 2015). The primary aims of these reforms have been to reduce the number of uninsured, increase financial risk protection and expand access to health services. A growing body of evidence suggests Kenya's reforms have had a positive effect on public policy objectives, as shown in Table 1. Between 2007 and 2014, general government health expenditures (GGHEs) as a percent of total health expenditures (THEs) and total government expenditures (TGEs) rose from 3.9 and 7.1% to 6.1 and 12.8%, respectively (Ministry of Health 2014; Maina *et al.* 2016). Meanwhile out-of-pocket expenditures (OOPs) as a percent of THEs fell from 47.4 to 26.1%. Financial risk protection and health outcomes also improved over the 2007–14 period. Both the incidence of catastrophic health expenditures (14.8–4.5%) and incidence of impoverishment due to health expenditures (4.0–1.2%) fell, as did Kenya's infant mortality rate (68–55 per 100 000) and under-five mortality rate (103–76 per 100 000) (WHO 2014; Kimani and Maina 2015; Barasa *et al.* 2017).

Yet when measured by a common set of global indicators, Kenya's progress towards UHC remains limited (Obare 2014; Wagstaff *et al.* 2015). Household out-of-pocket health expenditures still account for over 26% of THEs and 83% of the population remains uninsured, resulting in over 450 000 individuals being pushed into poverty each year (Barasa *et al.* 2017). Effective coverage (the percent of a population utilizing health services that meet a minimum quality standard) frequently lags behind contact coverage (the percent of a population utilizing health services, regardless of quality) for many maternal and child health services (Nguhiu *et al.* 2017a). Further still, the benefits of Kenya's reforms have largely been concentrated among higher income households, the formally employed, and those living in urban areas (Munge and Briggs 2014; Obare *et al.* 2014; McIntyre and Kutzin 2016). This means that wealthier, urban households have considerably easier access to higher quality, formal medical care while spending much less as a portion of total income than their poorer, rural counterparts (Ranson *et al.* 2010; Rheingans *et al.* 2012a, Ministry of Health, Government of Kenya 2014; Barasa *et al.* 2017).

Like other developing countries, Kenya's efforts to achieve UHC are constrained by its large informal sector, limited fiscal space, and weak institutional capacity. Global experience further suggests that Kenya's health financing and delivery system will require additional improvements if the benefits of reforms are to reach poorer, rural, and vulnerable populations (Hsiao *et al.* 2007; Cotlear *et al.* 2015). For instance, user fees were eliminated from public dispensaries and health centres in 2013 but are still permitted at public hospitals (Maina and Kirigia 2015). Despite public subsidies to primary care centres intended to offset lost user fee revenue, studies show that households continue to incur out-of-pocket costs for health services received at those facilities (Chuma *et al.* 2009; Maina and Kirigia 2015; Barasa *et al.* 2017). Although the breadth of NHIF coverage has grown (as measured by population and benefit package), the depth of NHIF coverage (as measured by its percent of THEs) remains small in part due to a limited network of contracted providers. Inequities in the distribution of human resources, health care facilities, medical supplies and drugs remain a serious problem throughout Kenya, and thus deficiencies in health service delivery exacerbate gaps in health financing (Anthopolos *et al.* 2017; Nguhiu *et al.* 2017a).

Study aims

Given an environment of constrained resources, Kenyan policymakers must identify and implement solutions for financing and delivering health services that are both efficient and sustainable. However, making informed policy decisions among a complex set of options first requires the generation of more and higher quality data

on household utilization patterns, factors influencing household medical decisions, as well as provider performance. Specifically, policymakers must (1) understand which demand and supply side factors impact households' choice of medical provider, (2) know how key indicators of performance, such as costs and quality, vary across provider types and (3) determine the conditions under which those performance measures impact household medical decisions, if at all. This information would allow policymakers to improve patient medical decisions while simultaneously reducing costs and improving quality of care through targeted health financing or delivery reforms. In turn, such reforms could more effectively and efficiently achieve better health system performance, such as financial risk protection and health outcomes (Grossman 1972; Culver and Newhouse 2000; Andersen 2008).

An ample body of literature has addressed these issues to different extents and with different individual, household, provider and market level factors. In Kenya and elsewhere, considerable work has examined the impact of OOPs, such as user fees and other health insurance based cost sharing mechanisms, on provider choice, utilization, and health outcomes (Bedi *et al.* 2003; Xu *et al.* 2006; Chuma *et al.* 2009; Ridde and Morestin 2011; Hatt *et al.* 2013, 2015; Memirie *et al.* 2017). A growing consensus on their impact is in large part what drove Kenya's 2013 policy to eliminate user fees from public dispensaries and health centres (Maina and Kirigia 2015).

