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The impacts of decentralization on health care seeking behaviors in Uganda

Paul Hutchinson[1]*, John Akin[2] and Freddie Ssengooba[3]

[1]*Department of International Health and Development, School of Public Health and Tropical Medicine, Tulane University, New Orleans, LA, USA*
[2]*Department of Economics, University of North Carolina at Chapel Hill, NC, USA*
[3]*Institute of Public Health, Makerere University, Kampala, Uganda*

SUMMARY

This paper examines the impacts of a public sector decentralization program on health care seeking behaviors in Uganda in the 1990s. Shifting priorities by local governments in Uganda's decentralized health system away from provision of primary health care, in particular the provision of public goods or goods with substantial consumption externalities, and toward provision of private health goods such as curative care are linked to shifts in individual-level care utilization behaviors. This analysis finds that, while the country has been undergoing a multitude of changes in recent years, decentralization appears to have led to increases in the use of curative services with largely private benefits, perhaps at the expense of the use of primary health care services and services with consumption externalities. A longer period of analysis is required to determine the persistence of these effects. Copyright © 2006 John Wiley & Sons, Ltd.

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INTRODUCTION

In recent years, decentralization of responsibilities from central to local governments for service provision, supervision, and resource allocation decisions has become an increasingly common strategy for addressing a variety of ills in developing countries (World Bank, 2000). Decentralization, it has been argued, can reduce technical inefficiency (Rondinelli *et al*., 1983; World Bank, 1997), can reduce bureaucracy and increase the speed of decision-making (Mills, 1990; Silverman, 1992; Shah, 1998; Dillinger, 1999), can increase representation by local populations—and therefore, the potential for improvements to be more sustainable (Thomas, 1997; World Bank, 1997; Dillinger, 1999), and can bring service provision more in line with local

* Correspondence to: Dr P. Hutchinson, Department of International Health and Development, School of Public Health and Tropical Medicine, Tulane University, 1440 Canal Street, Suite 200, New Orleans, LA 70112, USA. E-mail: phutchin@tulane.edu

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preferences (Tiebout, 1956; Oates, 1972; Musgrave, 1983). In its Health Financing Policy Paper, the World Bank (1987) proposed decentralization as one arm of a sector reform strategy that has since become a standard policy prescription in international development assistance.

In spite of the strong faith placed in decentralization by donor agencies and developing countries, recent empirical evidence has found that decentralization, if undertaken without sufficient planning or strengthening of appropriate institutions, may lead to outcomes that are potentially worse than centralized systems, leading instead to fragmented planning, inadequate consideration or funding of recurrent expenditures, local capture, or under-provision of certain types of services (Mills, 1990; Collins and Green, 1994; Prud'homme, 1995; Jeppsson, 2001; Schwartz *et al*., 2001; Akin *et al*., 2005).

The central goal of this paper, however, is to extend further the study of decentralization's effects in developing countries to determine whether decentralization can actually achieve the ultimate aim of most health sector reforms—improving the health status of populations. Specifically, this paper uses data from local government health budgets and population-based household surveys gathered during the decentralization process in Uganda in the 1990s to evaluate whether decentralization has been associated with changes in health behavior.

Uganda, a sub-Saharan African country of approximately 24 million people, has been undergoing a process of decentralization of most public sector services since the mid-1980s. This process, not isolated solely to the health sector, has involved transferring responsibility for service provision and supervision from the central government to the 45 districts in the country.[1] Early steps in the decentralization process focused on administrative decentralization, creating new posts at the district level that had only limited accountability to the central ministries. In the health sector, the process of decentralization has been undertaken in addition to a variety of other reforms, including the introduction (and subsequent abandonment) of user fees, experimentation with hospital autonomy, and implementation of pre-payment schemes. Starting in 1993, fiscal control over local health budgets was devolved in phases to district governments. By 1997, all 45 districts in the country had been given responsibility not just for service provision but also for carrying out other components of fiscal decentralization (Okuonzi and Lubanga, 1997; Nsibambi, 1998).

Decentralization can impact upon health services utilization in numerous ways, for example, by increasing the level of resources available for health if local governments consider health to be a higher priority than the central government, thereby deciding to transfer resources from other sectors to the health sector. Greater resources might then be translated into greater availability of health services, decreasing time costs and increasing health services utilization. In Uganda, this does not appear to have been the case, at least during the initial phases of the decentralization process. In fact, local governments appeared to be less likely to allocate resources to health than had the center, unless the resources were designated transfers to the health sector from the central government (Jeppsson, 2001).

[1]At the time that these data were collected, there were 45 districts in Uganda. As of 2005, there are now 56 districts.

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Decentralization may also improve technical efficiency by allowing existing resources to be used more effectively, with less wastage, more rapid decisionmaking, and fewer levels of management (Mills, 1990; Shah, 1998; Dillinger, 1999). Decentralization, by definition, reduces the scale of output, potentially removing diseconomies of scale that result from attempting to coordinate disparate activities over a large geographical area or large populations from a single central location. Decentralization can also improve technical efficiency if it fosters innovation or allows the use of local production techniques that the central government—a monopoly provider of health care under centralized systems—has little incentive to develop (Bardhan and Mookherjee, 1999). More efficiently delivered services may also be higher quality services, therefore, making them more highly desired and more likely to be used by constituents.

Most commonly, however, decentralization is argued to increase allocative efficiency by addressing differences in preferences for health services across regions or population sub-groups. In the absence of cost savings or inter-jurisdictional external effects, decentralization can improve societal welfare by providing a level of health goods and services that better meets these different needs or preferences than a central government might if it provides a uniform set of goods and services across all regions (Oates, 1972; Griffin, 1999; Akin *et al*., 2005). These differences in needs or preferences for health services might arise when there are different epidemiological patterns or environmental conditions across regions, leading to higher incidences of certain diseases such as river blindness or malaria. The central government might be unable, due to lack of information, or unwilling, because of the costs of collecting regionally specific information, to ensure that a different package of health services is provided in these different circumstances. Local governments, having informational advantages or having constituents more willing to advocate appropriate services, may be better able to meet these different preferences and needs.

On the other hand, several factors might reduce or destroy the advantages of decentralization. In particular, planning at the local level that does not take into account interjurisdictional spillovers may lead to an undersupply of health services. Such external effects might be present with services such as health education, vector control measures, or other public goods activities or with referral hospitals that serve multiple jurisdictions but whose governance is controlled by the local district in which it is situated (Oates, 1972; Akin *et al*., 2005).

There is also the concern about local capture of the governance processes by special interest groups, local elites, or perhaps even different ethnic groups who may choose to direct resources to themselves or to favored groups (Collins and Green, 1994; Prud'homme, 1995; World Bank, 1997; Bardhan and Mookherjee, 1999). Because public goods are characterized in general by the inability to exclude consumption, this targeting behavior is more likely when private consumption goods (such as curative health care) are provided publicly. The result may be that local governments pay for private consumption goods for a targeted group rather than for public goods to be enjoyed by all.

Since many of these public goods and goods with externalities in consumption are those deemed to be the most cost-effective at reducing the burden of disease in

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developing countries (World Bank, 1993), a tendency for decentralization to reduce public goods provision, even when local governments are well-meaning, provides cause for concern and emphasizes the need for empirical studies of the link between local government behavior and individual-level health outcomes.

The inherent question, therefore, is what types of goods and services are constituents most likely to express desires for and are local jurisdictions most likely to provide? The empirical literature provides few examples upon which to draw conclusions. A study by Akin *et al*. (2005) has found that decentralization in Uganda led to a decline in the share of budgets allocated to public goods or public health type activities. Schwartz *et al*. (2001) examining the situation in the Philippines found that decentralization was associated with greater local health expenditures and higher shares of resources allocated to health but also found that the share of budgets allocated to public-goods activities decreased as a result. Faguet (2001) found that decentralization in Bolivia was associated with greater attention to social need in the education, agriculture, urban development, water management, and sanitation sectors but less so for the health, transportation, and communication sectors. Bossert *et al.* (2003), as a counter example, found that decentralization in Zambia was associated with higher allocations of resources to primary care, though local government fiscal autonomy was limited.

This work looks at several different types of health services falling into both public and private goods categories. Using data from local government health budgets during a period immediately following the beginning of a decentralization process in Uganda, we examine how higher levels of allocations to different categories of goods—both on a per capita basis and as a share of budgets—affect whether individuals and households consume various health services. The public or mixed public goods included in the analysis are diptheria, pertussis, and tetanus vaccinations (DPT3), household's source of water, and household's toilet type, all of which have benefits extending beyond the direct users. DPT vaccinations, for example, reduce the likelihood that even unvaccinated children will suffer from these diseases. Water sources and toilets are often communally shared in Uganda; boreholes are often installed for entire communities, while latrines serve as a public good for collective communal environmental health. The private goods are curative care for children under age 5 and adults older than age 15. A third private good is antenatal care for pregnant mothers with benefits exclusively for the mother and her future child. The principal test will be to see whether individuals in those jurisdictions allocating higher levels of resources to a specific type of public or private health good—either as a share of the budget or on a per capita basis—are more likely to use those goods or services. A further test will be to examine time trends measuring the length of time that a district has been decentralized relative to the simple passage of time.

