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Title: Leakage of Public Resources in the Health Sector: An Empirical Investigation of Chad

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Abstract

In the public sector in developing countries, leakage of public resources could prove detrimental to users and affect the well-being of the population. In this paper, we empirically examine the importance of leakage of government resources in the health sector in Chad and its effects on medication mark-up. We make use of data collected in Chad as part of a Health Facilities Survey organized by the World Bank in 2004. The survey covers 281 primary health care centers and hospitals and contains information on the provision of medical material, financial resources and medication allocated by the Ministry of Health (MoH) to the regional administration and primary health centers. While the regional administration is officially allocated 60% of the MoH's non-wage recurrent expenditures, the share of the resources that actually reach the regions is estimated to be 18%. The health centers, which are the frontline providers and the entry point for the population, receive less than 1% of the MoH's non-wage recurrent expenditures. Accounting for the endogeneity of the level of competition among health centers, we observe that leakage of government resources has a significant and negative impact on the mark-up health centers charge patients on drugs sales. Furthermore, it is estimated that had public resources earmarked for frontline providers reached them in their entirety, the number of patients seeking primary health care in Chad would have more than doubled.

1   Introduction

The importance of health for development provides a strong case for allocating public resources to the health sector. However, a growing body of research demonstrates that it cannot be taken for granted that allocating more budgetary resources to the sector will necessarily deliver better outcomes (Musgrove, 1996, Filmer and Pritchett, 1999; Filmer et al, 2000). Filmer et al (2000), for instance, find that health spending has, on average, no significant impact on the population's health status in most of the studies they reviewed.[1]

As noted by Ablo and Reinikka (1998), public health spending may have little impact on health status because health expenditures may not translate into improved services. Indeed, official health resources, as recorded in governments' budgets, may not be adequate measures of resource availability especially in a weak institutional environment where mismanagement and corruption are serious issues. Reinikka and Svensson (2004) find in their Uganda study significant gaps between primary schools' official entitlements from a large public program and the amounts of resources the schools actually received. They attribute the gaps to capture and leakage of funds by the various layers of the political and administrative apparatus.

In this paper, we estimate the extent of leakage of public spending in Chad's health sector and empirically assess its impact on the delivery of health services. We try to identify the determinants of resource leakage, including characteristics of the public administration's institutional structure and their impact on the level and prices of health services offered to the population.

We make use of data collected as part of a Health Facilities Survey in Chad organized by the World Bank in 2004. The survey covered 281 primary health care centers and 30 hospitals in half the districts in the country, and contains information on resources and services as well as patients' characteristics. The

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[1] Filmer et al 2000 (p. 204) noted that: "The cross-national evidence has always been absent or ambivalent on whether health status is improved by greater commitment to or greater spending on primary health care (or both)." Furthermore, the World Bank's *World Development Report 1993: Investing in Health* notes that, controlling for the level of education at the cross-country level, there is no evidence that higher health spending leads to better health outcomes in terms of life expectancy or child mortality (pp. 53-54).

survey data include information on the central government budget, health centers' monthly reports of activities, and the Ministry of Health's (MoH) central store shipments to health centers. These data are used to keep track of the financial resources, medical material and main medication allocated by the MoH to health care providers.

We seek to identify factors contributing to the inefficiency of public resource allocation and health service provision to the population. We examine the mechanisms of resource allocation through the public administration apparatus (central government, regional health administrations and local health centers) in order to identify sources of leakage. We then analyze the impact of resource dissipation on health services. We also examine the effect of leakage on the mark-up of medication sold to patients by health centers.

The study shows that leakage is extensive at the central and regional levels of the health system, while local health providers receive a very small fraction of public resources originally intended for them. A central result of the paper is that public health spending has a strong positive and significant impact on service delivery once leakage of public resources is accounted for. As a matter of fact, we estimate that if all the intended public resources had reached the frontline providers, the number of patients seeking health care in Chad would have more than doubled. To explain this result we test whether drug prices could be the mechanism through which public resources receipt operates to increase demand. We show that in fact leakage has a significant impact on user fees because it increases the mark-up facilities charge on drugs, and thus directly impacts service accessibility and demand for health care.

The study is organized as follows. Section 2 describes the health sector in Chad. Section 3 presents the data from the health facility survey. Section 4 documents the importance of public resource leakage at the various levels of the health system. Section 5 presents econometric estimates of the determinants of resource allocation to health centers. It also assesses the impact of leakage on health services and on medication mark-up. Section 6 concludes.