Data limitations have largely inhibited research on transportation costs. Among the few studies conducted, Memirie *et al.* (2017) found that in Ethiopia transportation costs for moderate and severe diarrhoea (with inpatient care) accounted for 16 and 12% of total out-of-pocket costs, respectively. Another study by Barasa *et al.* (2017), which utilized nationally representative survey data in Kenya, found that transportation costs accounted for 24% of total medical costs, though this varied between poor (31.4%) and wealthy (17.5%) households. More importantly, the incidence of catastrophic health expenditures (defined as 40% of non-food related expenditures) rose from 4.52 to 6.57% of households when transportation costs were considered. Poorer households and those living in rural areas experienced a higher incidence of catastrophic health spending due to transportation costs.

Studies examining time costs are largely nonexistent, though theory and qualitative evidence hint that their impact on household medical decisions, how they vary across providers, and how they influence broader health system objectives could be significant—even more so than out-of-pocket costs (Becker 1965; Acton 1973, 1975; Coffey 1983). Also absent from the literature, there is limited understanding on how these costs impact household medical behavior across wealth groups (Ensor and Cooper 2004; Qian *et al.* 2009; Jacobs *et al.* 2011).

This study addresses these gaps by examining household out-of-pocket, transportation, and time costs for child diarrhoeal care in Kenya, in addition to the interactive impact that wealth has on costs and household medical decisions. Although not generalizable to all clinical conditions, diarrhoea is one of several childhood illnesses that can provide insight into the effectiveness and efficiency of Kenya's health financing and delivery system. Such conditions can often be treated in primary care settings and with minimal resources; however, delayed care or ineffective treatment can result in worsening health outcomes and substantial costs. Diarrhoea illnesses account for significant variation in Kenya's mortality rate and are leading causes of death globally; they are also primary drivers of impoverishment and economic burden to households (Anthopolos *et al.* 2017; Memirie *et al.* 2017; Nguhiu *et al.* 2017a).

Table 1. Health system indicators

Indicator	2007	2014
Health expenditures		
THE per capita ($)	35	78
THEs as a percent of gross domestic product (GDP) (%)	4.1	5.7
GGHEs as a percent of THEs (%)	3.9	6.1
General government health expenditures [GGHE] as a percent of TGEs (%)	7.1	12.8
OOPs as a percent of THEs (%)	47.4	26.1
PHI as a percent of private health expenditures (%)	8.2	21.7
Insurance Coverage		
Percent of the population covered by health insurance (%)	10.0	17.1 (2013)
Financial Risk Protection		
Incidence of catastrophic health expenditures (40%)	14.8	4.5
Richest quintile (40%)	7.0	1.9
Poorest quintile (40%)	20.0	9.9
Incidence of impoverishment due to health expenditures (%)	4.0	1.2
Health outcomes		
Life expectancy at birth	58	61
Infant mortality rate	68	55
Under-five mortality rate	103	76

Methods

Data sources and survey design

This article uses data from the Global Enterics Multi-Center Study (GEMS), a 3-year, case-control study conducted at field sites across four African and three South Asian countries (Kotloff *et al.* 2012). GEMS aimed to assess the incidence, etiology, and clinical burden of moderate to severe diarrhoea in order to identify interventions that might improve child mortality and morbidity. Each site randomly sampled households that were enrolled in a country's Demographic Surveillance System (DSS), a national program that monitors households' vital events within nationally representative, geographic areas (Nasrin *et al.* 2013). Within this population, case households were selected if they had at least one child between 0 and 59 months of age with an episode of acute diarrhoea within the past 2 weeks. A propensity matched, control group of households with children without acute diarrhoea were selected from the DSS population.

A baseline Healthcare Utilization and Attitude Survey (HUAS) was administered in 2007 among roughly 1,000 DSS case and control households per site (Kotloff *et al.* 2012). This was followed with an abbreviated HUAS survey in years two and three of the study. For a given household multiple attempts were made to complete each HUAS; follow up visits occurred within a given year to validate responses and minimize recall bias by household caretakers. Adapted from a validated World Health Organization survey, the HUAS contains 65 questions across 8 sections (Nasrin *et al.* 2013). These included household demographic and socioeconomic characteristics, comorbidities and clinical severity, perceptions of illness, health care utilization patterns, health expenditures and health care attitudes (Rheingans *et al.* 2012b). The analysis reported herein is limited to the Kenyan site (Omore 2012), and draws upon the 275 Kenyan case households. This sample size was deemed adequate to maintain statistical power and effectively achieve the study's objectives.