DATA

Two sources of data are used in this analysis: annual district health workplans (budgets) and national population-based household surveys.

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Annual district health workplans

This analysis uses annual district health workplans for fiscal years 1995–96 and 1996–97 (Ministry of Health, 1996, 1997). Subsequent years are available and have been analyzed elsewhere (Akin *et al*., 2005) but do not correspond to the years for which household survey data are currently available.

These data represent a unique opportunity to examine the impact of government budgetary allocation patterns on individual-level health behaviors. In the past decade, considerable effort has gone into collecting data on aggregate health expenditures for developing countries (Berman, 1997; Peters *et al*., 1999). Even so, such expenditure data are still of limited availability for developing countries, and often, when available, reflect only national aggregates. The data that we use are unique because they are available below the national level and because they can be categorized into different types of budget items, thereby providing a detailed picture of local government preferences in the health sector.

It should be noted that we use budgeted figures as our principal measure of local government planning behavior rather than realized expenditures. This was done for several reasons. First, planned rather than actual expenditures are more likely to reflect the preferences and priorities of local planners. Actual expenditures, in contrast, may reflect the availability and timing of release of funds, particularly donor funds that are outside of the control of district officials. Second, and most importantly, actual expenditure data were available only after the period for which household survey data were available.

For our purposes, therefore, we make the assumption that the activities which are actually implemented—and for which expenditures are incurred—represent a sample from the overall list of activities in the workplans, and that the selection of this sample, while perhaps not completely random, is at the very least not systematically related to the individual-level decision-making processes that form the outcomes under study. By using budgetary data rather than expenditure data, we, therefore, introduce measurement error in our variables, which would tend to bias our analysis towards not finding statistically significant results. That, as will be seen, we still find a distinct pattern of statistically significant results even in the presence of this measurement error would seem to demonstrate the strength of the underlying relationships.

The annual district health workplans are prepared by the District Director of Health Services (DDHSs) and the District Health Management Team (DHMT) and approved by the District Council. The workplans list all of the activities that they plan to undertake in a given fiscal year. The activities include purchases of additional drugs, equipment and supplies; training; construction or renovation of buildings; support supervision; and other expenses incurred in direct service provision. What is omitted from the workplans are budgeted amounts for hospitals (which are outside of the control of district officials during the study period), regular salaries for health workers, and in-kind transfers from the central government to districts for drugs, supplies, and equipment.

Funding for activities in the district workplans comes from multiple sources, and districts are heavily dependent upon central government transfers and donor funds to

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support health activities. This brings into question the level of autonomy that districts have in making decisions about how to allocate that funding. In general, local revenue is the source of funding for less than 15 per cent of total district health spending (Ministry of Health, 1998; Hutchinson, 1999a), while much of the central government transfers are earmarked for specific activities (e.g., hospitals, salaries, etc.) and cannot be reallocated elsewhere. Certain donors provide funding only for specific activities, for example, immunizations or river blindness eradication. Even so, some donor funding, for example that of the District Health Services Project from which this sample of districts is drawn, was used to support a broad range of activities, largely focused on primary health care. A sizeable portion of district funding also came from the unconditional (block) grant, which districts were permitted to allocate as they show fit. A study in 1999 estimated that districts could allocate as they chose approximately 25–50 per cent of their health budgets, providing some degree of flexibility at the margin for emphasizing priorities determined locally. Further, a qualitative analysis of a sample of District Directors of Health Services found little evidence that donor and central government funding was deemed to be too restrictive, emphasizing instead that implementation of priority activities was determined more by the availability of trained personnel or the timely release of funds (Hutchinson, 1999a).

Districts began preparing workplans after they had been decentralized, beginning in fiscal year 1993–94. Ideally, we would make comparisons of budgeting behavior by the central government before decentralization and by local governments after decentralization but district-level workplans were not prepared prior to decentralization. However, we can still make inferences about the effects of decentralization because the process was not uniform across the country, with some districts being decentralized before others. In fiscal year 1993–94, 13 of 39 districts received block grants, indicating the beginning of fiscal decentralization. In fiscal year 1994–95, an additional 13 districts received block grants followed by the remaining 13 districts in 1995–96. In 1997, several districts were divided, resulting in a total of 45 and now 56 districts in the country. This phased decentralization process allows for comparisons of districts decentralized first with those decentralized later.

Workplans are available from a sample of these districts—those receiving support from the World Bank's District Health Services Project. Specifically, 12 workplans are available for fiscal year 1995–96 and 19 workplans for fiscal year 1996–97. As discussed elsewhere (Akin *et al*., 2005), this sample of districts is believed to be a random sample of districts in the country. At the very least, however, it is not believed that selection into our sample is correlated with the health behaviors that we examine.

For this analysis, activities have been categorized in two ways: (1) by disease or health area (e.g., diarrheal diseases, HIV/AIDS, immunizations) and (2) by type of activity (e.g., drugs, equipment, maintenance). For the former categorization, just over half of the budgets are not directly attributable to a specific disease or health problem because they provide general support to the entire health system and not to a specific problem. Interventions for diarrheal diseases, for example, include such items as training of health workers in diarrhea case management, purchases of Oral Rehydration Solutions, protection of springs, construction of boreholes, and health

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education. Interventions for environmental sanitation programs include health education, construction of pit latrines in communities, sanitation competitions, and construction of hand-washing facilities. MCH activities include such items as family planning programs; antenatal care; training of health workers in family planning, reproductive health and Integrated Management of Children Initiative (IMCI); and purchases of supplemental drugs and supplies. HIV/AIDS expenditures include health education; palliative care; training in case management of sexually transmitted infections; tracking and treatment of tuberculosis; and purchases of supplemental drugs.

The larger health areas, at least in 1995–96, were diarrheal diseases, sanitation programs, and HIV/AIDS (Table 1). Overall budget outlays were $2.93 per capita in 1995–96 and $4.03 per capita in 1996–97. Only diarrheal diseases experienced an absolute decline in expenditures between the two fiscal years.

Workplan activities were also categorized by the nature or type of activity rather than the specific health problem being addressed. The categories included: primary health care; information, education, and communication activities; drugs; civil works; equipment; vehicles; monitoring and evaluation; operations and maintenance; salaries; support supervision; supplies; training; and other. These categories reflected categorizations developed with the cooperation of the Ministry of Health and the District Health Services Project.

An alternative method of classification, based on the degree of 'publicness' of a specific activity, was also developed. Four categories were used: (1) public goods activities (or health goods with significant positive consumption externalities); (2) private or non-public goods; (3) support activities; and (4) other activities. The 'public' category included allocations for information, education, and communication (IEC) activities; primary health care; and drugs. Each of these components requires some justification. The IEC component is perhaps the clearest example of a public good. Radio messages, community events, newspaper advertisements, or signboards are generally both non-excludable and non-rival in consumption. A high proportion of the budgeted amounts for drugs was for communicable diseases, such as basic childhood illnesses, sexually transmitted diseases or tuberculosis treatment, which have clear positive externalities to non-recipients of the drugs. The primary

Table 1. Per capita and budget shares for health program areas

Health area	Budget shares		Per capita expenditure	
	1995–96	1996–97	1995–96	1996–97
HIV/AIDS	9.0%	9.7%	0.26	0.39
Diarrhea	17.9%	6.4%	0.63	0.29
Immunizations	2.8%	5.7%	0.07	0.21
Malaria	1.5%	6.2%	0.03	0.27
MCH	3.5%	9.0%	0.11	0.34
Nutrition	1.1%	2.4%	0.04	0.10
Sanitation	10.4%	8.1%	0.22	0.32
None/shared	53.9%	52.5%	1.57	2.12
Total	100%	100%	2.93	4.03

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health care component is slightly more difficult to justify along publicness grounds. The largest components of this category include condom distribution and family planning (with obvious implications for reduction of transmission of STDs including HIV/AIDS), construction of pit latrines or bore-holes (thereby reducing fecal contamination of water supplies), and distribution of insecticide impregnated materials. Many of these services, while not pure public goods, exhibit mixed public/private characteristics, with some rivalness in consumption but also significant spillover and shared benefits.