2   The Health Sector in Chad

Chad is a Central African country with a population of 8.8 million individuals divided into approximately 12 ethnic groups. Its economy is based mainly on agriculture and cattle rearing. The primary sector accounts for 38% of GDP and employs about 80% of the labor force. Since independence in 1960, the country has experienced ongoing political instability that contributed to the 1979 civil war. In a referendum in 1996, Chad adopted a constitution that made the country a decentralized state. According to the Human Poverty Index, Chad is one of the poorest developing countries with US$304 GDP per capita, ranking 100th out of 103 countries (UNDP, 2005). The adult illiteracy rate is 74.5%. Only 34% of the population has access to improved water and 8% to sanitary facilities.

2.1   Health Indicators

Health indicators in Chad are very mediocre and are even below what would be expected at the equivalent level of GDP (World Bank, 2002). Life expectancy at birth is 43.6 years and the child mortality rate (under 5 years) is 200 per 1,000 live births. Maternal mortality is among the highest in Africa, close to 1100 for 100,000 live births. The health problems affecting the population are mainly infectious diseases and parasites (malaria, diarrhea, respiratory infections). Outbreaks of meningitis and cholera are frequent in the country and cause many deaths among the poor and destitute. The incidence of these and other diseases has not improved during the last decade, despite significant increases in public resources officially allocated to the health sector.

2.2   Health System

The health system in Chad is organized as the pyramidal structure which is typical in Sub-Saharan Africa. It has four levels of responsibility. The MoH -the central level- is at the top of the pyramid and is in charge of formulating national health policies. At the second highest level one finds the 14 Regional Health Delegations

(RHDs) –the intermediary level- each headed by a regional delegate who is responsible for coordinating and implementing the strategy at the regional level. The regional delegate is also in charge for the management of the health personnel. The peripheral level is composed of 49 sanitary districts, each headed by a chief doctor, which are subsequently divided into 657 responsibility zones. The health infrastructure in a sanitary district should be composed at the minimum by a hospital (district level) and a network of health centers (zone level). However, in 2001 only 407 responsibility zones had at least one functional health center (World Bank, 2004) and most could not provide all the services included in the minimum package of activities.

There are currently three doctors, two midwives and 4 nurses per 100,000 inhabitants, significantly below the WHO standard of 10 doctors, 20 midwives and 20 nurses. The vast majority of formal health sector personnel are active in the public and non-profit sectors. The formal private for-profit sector employs less than 1% of the health personnel (World Bank, 2004). With regard to drugs, a Central Pharmaceutical Procurement Agency (CPPA) was created in 1994 in N'djamena to improve the availability of drugs in the facilities across the country. To support the delivery system in the regions, 14 Prefectoral Purchasing Pharmacies (PPP) were also created. The CPPA was conceived as an autonomous entity which needed to be self-sustainable, hence user fees for drugs were also introduced. The CPPA has a monopoly over drugs and medical products sold to the PPP and to the public and non-profit health facilities. The drugs sector is regulated by the government and markup rates at each level of the supply chain are determined at the central level by the MoH.

3   Data and Survey

The primary data used in this paper come from the 2004 Quantitative Service Delivery Survey (QSDS) for which we drafted the survey instruments, organized the field work and monitored data collection for which a local firm was hired.

The survey examined various levels of the health sector, collecting the most complete information possible on resource use, delivery processes, health output and

prices of health services. Data were collected between May 1 and July 16, 2004, using questionnaires administered to regional delegates, district chief doctors, regional pharmacy managers, heads of health facilities, health workers, and patients.

The primary data has been supplemented by an impressive amount of secondary administrative data we collected directly from the MoH services. Data on facilities output such as the number of patients (in and out) by type of ailment, financial information such as user fees revenue and epidemiological information were collected from the Division of Sanitary Information. The Division of Financial Resources provided us with the budget of the MoH along with its breakdown by region and district.[2] We also collected the logbook of materials sent to regions and districts for the year 2003 by the MoH's central warehouse. This information comes with price data and thus allows a precise estimation of the value of all public material the center sent to its regional branches. Finally, we also collected data from the CPPA on the delivery of medical consumables to regions and health centers along with the purchases of the CPPA's clients including the MoH for 2003.

A key aspect of the survey is data triangulation whereby questions were included in the instruments to re-capture secondary data and assess the validity of the answers at the region, district, and facility levels. For instance, using the logbook of shipments of material from the MoH central warehouse to the regions or districts, eight materials have been randomly selected from the list of materials and included in the region, district, and facility questionnaires. The questionnaires ask for each of these items the quantity received and the date of reception. We then can compare the answers of the respondents to the data collected at the MoH.