Table 2. Variables

Variable	Definition
Dependent variables	
Medical provider	
Public	Public Hospital or Health Centre
Private	Licensed Practitioner or Private Doctor (Not at Hospital); Pharmacy
Informal	Traditional Healer; Unlicensed Practitioner; Village or Bush Doctor; Friend or Relative; Bought a Drug at the Shop or Market
Self-care	Sought care from home
Independent variables	
Direct medical costs	Household out of pocket costs directly resulting from the provision of health care services (2016 US$)
Direct non-medical costs	Household out-of-pocket, transportation costs of reaching a health care provider (2016 US$)
Indirect medical costs	Household time costs that are spent utilizing medical care which could otherwise be allocated towards work, household or leisure activities (2016 US$)
Total costs	Sum of direct medical, direct non-medical and indirect costs (2016 US$)
Covariates	
Age	1–60 months
Gender	Male; Female
Maternal education	No formal schooling, Religious; Less than primary; Completed primary; Post-secondary; Completed secondary
Case severity	Moderate to severe diarrhoea; Had diarrhoea but minor
Cultural factors and beliefs	Vaccine Safety and Effectiveness (No; Yes)
Wealth	Poorest, Poor; Middle; Middle to Upper, Wealthiest
Wealth*DMC	Interaction of Wealth and Direct Medical Costs
Wealth*DNMC	Interaction of Wealth and Direct Non-Medical Costs
Wealth*IMC	Interaction of Wealth and Indirect Medical Costs
Perceived quality of care	Excellent; Good; Fair; Bad
Clinical quality of care	IV, Fluids; ORS, Zinc; Antibiotics; No Treatment

Variables

Table 2 presents the study's dependent variables, independent variables, and covariates. The dependent variable in this study is the type of health care provider utilized by households. The HUAS limits respondents' choice to four, broad provider types: public formal, private formal, private informal, and self-care. The term 'provider' refers to any medical facility or individual through which health care is delivered. A formal provider is defined as those registered, accredited and/or working in the confines of the publically regulated health care system (Waters *et al.* 2003; Ahmed *et al.* 2009; Shah *et al.* 2011). Although the distinction between self-care and informal care is often blurred in the literature, this study differentiates the two variables by suggesting that self-care is defined only as care provided in a home and by the household. The HUAS asks households where they first sought medical care for their child's diarrhoea, which in Kenya can include community, primary care health centres and dispensaries, first level referral hospitals, and national level facilities such as tertiary hospitals. By consolidating formal public and private providers into two categories, this study is unable to detect the marginal effect of costs on household behavior for each, unique provider type in Kenya. These constraints will thus limit the generalizability of its recommendations to policymakers.

Among the study's independent variables, direct medical costs are defined as out-of-pocket costs directly resulting from the provision of health care services. These can include the cost of drugs or medications, consultation, lab services, or other insurance based, cost sharing mechanisms like co-pays, co-insurance or deductibles (Asenso-Okyere and Dzator 1997). Direct non-medical costs represent patients and households' direct out-of-pocket, transportation costs of reaching a health care provider. This may include the cost of gas, renting a vehicle, taking the bus, driving a car or any other mode of transportation. Indirect medical costs are defined as time costs that are spent utilizing medical care, such as traveling to and from a health care provider as well as waiting to be treated or purchase medications. Households chose a perceived monetary value of time lost to unpaid, household or personal activities, which was measured in local currency and converted to US dollars. Total costs are defined as the sum of direct medical, direct non-medical and indirect costs. Costs were collected in Kenyan shillings, adjusted to 2016 as the reference year, and converted to US dollars.

When compared with income, wealth encompasses a broader range of assets including income, livestock, property and savings. Because households in developing countries often purchase medical care through loans, trading of livestock, or other assets, wealth is likely to have a greater impact on provider choice than income earned.

Model

This study utilizes an unordered, nested logit model for two reasons (McFadden 1993; Dow 1999). First, the dependent variable is an unordered choice function of four health care providers, whereby households do not vary their choice of public, private, informal or self-care in an ordered manner. Second, the Independence of Irrelevant Alternatives (IIA) assumption, which precludes that no two health care provider types are closer substitutes for households than the other available types, did not hold when tested.