'Non-public' activities included allocations to civil works, vehicles, and equipment, all of which are essential for the proper functioning of a health system, but which could also be considered to be non-financial job benefits for health workers, that is, perks, to supplement meager public sector salaries. Vehicles, for example, are often used for personal transportation as well as official health business. New civil works—clinics and district management offices—may be constructed more as demonstrable indications of active civic involvement than for considerations of relative costs and benefits, particularly in light of the low levels of utilization at existing facilities (Hutchinson, 1999b).

We use two additional categories—'support' activities and 'other'—to categorize activities that could not be easily classified using the 'publicness' criteria. These include activities of the District Health Management Team, such as supervision of health units and health workers, training of health workers, studies, payment of salary supplements, and maintenance of health equipment and other items.

For the 2 years for which workplan data are analyzed, a dramatic decline was observed in the primary health care and public category (Table 2). This finding is corroborated by evidence found in other studies (Jeppsson, 2001). Increases were

Table 2. Per capita and budget shares for type of health activity

Health area	Budget share		Per capita expenditure	
	1995–96	1996–97	1995–96	1996–97
Primary health care	30.9%	19.7%	0.93	0.88
Information, education, & communication	3.3%	8.0%	0.10	0.31
Drugs	15.3%	10.4%	0.31	0.47
Public	49.5%	38.1%	1.34	1.65
Civil works	9.2%	13.4%	0.28	0.61
Equipment	5.5%	7.6%	0.16	0.35
Vehicles	2.6%	3.4%	0.09	0.14
Private	17.4%	24.4%	0.52	1.11
Operations & maintainance	2.4%	2.8%	0.06	0.12
Monitoring & evaluation	1.0%	2.5%	0.02	0.11
Salary	7.7%	6.4%	0.24	0.26
Support supervision	3.3%	3.9%	0.08	0.15
Supplies	3.7%	3.8%	0.10	0.15
Training	13.3%	16.6%	0.36	0.67
Support	31.4%	36.0%	0.86	1.46
Other	1.6%	1.5%	0.05	0.06
Total	100.0%	100.0%	2.77	4.28

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observed in both the private and support categories, both of which increased by about $0.60 per capita. Expenditure on public goods activities was still the largest category ($1.65 per capita in 1996–97 or 38 per cent of the total budget), but its share declined from 49.5 per cent to 38.1 per cent. Private goods activities increased from $0.52 per capita to $1.11 per capita.

National household surveys in 1995 and 1997

National household surveys were conducted annually in Uganda throughout the 1990s. These surveys, based on the World Bank Living Standards Measurement Surveys (LSMS), principally focused on collection of household expenditures and inputs into household agricultural production. In some years, however, information was also collected on individual-level health behaviors and health outcomes: prevalence of illness, source of curative care, basic childhood immunizations, use of antenatal and postnatal care, and breast-feeding. Data were also collected on household amenities such as source of drinking water, type of toilet facility, and condition of the dwelling.

The Uganda National Household Surveys in 1995–96 and 1996–97 contained 34 795 and 34 145 individuals in 5535 and 6657 households, respectively. In both years, community surveys collected information on the principal health facilities serving each enumeration area. However, such information was collected for only two-thirds of the enumeration areas. The effective sample was reduced further because annual health workplans were available for only 11 of 39 districts in fiscal year 1995–96 and 19 of 45 districts in fiscal year 1996–97. Therefore, the total number of individuals available for the analysis included 7742 and 12 903 individuals in 1157 and 2473 households in 1995–96 and 1996–97, respectively.

EMPIRICAL FRAMEWORK

The empirical framework is intended to examine whether or not decentralization has affected health services utilization in our sample of districts. Our goal is to determine if districts that prioritize resources to specific health areas (e.g., immunizations, MCH) or types of activities (e.g., public, mixed public, or private goods) have higher levels of utilization for these health services. To test this, we estimate equations at the individual-level for the use of health services, including as key explanatory variables the level of government budgeted resources—either in per capita figures or budget shares—and variables for time trends and the length of time that a district has been decentralized. As statistical controls, we include individual and household characteristics and characteristics of the closest health facility to the individual's community.

The individual-level dependent variables in our models include three different types of local mixed public goods—DPT3 vaccination in children aged 12–35 months, household's source of drinking water, and household's type of toilet—and two types of private goods—antenatal care in women giving birth in the last year and curative care in children under 5 years and adults aged 15 or older. In Uganda, close to 90 per cent

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of women—87 per cent in 1995 and 89 per cent in 1997—make at least one antenatal care visit. DPT3 coverage rates for children aged 12–35 months are considerably higher than those found elsewhere—73.7 per cent in 1995 and 83.1 per cent in 1997. The majority of households have access to pit latrines and to boreholes, generally shared within communities. More than a third of children and adults report being ill in the 30 days prior to the survey, and, of these, approximately 60 per cent seek care from a modern medical provider, either government or private sector (Table 3).

As shown in Equation (1), we use a latent variable framework to describe individual i's health services utilization decision, where Y_i^* represents the individual's underlying propensity to use health services (e.g., antenatal care, DPT3, curative care) as a function of a set of individual and household level characteristics, X_i, the level of district government budgeted health resources, P_k, for k districts, the characteristics of the most proximate health facility in each enumeration area j, F_j, a set of time variables T_k depicting the fiscal year of the observation and the number of years that a district has been decentralized, a set of district dummy variables, D_k, and an individual level error term, ϵ_i. The discrete realization of Y_i^* is given by $Y_i = 1$ if Y_i^* is greater than an arbitrary threshold set at 0. We assume a normal probability density function for ϵ_i, and estimate Equation (1) by maximum likelihood probit.

$$Y_i^* = \beta_1 X_i + \beta_2 F_j + \beta_3 P_k + \beta_4 D_k + \beta_5 T_k + \varepsilon_i \quad (1)$$

For each dependent variable, we estimate separate equations using different variables for P_k, specifically, the total district health budgeted expenditure per capita, the total district public and private goods budgeted expenditure per capita, and the share of a district's budget to public and private goods and services. We also examine

Table 3. Distribution of responses for dependent variables

Dependent variable	1995	1997
DPT3 coverage (aged 12–35 months)	73.7%	83.1%
Type of toilet		
None	18.7%	15.7%
Pit latrine	76.6%	80.3%
Flush	4.7%	4.0%
Total	100.0%	100.0%
Water source		
Natural/river	42.7%	39.5%
Borehole	52.1%	55.1%
Tap	5.2%	5.4%
Total	100.0%	100.0%
Curative care		
0–5 years		
Reporting illness	36.9%	37.2%
Using care	61.7%	61.0%
15 and older		
Reporting illness	32.7%	34.0%
Using care	59.2%	51.1%
Antenatal care	87.0%	89.0%

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budgeted allocations to different program areas and their impacts on the corresponding services they are intended to promote. Specifically, we look at allocations to MCH programs to assess use of antenatal care, allocations to diarrheal programs to assess a household's source of water, allocations to sanitation programs to assess household's toilet type, and allocations to immunization programs to assess DPT3 vaccinations for children 12–35 months of age.

To examine whether the decentralization process worked over time to change behavior, we include three time variables: the number of years since the introduction of decentralization, the actual year of observation (1995 or 1996), and an interaction of the two time variables. These variables represent different potential effects; dummy variables for fiscal years represent effects common to all districts, perhaps reflecting MOH policies, while the variable for the number of years that a district has been decentralized reflects the experiential effects of the decentralization process itself. The interaction term allows for different effects of the decentralization process over time.

In addition to the program variables, individuals were linked to the closest health facility—government, NGO, or private—serving the enumeration area in which they live. Approximately 70 per cent of the facilities to which individuals were linked were government owned. Facility characteristics included ownership, number and type of staff, availability of drugs and supplies, hours open per week, and prices of basic services. From the drugs and supplies, an index of facility capacity was constructed.

One concern for estimating Equation (1) is the potential endogeneity of the level of district government budgeted health resources variable (P_k), which would occur if common unobservables affect both budget allocations and individual-level outcomes. In such a case, a standard classical linear regression assumption, that $\mathrm{Cov}(P_k, \epsilon_i) = 0$, would be violated, possibly leading to biased estimates of all of the model's parameters. This might occur if districts, quite rationally, target resources to their more substantive health problems, which are, in turn, affected by unobserved factors such as local attitudes towards family planning, HIV/AIDS, or child health. This concern has been expressed, and justified empirically, in previous work, including Angeles, Guilkey and Mroz (1998), Pitt *et al*. (1993), and Gertler and Molyneaux (1994).

In order to control for the potential endogeneity of district government budgeted health resources in Equation (1), we assume that the correlation between the unobservable effects and P_k are fixed across time and within districts and can be represented by district level fixed effects, D_k. In all of the estimations except those for antenatal care, the district fixed effects were jointly significant.