The main objective of the survey was to precisely measure leakage, if any, of public resources in the health sector. We will make precise the definition of leakage we use in the next section. However, a proper estimation of the leakage rate impacts the sampling strategy one can use. We used a two-stage sampling strategy for the QSDS. First, in each of the 14 delegations, either one or two districts, depending on the number of districts in the region, were selected at random. Second, in each of the

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[2] The district is the lowest level for which financial budget information is available. There is no resource earmarked for facilities and this will prove crucial for both the definition and estimation of leakage.

selected districts, we proceeded to a census of the health facilities which were all first identified and then visited.[3] Given the importance of the capital, N'djamena, all its health centers were included in the sample. The original health center list was provided by the MoH Division of Sanitary Information and Statistics (DSIS). In addition, enumerators were instructed to identify and visit all health centers not on the initial list in a selected district, and especially the private clinics.

The final sample is presented in Table 1. Of the 281 health centers making up the sample, approximately two-thirds are public, 14% are private, 16% are faith-based and 3% are run by NGOs. About two-thirds of the health centers are located in rural area, less than one-quarter in the capital and 14% in other urban areas.

<div align="center">Table 1: Distribution of the Sample</div>

	Capital	Other urban areas	Rural	Total
Public	26	26	139	191
Private	19	9	11	39
Faith-based	4	2	39	44
NGO	3	1	3	7
Total	52	38	191	281

In rural areas, public sector clinics account for approximately three-quarters of all health centers, compared with one-half in the capital. The private sector is mainly present in urban areas; approximately one-third of the capital's health centers are privately owned, compared with one-quarter in other urban areas and only 6% in rural areas. Private clinics rank second in importance in urban areas, while faith-based clinics rank second in rural areas, accounting for one-fifth of health centers. Private clinics are absent in half of the country's 14 regions.

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[3] One regional delegation (B.E.T.) was not included in the final sample because of security problems in the region at the time of the survey.

4 The Extent of Leakage in the Health Sector

Leakage is usually defined as the proportion of resources intended for identified beneficiaries that does not reach them. The estimation of leakage rates then implies the ability to pin down exactly how much the intended beneficiaries received versus how much they should have received as given by resources earmarked[4] for them. We use this definition to determine leakage at the regional and district levels. However, for individual health facilities, because no resources are earmarked for them, the estimation of leakage, in this sense, at the facility level is not feasible. We revert then to estimating the share of the health budget that does reach the primary care health facilities as a share of the total health budget earmarked for the regions. Because most of the public resources for health should end up in the facility, which is the service delivery point, this could be viewed as a broader concept of leakage.

In this section, we assess the importance of leakage in the health center in Chad. We proceed in two steps. We first compare planned health expenditures at the central MoH level with those at the regional and district levels. We then estimate the amount of public resources that ultimately reaches primary health centers and potentially available to the population.

4.1 Public Resources Reaching the Regional Level

In 2003, the MoH budget was 33 billion CFA Francs (US$57 million). This represented 8.4% of the total government budget and an increase of 24% over the preceding year. Support from foreign donors in the form of grants and loans represented 48% of the total health budget. The share of recurrent and capital expenditures in the budget was 43% and 57% respectively. Personnel expenditures accounted for 16% of the total budget (37% of recurrent expenditures). Our analysis focuses on MoH recurrent expenditures. Despite their importance, capital

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[4] We will use the terms budgeted, earmarked, planned and official interchangeably throughout the paper.

expenditures are excluded from our analysis because of the absence of information concerning their execution.[5]

In 2003, recurrent expenditures on health activities under the responsibility of the 14 regional health delegations (RHD) amounted to 8 billion CFAF. This corresponds to about 60% of the MoH recurrent budget (or two-thirds of the MoH non-wage recurrent budget). While the share of the MoH budget devoted to the regional level is significant, the vast majority of it (86%) is directly controlled by the MoH through so-called *centralized credits.* The remaining 14% of the regional health budget is managed at the regional level through *decentralized credits.* Table 2 presents the health budget structure.

Table 2: Structure of the Health Budget (2003)

	Central budget (MoH)	Regional budget (RHD)	Regional share (RHD)	Decentralized share
	Billions of CFAF		%	%
Total	33.408			
Operations	13.407	8.030	59.9	14.3
of which				
Personnel	5.295	2.560	48.4	100
Materials	7.092	4.938	69.6	
Services	1.020	0.532	52.2	

Source: Revised Finance Law, Chad 2003

The value of public resources arriving at the RHD level is therefore the sum of four components, namely (1) centralized credits, (2) decentralized credits, (3) ad hoc requests, and (4) drugs and vaccine delivery.