The nested logit model offers several distinct advantages over alternative models, specifically that it provides more in-depth analyses. Within nesting groups, the multinomial component determines whether and to what extent non-variant characteristics, such as income and age, impact households' choice of medical provider across any stage of their decision making process. The conditional component utilizes characteristics (i.e. costs and quality) that vary across

medical providers, and thus it can determine how these variables impact provider choice, households' non-proportional cross cost-choice elasticities, and the extent to which they vary across providers.

To ensure unbiased statistical results, this study accounted for selection bias, simultaneous equation bias, and measurement error. Bivariate and multivariate results from this study were defined as being significant at the $P < 0.10$ level; expanding the range of statistical significance was appropriate given the study's small sample size.

Results

Overview

The IIA tests revealed that nests for Kenyan households should be broken down by 'formal' and 'informal' care providers, with the former including public and private medical providers and the latter including informal care providers or self-care. Consistent with the literature, this finding indicates that public and private providers were highly correlated alternatives among households seeking medical care; if either of these two choices were removed, households should proportionately shift their demand to the alternative provider type. Similarly, informal care providers and self-care made up the 'informal care' nest and were highly correlated alternatives for households.

Descriptive statistics

Descriptive statistics for Kenyan households are presented in Table 3. Utilization across private, public, informal and self-care was evenly distributed for Kenyan households. Mothers seeking formal medical care for their child's diarrhoea were more highly educated than those seeking informal care or self-treating; however, nearly 96% of all mothers had at most completed primary education. Almost 66% of all households indicated that their child had moderate or severe diarrhoea, although only 43% of those self-treating responded as such. About 40% of households seeking formal medical care were in the top two wealth quintiles, while that figure was only 30–35% for those seeking informal diarrhoeal care or self-treating. Only 49% of households said they had received excellent quality care from informal providers compared with 70% utilizing formal, private care and 100% utilizing public care. Roughly 75% of public providers administered oral rehydration salts, whereas 63, 12 and 0% of private providers, informal providers and self-treating households followed suit.

Cost summary

A summary of households' total, direct medical, direct non-medical and indirect medical costs for diarrhoeal care is presented in Table 4 in 2016 US dollars. Across all households, average costs for these categories were \$10.23, \$0.92, \$0.42 and \$8.90, while the proportion of households incurring any costs was 88, 48, 18 and 76%, respectively. Indirect medical costs accounted for the majority of total medical costs, with direct and direct non-medical costs being similar and relatively small. Households seeking private care were more likely to incur costs and spent more overall for care, followed by public care and then informal care. As expected, households that self-treated incurred fewer total costs and were less likely to incur costs on average than those seeking private (\$14.02; 99%), public (\$12.97; 96%) and informal care (\$9.90; 93%).

Households seeking private care were on average more likely to incur direct medical costs (83.3%) and spent more (\$1.67) than those who utilized public providers (54.6%, \$0.95), informal providers (43.6%, \$0.83) and self-care (3.17%, \$0.01). Households utilizing private care were more likely to experience catastrophic out-of-pocket costs than those utilizing other provider types.

Conversely, households utilizing public care were more likely to incur direct non-medical costs (36%) and spent more on these costs (\$0.79) than any other provider type. Private providers were the next highest (19.23%, \$0.56), followed by informal providers (9%, \$0.09) and finally self-care (1.6%, \$0.05). Households seeking private or public care for their child's diarrhoea appeared more likely to incur very high transportation costs than those seeking informal care.

For indirect medical costs, roughly 92% of households seeking private care faced some time costs while incurring, on average, \$11.22. These figures were 98.7% and \$11.78 for households utilizing public care, respectively. However, households seeking private care were more likely than those seeking public care to incur very high time costs. Mean indirect medical costs for informal care and self-treatment were \$8.97 and \$2.49, respectively, with 89% and 17.5% of those families incurring some time costs.

Multivariate results

Outputs from the multivariate, nested logit models are presented in Table 5. In the first section of Table 5, coefficients for each cost category indicate the probability of choosing different medical providers, irrespective of type, as costs change. Direct medical costs, indirect medical costs, and direct non-medical costs all had a statistically significant impact on households' choice of medical provider. As direct, indirect, or direct non-medical costs increased by 10% for a given medical provider, the likelihood of choosing that provider type declined by 1.80%, 1.90%, and 4.90% respectively. Results for wealth interaction effects were statistically significant, such that direct medical costs, direct non-medical costs and indirect medical costs impacted households' choice of medical provider differently according to wealth group.