All estimations were conducted using the Stata 8.0 statistical software program with Huber/White standard errors to control for the non-independence of observations within survey enumeration areas.

RESULTS

Table 4 below summarizes the directions of the effects and the levels of statistical significance on the budget variables for 46 different probit estimations, each cell

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Table 4. Summary of probit estimation results

	Curative 0–5	Curative 15+	ANC	DPT3	Pit latrine/ flush toilet	Safe water (borehole, tap)
Expenditures per capita						
Total	+	+	0	0	+	0
Private	+	+	0	0	+	0
Public	+	+	+	0	0	0
Program area	+	N.a.	0	0	0	0
Budget shares						
Private	+	0	0	+	0	0
Public	0	0	0	0	0	0
Health area	+	N.a.	0	0	0	0
Ratio of public to private	−	−	0	0	0	0
Years since decentralization process began	+	+	0	0	0	+

+,− indicate significant at the 5% level; 0 indicates no significant effect.

representing a different probit estimation (the full set of probit estimations can be obtained from the authors).

The estimations provide considerable evidence of the strong impacts of government inputs on the use of curative care services but negligible effects of government inputs on the use of immunization services, antenatal care, and access to safe water and sanitation. Specifically, for curative care for both children and adults, higher budgeted amounts per capita were positively associated with the likelihood that ill individuals would use curative care services when ill. Greater budget shares to MCH programs and to private goods in general were also associated with a higher likelihood that ill children would be taken for curative care.

A similar relationship was not consistently observed for the other health services examined; higher expenditures or higher shares on public goods or on different program areas—sanitation, diarrheal diseases, immunizations, MCH activities—did not lead to higher probabilities that children would be vaccinated or that households would have access to pit latrines or boreholes. For none of the health program variables—sanitation, immunization, or diarrheal diseases—was there a positive and significant relationship between expenditures or budget shares and health resources available to the households.

Total expenditures per capita—the total amount that a district spends per person on health—were associated with greater likelihoods that individuals would use curative care and have access to pit latrines.

The variables on years of decentralization were positive and significant in the curative care results but not so in general for the other variables. However, because of the interaction terms, discerning the impacts of the time trend and years of decentralization variables is not straightforward, and it is left to the simulations below to provide a clearer interpretation of the estimation results.

We mention only briefly some of the results related to the effects of individual and household factors on the use of health services. Children of more educated mothers were more likely to be taken for curative care when ill and to receive their DPT3

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vaccinations, while households with more educated members were more likely to have pit latrines or flush toilets relative to having no source of toilet and were more likely to have access to a borehole or tap relative to having an unsafe source of water. Education did not appear to be an important factor when adults chose whether or not to seek curative care or whether or not pregnant women used antenatal care. Income, measured in quartiles relative to the lowest quartile, was an important determinant of whether adults sought curative care, of whether children were taken for curative care or received their DPT3 vaccination (highest quartile only), and whether or not households had access to safe water or adequate toilets. For all services except antenatal care and children's curative care, being in rural areas reduced the likelihood that services were used or that households had access to the services, even controlling for individual, facility and health program effects. There were different patterns in use of services for boys and girls. Girls were somewhat less likely to receive the preventive care service (DPT3) but somewhat more likely to be taken for curative care.

For the four dependent variables linked to health facility variables, there was modest evidence that facility characteristics influenced the use of health services. The index of facility capacity (an index of drug and equipment availability) positively affected whether children were taken for curative care (at low levels of statistical significance), whether women used antenatal care, and whether children received their DPT3 vaccinations. The distance of the health facility from the community was negatively related to the use of curative care and DPT3 vaccinations. If the closest health facility was a government MOH facility, women were less likely to use antenatal care than if the closest was an NGO or private facility. Government ownership was negatively related to use of antenatal care, a result that appears to help explain the positive price effect in the antenatal care estimation—pregnant women preferred private, higher quality (and therefore, higher priced) care for their antenatal care check-ups.

Simulations

Two types of simulations were undertaken using the coefficients from the estimations of health behaviors: (1) the simulated effect of an additional year of decentralization and (2) the simulated effects of changes in the budget shares or per capita budgeted expenditures.

For each of the health behaviors, the effect of an additional year of decentralization was simulated while keeping the calendar year constant (Figure 1). The simulations indicate that the use of curative care was associated with the progression of the decentralization process, even controlling for the year of observation. The largest impacts of an additional year of decentralization were for the two curative care dependent variables. An additional year of decentralization would be associated with an increase in curative care use of 29.9 and 41.8 per cent for children and adults, respectively. A similarly large impact was observed for only one of the public goods—safe water. For the other three dependent variables—antenatal visit, DPT3 vaccination, and adequate toilet—the impacts were positive but only one-tenth to one-fifth per cent as large.

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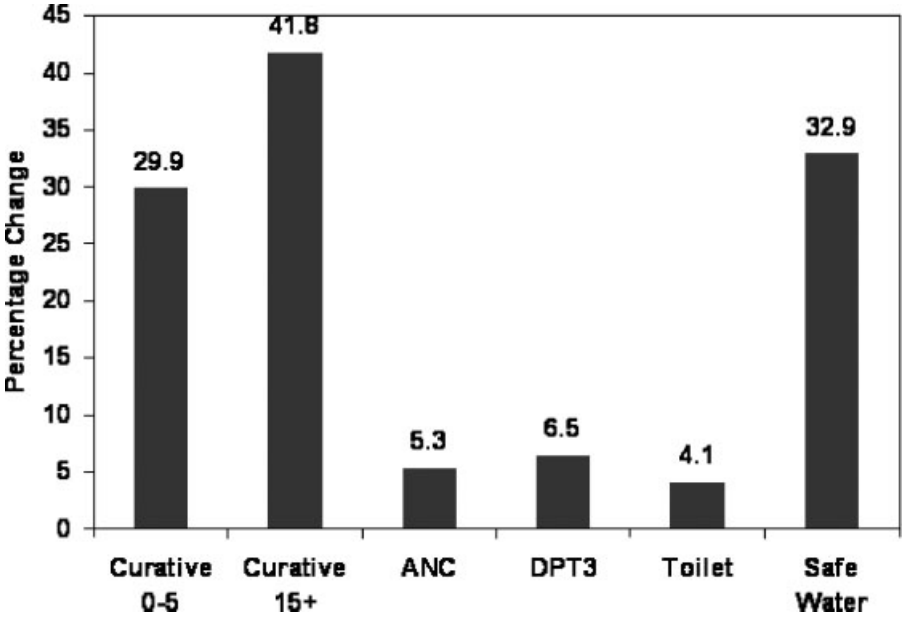

Figure 1. Simulated effects of one additional year of decentralization on health behaviors

Simulations were also conducted for the district budgeted health resources and budget share variables. In general, the simulations attempted to measure the impacts of equal sized changes in budget shares or budgeted amounts across the different areas, looking, for example, at how \$0.50 spent on private care would impact on curative care use relative to an identical \$0.50 spent on local public goods activities or how an additional \$0.20 spent on MCH services would impact on the use of children's curative care relative to the same \$0.20 per capita spent on immunization programs.

The simulations for the health program variables indicate that budgeted amounts for private goods had larger impacts on the consumption of private goods—curative care and antenatal care—than did budgeted amounts for public goods on the consumption of mixed public goods (Table 5). For example, an increase of \$0.50 per capita in the amount budgeted to private goods would increase the likelihood that curative care

Table 5. Simulated effects of changes in expenditures and budget shares on health behaviors

	Curative care 0–5	Curative care 15+	ANC	DPT3	Adequate toilet	Safe water
Expenditures per capita						
Private per capita of \$0.50	8.3%	12.8%	1.0%	2.7%	6.0%	4.9%
Public per capita of \$0.50	6.4%	5.9%	4.7%	−1.3%	3.1%	3.9%
Health area per capita of \$0.20	18.0%	4.6%	1.7%	−4.6%	−0.1%	−1.7%
Change share of						
Private goods by 10%	7.0%	5.0%	−0.3%	5.1%	1.9%	−1.8%
Public goods by 10%	−3.8%	−0.4%	−0.4%	3.0%	−0.4%	1.3%
Health area by 10%	14.6%	1.1%	1.7%	5.8%	−0.8%	−0.3%
Ratio of public to private by 25%	−2.9%	−8.9%	0.1%	−1.0%	−0.2%	1.2%

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would be used by 8 per cent for children and 13 per cent for adults. A similar-sized increase for mixed public goods would increase access to adequate toilets (i.e., pit latrines and flush toilets) and safe water (i.e., borehole or tap) by 3.1 per cent and 3.9 per cent, respectively. A similar result was evident for budget shares. Increasing the share of the budget for private goods would increase use of curative care for children by 7 per cent and for adults by 5 per cent. Increasing the share of the budget for mixed public goods would increase DPT3 vaccinations by 3 per cent, increase access to safe water by 1.3 per cent but decrease access to adequate toilets by 0.4 per cent.