(i) *Centralized Credits:* These resources essentially consist of materials and medical consumables purchased by the MoH and destined for regional and district administrations and health centers. The official rationale for centralizing purchases is to benefit from economies of scale through public tendering procedures, combined with a lack of local capacity and suppliers.

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[5] Capital investments are mainly financed by foreign donors. Information on their execution is lacking because donors do not have common reporting procedures. Even so, based on information collected by the Financial Resources Directorate (FRD), in 2003, 32 public tendering procedures were officially proposed by the MoH, representing a value of 3.66 billion CFAF. However, only 7% of the investment budget had been officially accounted for at the end of the fiscal year and no contract had been yet executed.

There is no explicit allocation rule at the MoH level for allocating materials and medications to regions, districts and health centers. Allocations may reflect the preferences of the MoH, as well as specific demands by lower administrative levels.[6]

(ii)   *Decentralized Credits:* These are budgetary resources given to regional or district administrations. Regional health delegates or district chief doctors are responsible for managing these financial resources, and for redistributing purchased materials and medications to health providers under their jurisdiction.

(iii)   *Ad hoc requests:* Regional health delegates and district heads sometimes submit specific requests for (a list of) materials directly to the MoH. Once the request is granted and authorized, the regional delegates or district heads go to the central warehouse with their authorization letters and carry the material at their own expense to their regions or districts.

(iv)   *Drugs and vaccine deliveries:* Drugs and vaccines destined for health centers and hospitals are purchased from a credit line managed by the MoH. In 2003, the drugs budget was 695 millions CFAF (US$1.4 million), or 12.7% of the RHD recurrent budget (excluding salaries).[7]

Table A1 in the Appendix presents the value of the first three components of public resources (decentralized credits, centralized credits and ad hoc requests) actually received by the 14 RHDs during fiscal year 2003. The resources in question account for approximately 26.1% of the recurrent expenditures earmarked for the regions.[8] To estimate the total value of public resources reaching the regional level,

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[6] All materials purchased with centralized credits to be sent to the regions originate from the central MoH warehouse in N'djamena. The destination points are the MoH warehouses in the regions and districts. All material exits are registered on exit slips by the central warehouse manager. When the material reaches the regional warehouse, the regional delegate verifies the list of material and certifies that the material has been received. He or she notes any missing material or potential quality problems with the material.

[7] Drugs and vaccines are formally included in the centralized credits, but follow a different path. Given that information on the MoH's shipments of drugs was not available, we made use of data from the facility survey.

[8] Ad hoc deliveries were valued at 79.6 million FCAF in 2003, corresponding to just 1.3% of the non-salary resources officially allocated to the RHDs. Materials sent to delegations were diversified and included ambulances, office desks, bleach, pens and paper. Material deliveries are estimated at 203 million CFAF, less that 4% of the non-salary operating budget. With regard to ad hoc pick ups, there were some significant regional differences, with one of the 14 regions accounting for 72% of the total material value and certain regions located at some distance from the capital not receiving any

we add to these figures the value of drugs and vaccines received at the regional level.[9] All the data has been triangulated to make sure of its validity.

Figure 1 presents the actual allocation of public resources by region as a percentage of planned and executed expenditures. We observe that, on average, regional delegations received a total of 26.7% of their official non-wage budgetary expenditures from the MoH.[10] The capital region (Chari-Baguirmi) exhibits the highest official expenditures, but also the third lowest resource arrival rate (19.6%) after the Batha (17.5%) and Salamat (15.7%) regions. The Mayyo-Kebbi region exhibits the highest resource arrival rate, at 45%.
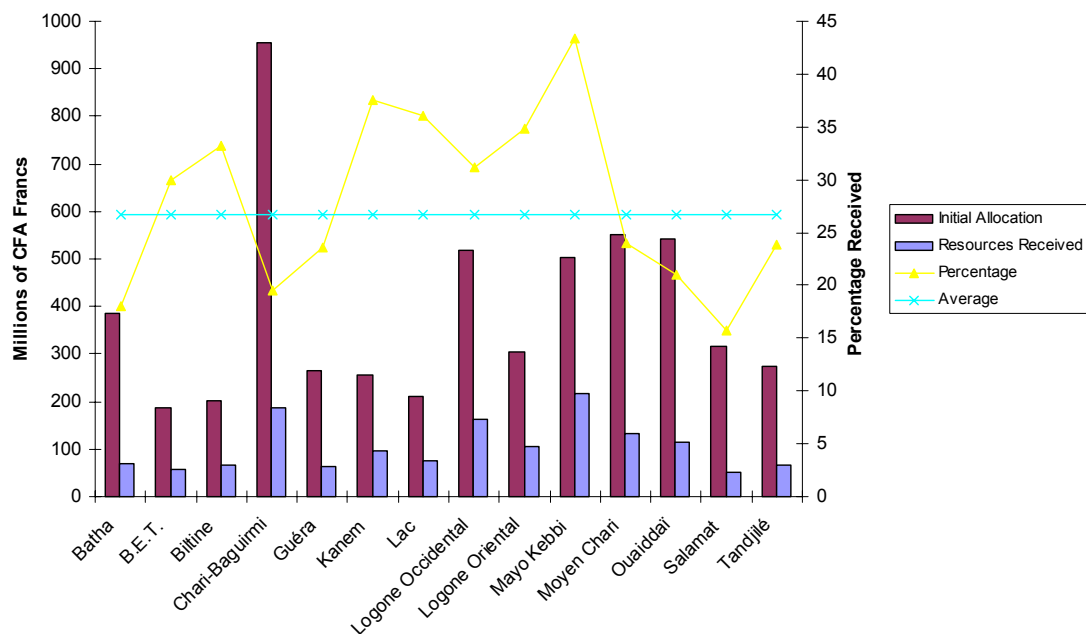