The second section of Table 5 examines covariates that impact households' decision to seek formal care (private and public formal) for diarrhoea relative to informal care (informal and self-care). Child gender, maternal education, child age, and case severity did not significantly influence this choice, though wealth and cultural beliefs did have an impact. As households went up one wealth category they had 59% greater odds of utilizing formal medical care; households who believed in the effectiveness of vaccines had 7.53 times greater odds of utilizing formal care.

Clinical quality of care coefficients are presented in the third section of Table 5, with self-care having no household data to analyze. Public providers were 12.96 and 13.80 times more likely than private and informal providers to administer ORS than fluids for diarrhoea, respectively. Private providers were 4.50 times more likely to administer ORS than informal providers. Informal providers were 8.97 and 8.17 times more likely than private and public providers to deliver antibiotics.

Cost-choice elasticities

Table 6 presents own and cross cost elasticities of demand for each cost category, wealth group and provider type. Cost elasticity refers to the percent change in demand for one or more types of health care provider in response to a one percent change in the cost of a given type of provider. Put another way, it measures households' responsiveness to changes in a provider costs. The tables are interpreted using the following example. For direct, out-of-pocket costs

Table 3. Study population characteristics, by covariate and provider type

	Total ($n = 271$)			Private provider ($n = 78$)			Public provider ($n = 75$)			Informal provider ($n = 55$)			Self-care ($n = 63$)		
	Percent of sample	Mean	SD	Percent of sample	Mean	SD	Percent of sample	Mean	SD	Percent of sample	Mean	SD	Percent of sample	Mean	SD
Age		16.63	12.73		18.88	11.89		14.89	10.70		20.32	15.36		12.68	12.25
Gender															
Male	55.72			48.72			68.00			50.91			53.97		
Female	44.28			51.28			32.00			49.09			46.03		
Maternal education															
No formal schooling	3.69			6.41			2.67			1.82			3.17		
Less than primary	47.97			39.74			46.67			54.55			53.97		
Completed primary	44.28			48.72			42.67			43.64			41.27		
Post-secondary	0.00			0.00			0.00			0.00			0.00		
Completed secondary	4.06			5.13			8.00			0.00			1.59		
Religious education	0.00			0.00			0.00			0.00			0.00		
Case severity															
Moderate or severe	65.68			73.08			77.33			65.45			42.86		
Had diarrhoea but minor	34.32			26.92			22.67			34.55			57.14		
Cultural beliefs															
Vaccine not important	1.11			0.00			1.33			1.82			1.59		
Vaccine important	98.89			100.00			98.67			98.18			98.41		
Income															
Poorest	27.78			28.21			21.33			34.55			29.03		
Poor	12.22			12.82			10.67			14.55			11.29		
Middle	25.93			19.23			29.33			25.45			30.65		
Upper to middle	19.26			20.51			24.00			16.36			14.52		
Wealthiest	14.81			19.23			14.67			9.09			14.52		
Perceived quality of care															
Excellent	75.48			70.51			100.00			49.09					
Good	7.69			16.67			0.00			5.45					
Fair	5.77			5.13			0.00			14.55					
Bad	11.06			7.69			0.00			30.91					
Clinical quality of care															
IV or fluids	25.46			21.79			4.00			61.90					
ORS or Zinc	51.29			62.82			74.76			12.70					
Antibiotics	16.97			14.10			14.67			9.52					
No treatment	6.27			1.28			6.67			15.87					

among poorer households using public providers, the own-cost elasticity is −0.30 while cross cost elasticities for private, informal and self-care are 0.03, 0.06 and 0.21, respectively. An own-cost elasticity of −0.30 implies that a 10% increase in OOPs for public care would lead to a 3% decline in the likelihood of poorer households utilizing public care for diarrhoea and an increase in their likelihood of utilizing the other forms of care by 0.3, 0.6 and 2.1%.

For direct, out-of-pocket medical costs, own-cost elasticities for private, public, informal and self-care are all cost inelastic and range from −0.06 to −0.36. Households are most responsive to changes in the out-of-pocket costs of public and self-care. Poorer households are generally the most responsive to changes in out-of-pocket costs (less cost inelastic) for diarrhoea care, while middle wealth families the least responsive. The one exception is for public medical care, where wealthier households appear far more responsive (−0.30) than poorer families (−0.06 to −0.12). Although cross-cost elasticities for direct, out-of-pocket costs do not vary significantly by household wealth, they do vary by provider type. As these costs rise for private, public, and informal providers, households of all wealth levels are most likely to self-treat their child's diarrheal illness.