Budgeted amounts on different health areas (e.g., MCH, HIV/AIDS) seemed to affect curative care use more strongly than the other health behaviors. Specifically, budgeted amounts for MCH programs were more effective in influencing the use of curative care than antenatal care. An increase in the budget of $0.20 on MCH activities would increase the use of curative care for children by 18 per cent but increase the use of antenatal care by only 1.7 per cent, though this latter result may be due in part to the small sample of non-users of antenatal.

CONCLUSION

The analysis to date, both from this work and from an earlier work (Akin *et al*., 2005), indicates that there was a shift in the emphasis of the health sector in Uganda during the decentralization process in the mid- to late-1990s away from several public and local mixed public goods services (those with consumption externalities) and towards private curative care services. This is a result that is fully in line with economic theories of decentralization suggesting local capture of public sector resources and targeting of benefits to preferred groups through services that are exclusionary. However, what alternative factors could also explain these changes? We consider two: the HIV/AIDS epidemic and shifts in donor priorities.

One potential explanation could be the current state of the health sector in Uganda and the potential for the AIDS crisis to alter health needs. Throughout the early and mid-1990s, Uganda experienced rapidly rising HIV/AIDS infection rates (UNAIDS 2000). It is certainly the case that the burden of HIV/AIDS on the health sector increased over this period. As a result, it is possible that local governments were responding to the crisis by shifting resources from other health programs. This might have a particularly strong effect on curative care through efforts to address HIV/AIDS opportunistic infections.

A second explanation could be that shifts in budgetary patterns reflect shifts in the availability of resources, particularly from international donors. Declines in resources to services traditionally addressed by vertical programs may be the result of reduced international assistance in these areas. It is certainly the case that reduced funding for immunization programs has reduced the number of fieldworkers conducting immunization outreach activities.

However, neither the HIV/AIDS crisis nor shifting donor priorities can provide a full explanation. In fact, one would expect that these factors would have uniform effects across all districts or at least be randomly distributed across districts. Instead, we observe that these shifts are most apparent in districts that have been decentralized longer.

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What this analysis shows, therefore, is that decentralization is doing exactly what it is intended to do—allowing local planners to respond to local preferences in a way that can impact on utilization patterns by individuals. What the analysis also shows is that the impacts of decentralization may not be in the areas intended by the framers of the decentralization process, since preferences in a decentralized health system may not conform to the preferences of the central government. Our analysis indicates that decentralization is positively associated with greater use of curative care services but shows no significant association with basic primary health care activities such as childhood vaccination, access to safe water nor access to adequate sanitation.

Again, this analysis is intended primarily as a contribution to the scant evidence base surrounding the effects of decentralization on health outcomes. Further study over longer periods of time and in countries of similar circumstances is clearly warranted.

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APPENDIX

Table 6. Types of activities by health area

Health area	Activities
Diarrheal diseases	Water-testing, health education, construction of boreholes
Immunizations	National immunization days; supervision of EPI programs; monitoring and evaluation
Malaria	Insecticide treated materials; endemicity studies; IEC
Maternal and child health	Training of health workers, TBAs; family planning
Nutrition	Health education; demonstration gardens
Environmental control and sanitation	Pit latrine construction; health education;
HIV/AIDS/STIs	Palliative care; TB/leprosy drugs and treatment; Health education; condom purchases and distribution; STD drugs and treatment
Other	Dental care; onchocerciasis; trypanosomiasis
None	Renovation; equipment; supervision; recurrent costs

Table 7. Types of activities by program type

Type	Description
Civil works	New construction of physical structures, rehabilitation, renovation
Drugs	Purchases of supplemental Vaccines and other drugs
Equipment	Purchase/procurement of durable goods (e.g., refrigerators)
Information, education, and communication	Home-visiting for education and awareness-raising, community sensitization and mobilizations, drama groups, radio and newspaper messages
Monitoring and evaluation	Routine monitoring of health situations (outcomes), communities; scientific studies; Health Management Information System
Maintenance	Operations and maintenance, utilities' expenses, day-to-day running of District Medical Officers' offices
Other	Meetings at district or community level, library, management, study tours, travel, transport, District Medical Officer office work
Primary health care	Vitamin A, constructing wells, pit latrines, distribution of family planning supplies, procurement of Insecticide mpregnated Materials, growth monitoring, outreach to AIDS patients, Maternal and Child Health
Salary	District Medical Officer's office salaries and allowances, other health staff salaries, incentives, and allowances (excludes salaries and allowances for hospital staff since health unit staff are excluded)
Support supervision	Support supervision of District Medical Officer's office to district health workers or of central Ministry of Health personnel to District Medical Officer's office; monitoring and evaluation of health workers and process indicators (audits, performance reviews)
Supplies	Semidurable goods (uniforms, chemicals, office supplies)
Training	Health workers' courses and refresher courses
Vehicle	Purchase of vehicles, motorcycles

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Table 8. Descriptive statistics

Variable	1995/96					1996/97				
	Obs	Mean	Standard deviation	Min	Max	Obs	Mean	Standard deviation	Min	Max
Dependent variables										
Use curative care	2864	0.590	0.492	0	1	6549	0.539	0.499	0	1
DPT3 vaccination	593	0.737	0.441	0	1	1295	0.831	0.375	0	1
Antenatal care	330	0.870	0.337	0	1	764	0.890	0.313	0	1
Household variables										
Toilet										
None/outside	1186	0.203	0.151	0.002	0.524	3849	0.157	0.131	0.001	0.553
Pit latrine	1186	0.745	0.131	0.221	0.957	3849	0.803	0.115	0.331	0.955
Flush	1186	0.052	0.109	0.000	0.777	3849	0.040	0.080	0.000	0.667
Water source										
None/river	1376	0.427	0.495	0	1	3849	0.395	0.489	0	1
Borehole	1376	0.521	0.500	0	1	3849	0.551	0.497	0	1
Tap	1376	0.052	0.221	0	1	3849	0.054	0.226	0	1
Age	9164	18.255	17.738	−9	99	20 161	17.910	17.370	−9	99
Female	8839	0.515	0.500	0	1	19 331	0.506	0.500	0	1
Years of education	9166	10.237	12.087	0	81	20 161	10.286	12.977	−9	91
Mother's years of education	8408	18.705	12.926	0	81	18 428	18.527	13.191	0	81
Mother's age	8408	29.943	8.098	12	45	18 428	29.220	8.078	12	45
Income quartile										
Lowest	9141	0.259	0.438	0	1	20 161	0.218	0.413	0	1
2nd lowest	9141	0.255	0.436	0	1	20 161	0.235	0.424	0	1
2nd highest	9141	0.251	0.433	0	1	20 161	0.237	0.425	0	1
Highest	9141	0.235	0.424	0	1	20 161	0.311	0.463	0	1
Rural	9357	0.622	0.485	0	1	20 161	0.582	0.493	0	1

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Table 8. (*Continued*)

Variable	1995/96					1996/97				
	Obs	Mean	Standard deviation	Min	Max	Obs	Mean	Standard deviation	Min	Max
Facility characteristics										
Distance	7742	4.311	6.747	0	48	12 903	4.214	7.312	0	100
Government ownership	7742	0.647	0.478	0	1	12 903	0.720	0.449	0	1
Have inpatient facilities	7742	0.650	0.477	0	1	12 903	0.643	0.479	0	1
Price of consultation	7742	0.313	0.428	0	5	12 903	0.201	0.388	0	2
Index of facility capacity	9357	5.638	2.848	0	8	20 162	3.896	3.109	0	7
Per capita expenditure										
Total	9357	2.435	1.472	1.139	6.741	20 162	3.764	1.676	1.523	9.151
Private	9357	0.437	0.445	0	1.871	20 162	0.818	0.611	0.087	3.467
Public	9357	1.222	0.959	0.313	4.004	20 162	1.586	0.946	0.464	3.205
MCH	8035	0.087	0.103	0	0.468	20 162	0.290	0.171	0.007	0.758
Immunization	8035	0.073	0.044	0.023	0.160	20 162	0.206	0.155	0.008	0.599
Sanitation	8035	0.218	0.227	0	0.592	20 162	0.347	0.442	0.022	1.458
Diarrhea	8035	0.553	0.601	0	2.229	20 162	0.270	0.383	0	1.263
Shares										
Public	9357	0.508	0.208	0.135	0.816	20 162	0.403	0.122	0.207	0.588
Private	9357	0.174	0.139	0	0.484	20 162	0.203	0.102	0.057	0.513
MCH	8035	0.032	0.030	0	0.105	20 162	0.091	0.052	0.001	0.212
Immunization	8035	0.029	0.019	0.014	0.077	20 162	0.062	0.041	0.002	0.141
Sanitation	8035	0.109	0.131	0	0.345	20 162	0.102	0.106	0.010	0.308
Diarrhea	8035	0.178	0.168	0	0.558	20 162	0.066	0.078	0	0.248
Ratio of public to private	8605	5.208	4.523	0.391	17.534	20 162	2.954	2.523	0.493	10.379
Years of decentralization	9357	3.144	0.721	2	4	20 162	4.460	0.703	3	5
Year 1996 dummy	9357	0.000	0.000	0	0	20 162	1.000	0.000	1	1
Years* year 1996 dummy	9357	0.000	0.000	0	0	20 162	4.460	0.703	3	5