Figure 1: Planned vs. Actual Allocations by Regional Health Delegations (RHD)

Table A1 shows that decentralized credits account on average for more than 80% of total public resources received at the regional level. Most of the resources earmarked to the regions that are directly managed by the MoH do not ultimately reach the regional

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materials. (For example, an ambulance had officially been allocated to a regional delegation whose head delegate reported only a motorcycle as a means of transportation at his delegation.)

[9] Because information concerning medications sent by the MoH to delegations was not directly available at the MoH level, it was collected in the survey of medications and vaccines received by health centers. It was then used to estimate the value of medications that had actually arrived at the regional level. Our hypothesis was that the share of each RHD in the medication budget equals their share in the total budget.

[10] When wages are included, the RHD received 50.1% of their official allocation.

level. This over-centralization of public resources appears to be a serious impediment for regions and health centers to receive their intended resources.

4.2   Public Resources Reaching Health Centers

Having estimated the public resources reaching the regional level, we now estimate the percentage that ultimately reaches local health providers.

In Chad, health centers do not have specific budget lines in the national health budget. They are recipients of public resources only when higher administrative levels arbitrarily decide so. No administrative records are kept of resources sent to health centers. To estimate the value of resources reaching health centers, we use the survey data which include information on the financial resources received by health centers, as well as medical materials, medication and salaries.[11] From the responses of the heads of health facilities in the survey, we estimate the value of medical material received by all the primary health care providers in the country to approximately 50 million CFAF,[12] accounting for 17.7% of the total 282 million CFAF of materials received by all the regional delegations.[13] Only four health centers (2%) report receiving financial resources from the health administration in 2003.

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[11] Health centers report receiving no resources from regional delegations in the form of decentralized credits.

[12] The survey traced eight medical materials received by health centers. Health centers were questioned about the receipt of mattresses, beds, sheets, blankets, blouses for nurses and midwives, soap and detergent. The choice of these materials was based on their frequency in shipments. The risk of choosing a rare but high-value material would have been not finding that material in the visited health centers simply because not all of them were able to receive it. On the contrary, by choosing frequently-shipped materials of small value, it is likely that a maximum number of health centers will report receiving them. This gives us an upwardly biased percentage of health centers receiving materials from the authorities.

[13] According to the survey, 57 health centers (30%) received at least one of these materials in 2003 from the district or the delegation. The total value of materials is estimated at 1,750,000 CFAF. Given that these eight materials make up 7.4% of the value of centralized credit deliveries, we can estimate that health centers receive approximately 23 million CFAF in centralized credits. Given that the survey covers half the health centers, the estimate would therefore be 50 million CFAF for the entire country.

Lastly, the total value of medication received by health centers is estimated at about 20 million CFAF[14], accounting for less than 3% of the MOH official medication budget.[15]

Table 3 and Figure 2 summarize official health expenditures at the central level and resources actually received at the regional and local levels (excluding and including salaries). The first column of Table 3 shows the resources officially allocated to RHDs in the national budget. The second column presents the estimated resources actually reaching the regional level, and the third column presents the estimated public resources reaching the health centers. While regional health delegations are officially allocated 67% of MoH non-wage recurrent expenditures, the share of resources actually reaching the regional delegations is estimated at 18%. Leakage is also pronounced at the regional level, since the health centers, which are the frontline providers and the entry point for the population, ultimately receive less than 1% of MoH non-wage recurrent expenditures.