With respect to direct non-medical (transportation) costs, own-cost elasticities for private, public, informal and self-care are all cost inelastic and ranged from −0.15 to −0.60. Households are less responsive to changes in transportation costs for public providers than private or informal providers. Poorer households are the most responsive to changes in transportation costs (less cost inelastic), while middle-income families are the least responsive. Cross-cost elasticities do not vary significantly by household wealth, but they do vary by provider type. As transportation costs increase for private, public, and informal providers, households of all wealth levels are most likely to self-treat rather than seek another source of care for diarrhoea.

For indirect medical (time) costs, own-cost elasticities for private, public, informal and self-care are all cost inelastic and vary from −0.06 to −0.36. Households are less responsive to changes in time costs for public providers than private or informal providers. Poorer households are the most responsive to changes in time costs, while middle-income families are the least responsive. Cross-cost elasticities do not vary by household wealth but do by provider type. As time costs of utilizing care for diarrhoea increase among private, public and informal providers, households of all wealth levels are most likely to self-treat rather than seek another source of care. Conversely, as the time cost of self-care increased, household demand for private, public and informal care is equally likely to rise.

Table 4. Costs, by category and provider type (2016 US$)

	Total	Private provider	Public provider	Informal provider	Self-care
Direct medical costs					
% Incurring costs	48.71%	83.33%	54.67%	43.64%	3.17%
No. of households	271	78	75	55	63
Mean costs	$0.92	$1.67	$0.95	$0.83	$0.01
Min, max costs	$0.00, $15.10	$0.00, $15.10	$0.00, $11.75	$0.00, $6.86	$0.00, $0.39
Deviation	$1.94	$2.55	$1.96	$1.59	$0.05
Direct non-medical costs					
% Incurring costs	17.71%	19.23%	36.00%	9.09%	1.59%
No. of households	271	78	75	55	63
Mean costs	$0.42	$0.56	$0.79	$0.09	$0.05
Min, max costs	$0.00, $15.62	$0.00, $15.62	$0.00, $13.72	$0.00, $1.96	$0.00, $3.93
Deviation	$1.73	$2.03	$2.39	$0.38	$0.50
Indirect medical costs					
% Incurring costs	76.01%	92.31%	98.67%	89.09%	17.46%
No. of households	271	78	75	55	63
Mean costs	$8.90	$11.78	$11.22	$8.97	$2.49
Min, max costs	$0.00, $103.24	$0.00, $103.24	$0.00, $46.41	$0.00, $30.84	$0.00, $86.35
Deviation	$12.56	$16.06	$10.37	$7.80	$11.28
Total Medical costs					
% Incurring costs	88.97%	98.72%	96.00%	92.73%	17.46%
No. of households	271	78	75	55	63
Mean costs	$10.23	$14.02	$12.97	$9.90	$2.56
Min, max costs	$0.00, $106.70	$0.00, $106.70	$0.33, $46.99	$0.00, $37.30	$0.00, $90.27
Deviation	$13.61	$17.13	$11.45	$8.36	$11.75

Table 5. Multivariate nested logit results

	β-coefficient	*P*-value	β-coefficient	*P*-value	β-coefficient	*P*-value
Part I: Provider Choice						
Direct Medical Costs	–0.18	0.04				
Direct Non-Medical Costs	–0.47	0.09				
Indirect Medical Costs	–0.19	0.04				
Direct Medical Costs * Income	1.19	0.04				
Direct Non-Medical Costs * Income	1.93	0.06				
Indirect Medical Costs * Income	0.15	0.04				
Part II: Formal Care (Private and Public) relative to Informal Care (Informal & Self Care)						
Gender	1.23	0.63				
Maternal Education	2.63	0.36				
Age	1.02	0.22				
Income	1.59	0.08				
Case Severity	0.53	0.15				
Vaccine Belief	7.53	0.00				
Part III: provider type						
Fluids (relative to ORS)						
Private	Base	Base	12.96	0.06	–4.50	0.08
Public	–12.96	0.06	Base	Base	–13.80	0.05
Informal	4.50	0.08	13.80	0.05	Base	Base
Self-care						
Antibiotics (relative to ORS)						
Private	Base	Base	0.81	0.81	8.97	0.09
Public	–0.81	0.81	Base	Base	8.17	0.09
Informal	–8.97	0.09	–8.17	0.09	Base	Base
Self-care						
No Treatment (Relative to ORS)						
Private	Base	Base	10.84	0.25	7.57	0.48
Public	–11.52	0.25	Base	Base	–3.34	0.62
Informal	–7.45	0.50	3.40	0.62	Base	Base
Self-care						