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Table 9. Curative care for children 0–5 years

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Age	−0.067	−3.74	−0.078	−4.15	−0.068	−3.84	−0.066	−3.75	−0.079	−4.21	−0.069	−3.83	−0.069	−3.82	−0.069	−3.76
Female	0.065	1.13	0.052	0.86	0.053	0.94	0.052	0.92	0.050	0.83	0.065	1.13	0.063	1.09	0.055	0.93
Mother's age	−0.015	−2.73	−0.013	−2.24	−0.014	−2.58	−0.014	−2.59	−0.012	−2.21	−0.015	−2.77	−0.014	−2.70	−0.016	−2.87
Mother's education	0.009	2.59	0.008	2.12	0.009	2.45	0.008	2.39	0.008	2.14	0.009	2.55	0.010	2.70	0.009	2.58
Income quartile																
2nd lowest	0.032	0.32	0.049	0.47	0.049	0.49	0.043	0.43	0.047	0.45	0.032	0.32	0.030	0.30	0.014	0.13
2nd highest	−0.099	−0.95	−0.135	−1.24	−0.098	−0.95	−0.090	−0.88	−0.133	−1.22	−0.098	−0.94	−0.093	−0.91	−0.132	−1.22
Highest	0.247	2.06	0.207	1.66	0.251	2.12	0.246	2.08	0.209	1.68	0.258	2.15	0.249	2.06	0.222	1.78
Rural	−0.061	−0.64	−0.088	−0.87	−0.073	−0.78	−0.073	−0.78	−0.076	−0.76	−0.052	−0.55	−0.048	−0.51	−0.033	−0.35
Facility char.																
Distance	−0.005	−1.14	−0.006	−1.50	−0.005	−1.21	−0.005	−1.19	−0.007	−1.65	−0.006	−1.42	−0.006	−1.35	−0.007	−1.53
Government	0.042	0.44	0.076	0.78	0.041	0.45	0.043	0.46	0.082	0.84	0.043	0.47	0.051	0.54	0.050	0.53
Inpatient	−0.010	−0.11	−0.029	−0.27	−0.022	−0.22	−0.024	−0.25	−0.028	−0.27	0.006	0.07	−0.007	−0.07	0.016	0.15
Price	−0.031	−0.28	−0.006	−0.05	−0.005	−0.05	−0.043	−0.40	0.015	0.14	0.015	0.14	−0.018	−0.16	−0.021	−0.20
Index of capacity	0.035	1.17	0.032	1.06	0.029	0.99	0.027	0.93	0.032	1.05	0.035	1.18	0.035	1.15	0.034	1.13
Per capita expenditure																
Total	0.133	1.68														
MCH			1.779	2.47												
Private					0.304	1.80										
Public							0.236	1.72								
shares																
MCH									5.651	2.02						
Private											1.275	1.83				
Public													−0.676	−1.04		
Public/private															−0.053	−2.53

(Continues)

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Table 9. (*Continued*)

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Years decentralized	0.562	2.35	0.423	2.45	0.445	2.50	0.544	2.41	0.101	0.75	0.181	1.35	0.132	0.85	0.210	1.55
Year 1996 dummy	−1.815	−3.41	−3.459	−3.65	−2.015	−3.72	−1.238	−2.45	−2.826	−3.42	−2.030	−3.71	−2.022	−2.96	−1.812	−3.17
Years* 1996 dummy	0.183	1.31	0.564	3.37	0.290	2.49	0.070	0.45	0.542	3.11	0.390	2.92	0.397	2.31	0.303	2.13
Intercept	−1.794	−1.84	−1.247	−1.71	−1.241	−1.66	−1.443	−1.70	−0.109	−0.21	−0.436	−0.82	0.318	0.42	0.020	0.04
Observations	1895		1762		1961		1961		1762		1895				1821	
Pseudo R2	0.081		0.0828		0.0773		0.0774		0.0824		0.081				0.0848	
Test dummy variables																
$Chi^2(16)$	49.94		36.75		52.44		45.76		41.67		53.750				59.71	
$Prob>chi^2$	0		0.0023		0		0									

*Years decentralized × Year 1996 dummy.

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Table 10. Curative care for adults aged 15 or more

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Age	−0.005	−3.09	−0.006	−3.72	−0.004	−3.03	−0.004	−3.03	−0.006	−3.72	−0.005	−3.05	−0.005	−3.05	−0.005	−3.16
Female	0.066	1.48	0.051	1.09	0.071	1.62	0.074	1.69	0.054	1.15	0.067	1.49	0.067	1.50	0.061	1.35
Years of education	0.001	0.60	0.001	0.56	0.002	1.02	0.002	0.98	0.001	0.55	0.001	0.58	0.001	0.62	0.001	0.41
Income quartile																
2nd lowest	0.164	2.26	0.170	2.27	0.178	2.49	0.181	2.54	0.169	2.25	0.160	2.21	0.164	2.27	0.138	1.85
2nd highest	0.322	4.13	0.286	3.51	0.313	4.09	0.326	4.27	0.289	3.54	0.321	4.10	0.328	4.20	0.287	3.59
Highest	0.543	6.03	0.515	5.56	0.539	6.07	0.545	6.17	0.514	5.55	0.538	5.97	0.543	6.03	0.514	5.62
Rural	−0.138	−2.00	−0.144	−2.02	−0.121	−1.78	−0.118	−1.73	−0.145	−2.00	−0.132	−1.91	−0.130	−1.88	−0.136	−1.96
Facility characteristics																
Distance	−0.012	−2.94	−0.012	−2.80	−0.010	−2.65	−0.011	−2.74	−0.013	−2.87	−0.013	−2.99	−0.013	−3.00	−0.013	−2.93
Government	0.010	0.14	0.007	0.10	0.019	0.28	0.025	0.36	0.012	0.16	0.012	0.18	0.013	0.20	0.005	0.07
Inpatient	0.063	0.97	0.038	0.57	0.045	0.69	0.043	0.66	0.053	0.79	0.072	1.12	0.066	1.03	0.087	1.35
Price	−0.003	−0.05	0.061	0.87	0.042	0.61	0.014	0.20	0.050	0.70	0.030	0.45	0.017	0.26	0.008	0.11
Facility capacity	0.002	0.08	0.010	0.41	0.002	0.09	0.003	0.12	0.008	0.34	0.000	−0.01	0.003	0.11	0.000	0.00
Health expenditure per capita																
Total	0.110	1.97														
HIV/AIDS			0.332	2.14												
Private					0.388	3.14										
Public							0.176	1.84								
Shares																
HIV/AIDS									0.319	0.54						
Private											0.743	1.40				
Public													−0.059	−0.13		
Ratio															−0.037	−2.43
Years decentralized	0.386	1.43	0.280	2.46	0.504	2.48	0.309	1.57	0.228	2.09	−0.018	−0.13	−0.081	−0.61	0.070	0.46
Year 1996 dummy	−1.699	−4.30	−1.595	−4.34	−2.162	−4.91	−1.077	−3.00	−1.527	−4.06	−1.665	−3.89	−1.331	−2.65	−1.804	−4.40

(Continues)

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Table 10. (*Continued*)

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Years* year 1996 dummy	0.213	2.03	0.268	2.77	0.298	3.29	0.102	0.85	0.282	2.93	0.356	3.41	0.298	2.39	0.353	3.36
Intercept	−1.564	−1.55	−0.714	−1.55	−1.988	−2.55	−1.231	−1.62	−0.490	−1.14	−0.158	−0.30	0.165	0.31	0.019	0.04
Observations	3293		3095		3411		3411		3095		3293		3293		3165	
Pseudo R-squared	0.0759		0.0793		0.0737		0.0722		0.0783		0.0754		0.0748		0.0751	
F-test																
$Chi^2(16)$	76.07		71.75		92.95		76.27		78.89		95.3		91.52		106.65	
Prob>chi^2	0		0		0		0		0		0		0		0	

*Years decentralized×Year 1996 dummy.