Table 3: Arrival of Public Resources in RHDs and Health Centers

	Resources Officially Allocated to RHDs		Resources Actually Received by RHDs		Resources Received by Health Centers	
	Excluding Salaries	Total	Excluding Salaries	Total	Excluding Salaries	Total
Millions of CFAF	5,470	8,030	1,461	4,021	71.1	2,631
% MoH non-wage recurrent budget	**67.4**		**18.0**		**0.9**	
% MoH recurrent budget	40.8	**59.9**	10.9	**30.0**	0.5	**19.6**

[14] We estimate the value of deliveries to health centers by using the drugs prices charged by the CPPA. The total value of deliveries is estimated at about 5 million CFAF for the 11 drugs and medical consumables monitored in the survey. Based on the fact that these items accounted for 55% of CPPA sales in 2003, we can estimate the total value of drugs received by the health centers to be 9 million CFAF, and for the country as a whole, 20 million CFAF.

[15] The total value of resources reaching the health centers is the sum of the financial resources, medical materials, drugs and salaries received by health centers from the health administration. We use the formula *Total resources reaching Health Centers = (Centralized credits reaching RHD and ad hoc orders)*17.7% + (Total Medication Budget)* 3% + Salaries.* The formula hides regional disparities in arrival rates but health center data do not allow for capture of all the variance at the RHD level. The figure is biased upwards because the entire payroll of the delegations is allocated to the health centers. In reality, the salaries of administrative personnel in the regions and in the hospitals would have to be deducted.

As observed in Table 3, human resources are the most important resources to reach the health centers. Taking wages into account, the share of total resources officially allocated to RHDs and reaching health centers is 19.6% (See also Figure 2)[16].

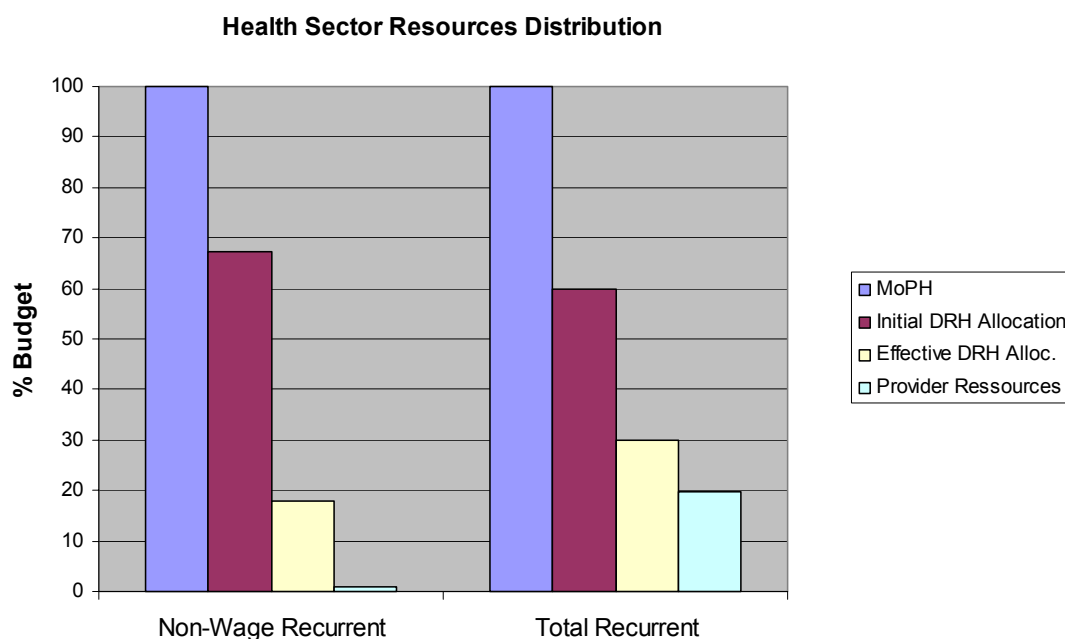**Health Sector Resources Distribution**

Figure 2: Public Resources in the Health Sector by Levels

Public resource arrival rates per capita vary considerably among regions. Table 4 presents planned and actual per capita public expenditures on health by region. The official recurrent health expenditure per capita (excluding salaries) is 681 CFAF (US$1.17) in 2003. Of this amount, we estimate that only 181 CFAF (US$0.31) reaches the regional level, and health centers ultimately receive about 10 FCFA

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[16] As a referee rightly points out, this figure tends to overestimate resources available for direct services at the provider level given that it does not account for staff absenteeism. Data on absenteeism was collected part of the survey and was estimated at 21%. Using this figure, the share of total resources reaching frontline providers goes down to 15.6%. However, this correction most probably still overestimates total resources available for direct services given that the methodology used in the survey to measure absenteeism was not specifically designed for such purpose and probably underestimate the problem. Indeed, the survey was carried-out using announced visits in order to realize a multi purpose data collection at the facility level, while adequate measurement of absenteeism would need to be carried out in the framework of un-announced and repeated visits (see for instance Chaudhury et al 2006).