Table 6. Elasticities by cost, provider type and household wealth

	δX/δP (private)–high income	δX/δP (private)–middle income	δX/δP (private)–low income	δX/δP (public)–high income	δX/δP (public)–middle income	δX/δP (public)–low income	δX/δP (private informal)–high income	δX/δP (private informal)–middle income	δX/δP (private informal)–low income	δX/δP (self care)–high income	δX/δP (self care)–middle income	δX/δP (self care)–low income
Direct medical costs												
Private	−0.12	−0.09	−0.15	0.03	0.00	0.00	0.00	0.00	0.00	0.09	0.06	0.12
Public	0.03	0.00	0.00	−0.30	−0.06	−0.12	0.03	0.00	0.03	0.06	0.06	0.09
Informal	0.00	0.00	0.00	0.06	0.00	0.03	−0.12	−0.09	−0.15	0.12	0.12	0.21
Self-care	0.09	0.09	0.15	0.21	0.06	0.09	0.09	0.06	0.12	−0.27	−0.24	−0.36
Direct non-medical costs												
Private	−0.24	−0.18	−0.27	0.03	0.03	0.03	0.03	0.00	0.00	0.18	0.18	0.24
Public	0.03	0.00	0.03	−0.18	−0.15	−0.21	0.03	0.03	0.03	0.12	0.09	0.15
Informal	0.03	0.00	0.00	0.03	0.03	0.03	−0.21	−0.18	−0.24	0.15	0.15	0.21
Self-care	0.18	0.18	0.24	0.12	0.09	0.15	0.15	0.15	0.21	−0.45	−0.42	−0.60
Indirect Medical Costs												
Private	−0.13	−0.13	−0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.15
Public	0.00	0.00	0.03	−0.12	−0.06	−0.12	0.03	0.00	0.03	0.06	0.06	0.09
Informal	0.00	0.00	0.00	0.03	0.00	0.03	−0.12	−0.09	−0.15	0.09	0.09	0.12
Self-care	0.13	0.13	0.13	0.09	0.06	0.09	0.09	0.09	0.12	−0.27	−0.27	−0.36

Discussion

Several themes tie together these results. First, time costs represent, on average, the largest share of total household costs for diarrhoeal care across health providers. This finding is consistent with theory and has been found in limited settings, including the Gambia and Pakistan (Rheingans *et al.* 2012a,b). Yet other studies in India, Bangladesh, and Mali observe that out-of-pocket costs exceed time costs for diarrhoeal care, implying that the relative magnitude of time costs varies by setting (Acton 1973, 1975; Coffey 1983).

Households seeking private care for their child's diarrhoeal illness are more likely to incur some costs, spend more on out-of-pocket costs, and experience more frequent catastrophic[1] out-of-pocket and time costs than households who seek public care, informal care, or self-treated. Studies within and outside of Kenya, as well as those examining diarrhoea and other conditions, have also noted the substantial cost of private care in LMICs (Qian *et al.* 2009; Memirie *et al.* 2017; Ngugi *et al.* 2017b). Relative to other households, it therefore makes sense that those using private care are the most responsive to changes in out-of-pocket, time, and transportation costs (Memerie *et al.* 2017).

Third, families utilizing public care for their child's diarrhoeal illness are the least responsive to changes in all costs yet, on average, spend more on transportation and time costs than households who use other provider types. An interesting exception is that wealthy households using public care are highly responsive to changes in out-of-pocket costs, which has implications for user fee policies.

OOPs, transportation costs, and time costs all influence households' choice of medical provider for childhood diarrhoeal care; yet households were twice as responsive to changes in transportation costs as they were to out-of-pocket or time costs. This is an interesting finding given the observation that transportation costs account for a small proportion of total costs and few households incur them, as has been cited in other studies (Barasa *et al.* 2017; Memirie *et al.* 2017). This could be the result of an endogeneity effect, whereby households actively sought out care that minimizes their transportation costs.