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Table 11. Antenatal care

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Age 21–25	−0.494	−2.67	−0.490	−2.53	−0.365	−2.05	−0.376	−2.10	−0.489	−2.51	−0.485	−2.61	−0.485	−2.61	−0.512	−2.65
Age 26–35	−0.178	−0.97	−0.210	−1.11	−0.089	−0.50	−0.080	−0.45	−0.209	−1.11	−0.174	−0.95	−0.175	−0.95	−0.206	−1.07
Age 36–49	−0.369	−1.61	−0.339	−1.45	−0.265	−1.19	−0.253	−1.15	−0.338	−1.45	−0.381	−1.66	−0.380	−1.65	−0.413	−1.76
Years of education	0.006	0.95	0.006	0.98	0.007	1.16	0.006	0.96	0.006	1.00	0.006	1.07	0.006	1.06	0.006	0.93
Income quartile																
2nd lowest	0.035	0.21	0.051	0.29	0.051	0.31	0.045	0.27	0.050	0.29	0.033	0.20	0.032	0.19	0.131	0.78
2nd highest	0.027	0.15	0.005	0.03	0.006	0.04	−0.022	−0.13	0.003	0.02	0.033	0.19	0.031	0.17	0.062	0.35
Highest	0.084	0.42	0.220	1.08	0.096	0.49	0.086	0.43	0.217	1.07	0.089	0.44	0.087	0.43	0.115	0.57
Rural	−0.191	−1.14	−0.096	−0.58	−0.173	−1.07	−0.177	−1.09	−0.095	−0.58	−0.182	−1.09	−0.183	−1.09	−0.172	−1.03
Facility characteristics																
Distance	0.001	0.09	−0.003	−0.41	0.001	0.18	0.002	0.23	−0.003	−0.43	0.000	0.02	0.000	0.00	−0.001	−0.15
Government	−0.264	−1.54	−0.353	−2.16	−0.185	−1.11	−0.197	−1.20	−0.352	−2.15	−0.251	−1.46	−0.253	−1.48	−0.171	−0.98
Inpatient	−0.190	−1.35	−0.163	−1.10	−0.190	−1.37	−0.193	−1.40	−0.164	−1.11	−0.185	−1.32	−0.186	−1.32	−0.200	−1.41
Price	0.228	1.05	0.280	1.19	0.247	1.18	0.192	0.93	0.286	1.20	0.260	1.17	0.258	1.17	0.301	1.33
Capacity	0.081	1.60	0.095	1.88	0.062	1.27	0.062	1.27	0.094	1.87	0.085	1.66	0.083	1.63	0.073	1.38
Per capita expenditure																
Total	0.152	1.30														
MCH			0.457	0.56												
Private					0.099	0.35										
Public							0.555	2.68								
Shares																
MCH									1.793	0.48						
Private											−0.145	−0.12				
Public													−0.182	−0.17		
Ratio public/private															0.006	0.15

(Continues)

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Table 11. (*Continued*)

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Years decentralized	0.420	1.10	0.012	0.05	0.200	0.59	0.865	2.28	−0.081	−0.28	0.032	0.13	0.000	0.00	0.107	0.42
Year 1996 dummy	−1.466	−1.70	−1.937	−1.65	−0.946	−0.98	−0.114	−0.14	−1.827	−1.69	−1.159	−1.29	−1.323	−1.27	−0.652	−0.68
Years* year 1996	0.224	1.00	0.458	1.81	0.201	0.98	−0.264	−1.03	0.463	1.72	0.333	1.48	0.375	1.35	0.170	0.68
Intercept	−0.654	−0.41	1.124	1.15	0.464	0.32	−2.153	−1.53	1.434	1.41	1.165	1.22	1.301	0.96	0.919	0.92
Observations	785		752		838		838		752		785		785		758	
Pseudo R-squared																
$Chi^2(16)$	13.98		12.62		12.32		19.29		12.92		11.95		11.34		10.7	
$Prob>chi^2$	0.5269		0.6319		0.655		0.201		0.6088		0.6825		0.7279		0.7734	

*Years decentralized×Year 1996 dummy.

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Table 12. DPT3 vaccinations for children 12–35 months

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Age	0.192	2.13	0.178	1.89	0.202	2.32	0.201	2.31	0.174	1.85	0.194	2.14	0.192	2.13	0.201	2.19
Female	−0.117	−1.34	−0.131	−1.45	−0.135	−1.58	−0.137	−1.61	−0.132	−1.46	−0.118	−1.34	−0.112	−1.28	−0.128	−1.43
Mother's age	−0.002	−0.38	−0.001	−0.22	−0.001	−0.14	−0.001	−0.16	−0.002	−0.25	−0.002	−0.34	−0.002	−0.35	−0.003	−0.47
Mother's education	0.025	5.65	0.024	5.45	0.026	5.97	0.026	5.95	0.024	5.45	0.024	5.66	0.025	5.61	0.024	5.57
Income quartile																
2nd lowest	−0.055	−0.48	−0.022	−0.19	−0.044	−0.39	−0.051	−0.46	−0.026	−0.23	−0.050	−0.44	−0.045	−0.39	−0.082	−0.70
2nd highest	0.147	1.08	0.116	0.82	0.134	1.03	0.142	1.10	0.123	0.88	0.120	0.87	0.149	1.09	0.063	0.45
Highest	0.503	3.19	0.463	2.87	0.479	3.15	0.476	3.13	0.462	2.87	0.493	3.13	0.509	3.23	0.444	2.79
Rural	−0.206	−1.62	−0.198	−1.48	−0.192	−1.57	−0.186	−1.51	−0.193	−1.44	−0.220	−1.76	−0.218	−1.71	−0.220	−1.73
Facility chars.																
Distance	−0.011	−1.45	−0.009	−1.16	−0.009	−1.30	−0.010	−1.39	−0.008	−1.17	−0.011	−1.43	−0.009	−1.29	−0.009	−1.25
Government	0.065	0.47	0.045	0.31	0.032	0.24	0.039	0.30	0.051	0.35	0.053	0.38	0.060	0.43	0.048	0.34
Inpatient	−0.102	−0.88	−0.104	−0.85	−0.093	−0.80	−0.090	−0.78	−0.097	−0.80	−0.095	−0.82	−0.101	−0.86	−0.070	−0.58
Price	0.137	0.82	0.123	0.70	0.123	0.76	0.138	0.84	0.125	0.73	0.147	0.85	0.108	0.65	0.104	0.62
Capacity	0.085	2.07	0.093	2.24	0.082	2.08	0.084	2.13	0.096	2.32	0.072	1.78	0.088	2.14	0.077	1.86
Per capita expenditure																
Total	−0.126	−1.31														
Immunization			−0.740	−0.54												
Private					0.182	0.80										
Public							−0.084	−0.49								
Shares																
Immunization									3.929	0.70						
Private											1.822	1.89				
Public													1.032	1.30		
Ratio															−0.032	−1.14
Years decentralized	−0.570	−1.22	−0.083	−0.33	0.274	0.87	−0.072	−0.22	−0.145	−0.54	0.149	0.62	−0.062	−0.28	0.186	0.72
Year 1996 dummy	0.991	1.32	1.341	1.06	0.229	0.28	0.601	0.95	0.086	0.08	−0.256	−0.33	1.354	1.45	0.297	0.38

(Continues)

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Table 12. (*Continued*)

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Years* 1996 dummy	0.051	0.28	−0.176	−0.69	−0.074	−0.47	−0.039	−0.20	0.093	0.35	0.083	0.44	−0.208	−0.93	−0.070	−0.36
Intercept	1.605	0.96	−0.231	−0.24	−1.423	−1.13	−0.107	−0.09	−0.307	−0.37	−1.106	−1.19	−0.826	−0.92	−0.638	−0.76
Observations	1309		1240		1377		1377		1240		1309		1309		1269	
F-test district dummies = 0																
$Chi^2(16)$	43.27		47.31		43.56		43.97		46.35		46.98		49.99		47.26	
Prob>chi^2	0		0		0		0		0		0		0		0	

*Years decentralized × Year 1996 dummy.