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(US$0.02) per capita. The average Chadian loses 670 CFAF (US$1.15) between the health expenditure officially programmed in its region and the health resources actually available in the health center where he or she receives services.

The highest rate of leakage is observed in the BET region, the most remote area of the country, where each individual loses an average of 1960 CFAF (US$3.92) in official public health expenditures. Despite having the highest rate of leakage, the BET region still receives the highest level of resources per capita due to its very small population. The region with the lowest level of effective health expenditure per capita is the Tangile region, with about 2 CFAF per capita. This is due to a low planned expenditure level and a high rate of leakage.[17]

Table 4: Resources Per Capita in Regions and Health Centers

	Official Allocation RHDs	Allocation Received RHDs	Allocation Received HCs	Official Allocation RHDs	Allocation Received RHDs	Allocation Received HCs
	Excluding Salaries (CFAF per capita)			Including Salaries (CFAF per capita)		
Batha	1046.78	188.87	12.95	1282.57	424.66	248.74
B.E.T.	1989.69	595.73	38.02	2654.38	1260.53	702.82
Biltine	851.55	282.88	19.20	1105.22	536.59	272.91
Chari-Baguirmi	595.94	116.55	6.16	944.05	464.65	354.27
Guéra	679.31	160.42	4.00	924.34	405.43	249.01
Kanem	717.52	269.03	11.96	1591.94	1143.44	886.38
Lac	650.15	234.30	10.93	808.84	392.96	169.59
Logone Occidental	890.86	278.27	9.65	1368.20	755.61	486.99
Logone Oriental	537.85	187.32	8.13	709.74	359.19	180.01
Mayo Kebbi	476.66	206.48	15.43	738.07	467.89	276.85
Moyen Chari	582.85	139.77	7.25	890.45	447.39	314.87
Ouaiddaï	776.85	163.61	10.27	952.58	339.32	185.98
Salamat	1338.09	210.55	13.03	1551.18	423.59	226.07
Tandjilé	469.49	111.76	2.30	843.29	485.57	376.11
CHAD	680.5	181.8	9.6	999.0	500.2	328.1

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[17] These estimates do not account for hospital expenditures, which tends to introduce a downward bias, especially in regions such as Chari Baguirmi, where the capital is located.

With regard to human resources, public expenditures reaching final users increase from 9 CFAF to 328 CFAF per capita, since these are the principal resources made available to health centers by the MoH (accounting for 32.8% of total health operating expenditures).

4.3. Primary Health Care Revenues

The MoH budget officially allocates 60% of its recurrent budget to regional health delegations (67% of non wage recurrent budget). However, only 26.7% of this amount (excluding salaries) effectively reaches regional delegations. Furthermore, there exists a high level of retention of resources at the regional delegation and district levels. Ultimately, primary health centers do not have access to the public resources that were intended for them. Public resources reaching health centers are estimated at 1.3% and 0.9% of the regional delegations and MoH non-wage recurrent budgets respectively. These shares jump to 32.8% and 19.6% once wages are taken into account.[18]

This considerable leakage reduces the contribution of public expenditures in the primary health sector in Chad with respect to what it should have been. Table 5 presents the contributions of the various actors that finance primary care in Chad including donors and households or the communities who pay user fees.

Table 5: Actual Contribution to Health Center Operations (%)

	Public	Private	Faith-based	NGO	CHAD
% of revenues (Excluding Salaries)					
User fees	88.4	96.6	90.3	78.5	89.7
Donors	8.1	3.4	9.7	21.5	8.0
Government	3.6	0.0	0.0	0.0	2.3
% of total revenues					
User fees	62.4	93.0	86.9	42.7	69.7

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[18] Accounting for absenteeism, these figures go down to 26.1% and 15.6%. See Footnote 16.

Donors	5.7	3.2	9.3	11.7	6.2
Government	31.9	3.7	3.8	45.5	24.1

Source: Authors' calculations using Chad 2004 PETS/QSDS Survey

Contrary to the conclusions of previous studies (Ministère de la Santé Publique 2001, and World Bank 2004), we observe that user fess is the single most important source of financing for primary health centers. Government transfers account for only 2% of health centers' revenues (excluding salaries) and for one-quarter of their revenues once salaries are included. Most public health expenditures are consumed by the central and regional administrations that do not provide direct services to the population. Once labor resources are allocated, health centers are left to their own devices to finance their activities through user fees. The impact in terms of access is significant, since the health centers will tend to charge higher user fees to make up for their lack of resources, as we will see in the next section.