Poorer households are more responsive to changes in out-of-pocket, time, and transportation costs than wealthier families. Such findings on out-of-pocket costs are widely supported by global evidence, while those on time costs are consistent with theory (Acton 1975; Coffey 1983; Preker *et al.* 2007). This helps explain why households who treat their child's diarrhoeal illness at home are poorer and spend less time traveling or waiting for medical care, paying for transportation or facing fewer out-of-pocket costs than any other provider type. But even controlling for wealth, self-treatment is the second most common alternative as costs rise in the formal sector.

Finally, given that costs impact household treatment decisions and no significant difference in the total cost of medical providers exists, one would expect utilization to be evenly distributed across provider types, as is observed. Yet many households—particularly poor ones—are seeking informal care for their child's diarrhoeal illness, while households who are wealthier and believe in vaccines are more likely to utilize formal medical care. Onwujekwe *et al.* (2011) and Omore *et al.* (2013) similarly observe that poorer households have greater odds of utilizing informal, poor quality providers. Indeed, in our study informal care costs the same as formal care but is of worse quality, suggesting that such households are making poor decisions.

Conclusion

Lessons for policymakers

These findings offer key lessons for Kenyan policymakers. First, they suggest that time and transportation costs could exacerbate inequities in access to child health services and primary care. Households often seek treatment for diarrhoeal illnesses at public facilities, because they believe such care will cost them less than care at a private facility. This study highlights that, as a result of exceedingly high time costs (and to a lesser extent, transportation costs), the total cost of diarrhoeal care at public facilities is not significantly different from care received at private providers—at least based on the time of data collection. Yet unlike private care, those seeking public care may also face unexpected user fees (Barasa *et al.* 2017). Although households could receive adequate diarrhoeal care in the public sector, the economic burden of such a decision would be as large as any private alternative. Poorer households that perceive both options as being too costly are most likely to forgo higher quality, formal medical care and instead self-treat their child's diarrhoeal illness.

Moreover, because this study cannot discern the type of public provider utilized and data was collected prior to Kenya's 2013 user fee reform, it is likely that household out-of-pocket spending for diarrhoeal care stemmed primarily from user fees. Despite the 2013 reform, evidence indicates that households continue to face informal fees at primary care facilities and user fees are still permitted at hospitals (Anthopolos *et al.* 2017; Barasa *et al.* 2017; Memerie *et al.* 2017). It is thus unclear whether and to what extent out-of-pocket costs for diarrhoeal care at public facilities have declined since 2013. If they have, this study's findings postulate that household demand for public care may increase substantially for wealthy but only marginally for poorer households. Reductions in out-of-pocket costs may also have a smaller impact on household demand for public care than would reductions in transportation costs. Conversely, demand for private providers—at least for diarrhoeal care—is likely to increase substantially if policymakers can identify solutions for reducing out-of-pocket, transportation, and time costs of care in the private sector.

For Kenyan policymakers three potential solutions exist to address public policy objectives such as financial risk protection, access and equity. To begin, policymakers could facilitate access to primary health care services, for which diarrhoeal care is included, by further refining financing policies that reduce out-of-pocket payments in both public and private sectors. They could, for instance, ensure that recent reforms to eliminate user fees at public health centres and dispensaries are regulated effectively. Policymakers should also consider reforms that reduce transportation and time costs for households. One option could be to integrate benefits into existing financing schemes that reimburse members for such costs—as has been successfully done with Health Equity Funds in Cambodia (Ensor *et al.* 2017). This would have a particularly strong effect on demand for diarrhoeal care in the private sector. Finally, households must be made aware of the variation in costs and quality of child diarrhoeal care across sectors or incentivized to use formal medical care. Over 20% of households in this study sought high cost, poor quality informal care for their child's diarrheal illness, either because they lack such information or were driven by other factors.

Limitations and future research

Notwithstanding this study's methodological and policy implications for researchers and decision makers, there exist limitations and areas for future work that must be considered. First, households may have inaccurately recalled the costs they incurred, particularly informal costs that required converting time to money. Yet such an issue would bias coefficients towards zero, and it could be argued that results from this study were actually more significant than they appeared. Second, the cross sectional nature of this study, the consolidation of provider groups, and the study's focus on care-seeking behavior for child diarrhoeal illnesses limits its generalizability. Third, future work should examine the impact of other health system factors, such as workforce, medical supplies, and drug availability, as well as alternative measures for culture, quality, and information asymmetry—all of which are likely to impact household medical decisions.

Acknowledgement

Authors would like to acknowledge all individuals involved in the Global Enterics Multi Center Study.

Conflict of interest statement. None declared.

Note

1. Catastrophic costs are defined as three or more standard deviations above the mean cost.

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