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Table 13. Household access to pit latrine or flush toilet (base category = no toilet or outdoor toilet)

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Category 1: pit latrine																
Highest education level	0.033	7.24	0.033	7.17	0.034	7.41	0.034	7.41	0.033	7.17	0.033	7.29	0.033	7.32	0.033	7.00
Income quartile																
2nd lowest	0.383	3.54	0.365	3.34	0.389	3.60	0.397	3.73	0.364	3.34	0.379	3.50	0.386	3.59	0.364	3.32
2nd highest	0.756	5.39	0.728	5.07	0.698	4.92	0.704	5.02	0.727	5.07	0.762	5.42	0.769	5.47	0.749	5.29
Highest	1.307	5.66	1.251	5.38	1.161	5.07	1.150	5.07	1.249	5.39	1.301	5.57	1.297	5.58	1.270	5.45
Rural	−1.394	−6.50	−1.384	−6.46	−1.425	−6.69	−1.420	−6.59	−1.385	−6.48	−1.387	−6.48	−1.377	−6.43	−1.354	−6.30
Per capita expenditure																
Total	0.339	3.75														
Sanitation			−0.024	−0.10												
Private					1.082	3.70										
Public							0.560	2.85								
Shares																
Sanitation									−1.077	−1.33						
Private											1.810	1.47				
Public													−0.404	−0.39		
Ratio															−0.018	−0.51
Years decentralized	0.161	0.39	−0.672	−1.71	0.201	0.67	0.132	0.39	−0.687	−1.80	−0.503	−1.25	−0.687	−1.79	−0.609	−1.39
Year 1996 dummy	−1.049	−1.43	0.257	0.35	−1.006	−1.21	0.271	0.37	−0.150	−0.19	−0.426	−0.58	−0.319	−0.33	−0.211	−0.26
Years* 1996 dummy	0.003	0.01	0.138	0.56	0.011	0.04	−0.334	−1.12	0.255	1.00	0.221	0.98	0.268	0.89	0.204	0.78
Intercept	1.301	1.48	3.389	4.39	1.551	2.27	1.591	1.83	3.546	4.64	2.927	3.50	3.695	3.89	3.492	4.63
F-test																
$chi^2(14)$	227.23		215.3		244.25		213.62		203.98		223.69		166.94		212.77	
Prob>chi^2	0		0		0		0		0		0		0		0	
Highest education level	0.080	10.56	0.082	10.43	0.082	10.74	0.082	10.79	0.082	10.45	0.081	10.58	0.081	10.46	0.081	10.36

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Table 13. (*Continued*)

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Category 2: flush toilet																
2nd lowest	0.398	0.80	0.371	0.74	0.412	0.83	0.418	0.84	0.371	0.74	0.406	0.81	0.404	0.81	0.417	0.84
2nd highest	1.486	3.39	1.432	3.24	1.464	3.35	1.468	3.36	1.430	3.24	1.505	3.44	1.505	3.44	1.406	3.23
Highest	2.760	5.75	2.668	5.52	2.615	5.46	2.603	5.46	2.667	5.52	2.763	5.73	2.750	5.72	2.649	5.52
Rural	−4.728	−9.07	−4.648	−8.93	−4.574	−9.39	−4.568	−9.37	−4.649	−8.94	−4.719	−9.07	−4.712	−9.05	−4.604	−8.87
Per capita expenditure																
Total	0.416	1.72														
Sanitation			0.057	0.08												
Private					1.108	2.30										
Public							0.664	1.26								
Shares																
Sanitation									−0.399	−0.16						
Private											2.520	0.90				
Public													−0.763	−0.24		
Ratio															−0.023	−0.24
Years decentralized	0.406	0.48	−0.638	−0.58	0.032	0.04	0.057	0.08	−0.679	−0.65	−0.425	−0.40	−0.672	−0.62	−0.556	−0.56
Year 1996 dummy	−0.445	−0.26	0.556	0.38	−0.081	−0.05	1.274	0.90	0.278	0.18	0.248	0.15	0.286	0.12	0.581	0.31
Years*1996 dummy	−0.575	−1.10	−0.302	−0.50	−0.475	−0.87	−0.902	−1.59	−0.211	−0.34	−0.273	−0.44	−0.186	−0.21	−0.319	−0.48
Intercept	−4.793	−2.67	−2.008	−0.83	−3.785	−2.14	−4.009	−2.31	−1.854	−0.78	−2.791	−1.16	−1.617	−0.48	−1.970	−0.80
F-test																
$chi^2(14)$	47.04		46.23				46.27		45.53		46.93		31.69		42.54	
Prob>chi^2	0		0		51.42		0				0		0.004		0	
Observations					0		5425		5033		5221		5221		5101	

*Years decentralized×Year 1996 dummy.

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Table 14. Household's access to water (base category = river or natural source)

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Category 1: borehole																
Highest education level	0.013	4.06	0.013	4.08	0.013	4.26	0.013	4.25	0.013	4.08	0.013	4.09	0.013	4.06	0.012	3.91
Income quartile																
2nd lowest	0.239	2.61	0.263	2.83	0.251	2.80	0.254	2.84	0.262	2.83	0.239	2.61	0.239	2.61	0.204	2.21
2nd highest	0.427	3.86	0.422	3.74	0.424	3.94	0.426	3.95	0.419	3.72	0.431	3.91	0.430	3.89	0.394	3.53
Highest	0.470	3.83	0.446	3.57	0.450	3.72	0.449	3.72	0.443	3.54	0.472	3.85	0.471	3.84	0.435	3.50
Rural	−1.794	−12.51	−1.792	−12.34	−1.744	−12.24	−1.750	−12.26	−1.795	−12.33	−1.790	−12.50	−1.792	−12.52	−1.802	−12.52
Per capita expenditure																
Total	0.073	0.52														
Diarrhea			−0.077	−0.36												
Private					0.295	0.96										
Public							0.270	1.20								
Shares																
Diarrhea									0.179	0.22						
Private											−0.355	−0.28				
Public													0.301	0.31		
Ratio															0.033	0.73
Years decentralized	0.492	0.74	0.129	0.38	0.818	1.75	0.867	1.93	0.202	0.67	0.137	0.43	0.184	0.65	0.136	0.38
Year 1996 dummy	−1.814	−2.32	−1.449	−2.38	−1.935	−2.38	−1.371	−2.28	−1.416	−2.27	−1.388	−1.93	−1.309	−1.56	−0.970	−1.30
Years* 1996 dummy	0.366	1.53	0.424	1.91	0.275	1.40	0.067	0.25	0.395	1.85	0.401	1.85	0.361	1.40	0.271	1.21
Intercept	−0.773	−0.44	0.189	0.23	−1.372	−1.09	−1.514	−1.24	−0.019	−0.03	0.208	0.26	−0.093	−0.13	0.003	0.00
F-test																
$chi^2(16)$	102.39		100.68		107.4		105.96		101.57		102.84		102.77		107.03	
$Prob>chi^2$	0		0		0		0		0		0		0		0	
Category 2: tap																
Highest education level	0.039	6.05	0.041	6.22	0.040	6.18	0.039	6.07	0.040	6.19	0.039	6.07	0.039	6.02	0.038	5.85

(Continues)

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Table 14. *(Continued)*

	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z	Coefficient	Z
Income quartile																
2nd lowest	0.613	2.12	0.660	2.18	0.622	2.14	0.623	2.16	0.670	2.21	0.613	2.11	0.607	2.08	0.572	1.96
2nd highest	1.283	4.12	1.356	4.24	1.280	4.11	1.273	4.09	1.346	4.20	1.287	4.12	1.280	4.09	1.223	3.87
Highest	1.915	6.48	1.906	6.13	1.902	6.42	1.894	6.43	1.909	6.16	1.918	6.47	1.912	6.43	1.894	6.36
Rural	−4.652	−10.35	−4.613	−10.15	−4.622	−10.30	−4.636	−10.33	−4.611	−10.14	−4.650	−10.34	−4.650	−10.33	−4.652	−10.20
Per capita expenditure																
Total	0.057	0.21														
Diarrhea			0.766	1.80												
Private					−0.280	−0.47										
Public							0.423	0.99								
Shares																
Diarrhea									1.840	1.21						
Private											0.211	0.10				
Public													−0.324	−0.18		
Ratio															0.017	0.20
Years decentralized	−0.284	−0.18	0.106	0.16	−0.863	−0.75	0.255	0.23	−0.344	−0.50	−0.505	−0.67	−0.521	−0.75	−0.371	−0.48
Year 1996 dummy	−1.389	−1.03	−0.564	−0.51	−0.573	−0.39	−0.913	−0.82	−0.668	−0.62	−1.187	−0.98	−1.305	−0.87	−0.532	−0.40
Years*1996 dummy	0.440	0.86	0.184	0.45	0.442	1.13	0.053	0.09	0.357	0.87	0.487	1.17	0.525	0.99	0.200	0.45
_Cons	−2.886	−0.70	−4.226	−2.74	−1.293	−0.41	−4.365	−1.42	−3.013	−1.81	−2.318	−1.20	−2.083	−0.99	−2.463	−1.42
Observations	5102		5035		5428		5428		5035		5223		5223		5102	
$chi^2(16)$	36.27		41.64		48.27		36.85		45.93		46.23		45.66		45.81	
Prob>chi^3	0.00		0		0		0		0		0		0		0	

*Years decentralized × Year 1996 dummy.

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