5   Econometric Analysis

In this section we examine the determinants of public resource allocation to regional delegations and local health centers and discuss the factors favoring leakage. We then examine the relationship between public expenditures and health services. In particular, we examine the link between health expenditures allocated to a region (or a district) and how they translate into health production. Finally, we examine the effects of leakage on service prices by looking at the prices of drugs sold by health centers.

5.1   Determinants of Public Resource Received by the Health Centers

Three main factors can be proposed to explain the low level of resources received at the decentralized level. First is the very high rate of resource centralization at the MoH level, second is the lack of supervision and control of resources, and third is the lack of planning in the allocation of resources. Allocations are arbitrary at every level. For example, once the delegated credits are allocated to regional administrators, they are entirely responsible for allocating those resources to the

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various district heads or health centers in their area. The MoH does not provide any guidelines for resource allocation. In other words, a health center receives public resources only if the administrative authorities arbitrarily decide so.

In order to examine the determinants of public resource receipt by health centers, we make use of a simple probit equation.

$$\Pr(A_{ij}^* = 1) = \Phi(\alpha_1 + \alpha_2 X_i + \mu_i)$$

where A_{ij}^* indicates whether or not health center i has received a strictly positive amount of public resource j (financing, drugs, material and total). X_i is a vector of health center and health administration characteristics and μ_i is an iid error term. In particular, X_i includes location, size in terms of number of employees, frequency of supervision visits by regional or district officials, and whether or not the center has received foreign donor support. The results are presented in Table 6.

Table 6: Regression Results: Determinants of Public Resource Receipt by Health Centers (Probit)

	(1)	(2)	(3)	(4)
	Financing	Drugs	Medical Material	Total Public Resources
Public		1.055 [0.109]	1.019 [0.161]	1.202 [0.271]
		(2.84)***	(3.26)***	(4.47)***
Urban	0.099 [0.005]	0.233 [0.032]	-0.111 [-0.021]	0.075 [0.021]
	(0.19)	(0.76)	(0.41)	(0.31)
Facility staff size	0.041 [0.002]	-0.041 [-0.005]	-0.076 [-0.015]	-0.049 [-0.014]
	(1.64)	(1.17)	(2.53)**	(1.92)*
Supervision from region	-0.394 [-0.019]	0.311 [0.043]	0.615 [0.129]	0.372 [0.106]
	(0.8)	(1.4)	(3.01)***	(1.99)**
Supervision from district	-0.003 [0]	0.227 [0.027]	0.496 [0.084]	0.391 [0.1]
	(0.01)	(0.72)	(1.57)	(1.47)
Support from donors		-0.342 [-0.038]	**-1.029 [-0.136]**	**-0.913 [-0.193]**
		(1.1)	**(3.32)***	**(3.39)***
Constant	-2.138	-2.246	-1.77	-1.629
	(5.48)***	(3.97)***	(5.05)***	(4.89)***
Observations	155	277	277	277

Pseudo R-squared	0.06	0.12	0.22	0.20
Log Likelihood	−17.4	−80.13	−107.04	−128.5

Absolute value of z-statistics in parentheses and marginal effects in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%.

The first three columns concern specific resources (financing, drugs and material) while the fourth presents the probability that a health center has received any type of public support.

As expected, public health centers receive significantly more resources than other facilities, while smaller clinics are more likely to receive public resources. Furthermore, the results show that the discretion of district and regional administrators has a significant impact on the probability of receiving public resources, in that the probability of receiving material resources increases significantly for health centers that have been visited by the regional delegate. This is also true for visits by the district head, but to a lesser extent.

Transfers of financial resources (column 1) are not governed by the same rules as material resources (column 3), since virtually no health centers received any financial support and no variable is significant. An interesting result is the negative and significant impact of support by foreign donors on the receipt of public resources (columns 3 and 4). This tends to indicate that foreign donor support has a strong crowding out or displacement effect on public resources; the presence of donor support reduces the probability of receiving public medical materials by 13.6% and any type of public resources by 19.6%.

5.2   Impacts of Public Resources on Health Service Production

We now examine the link between government spending and services actually provided. Do public expenditures have an impact on output in the health sector, in terms of patients treated in health centers? Several studies have questioned this relationship (Filmer et al, 2000). An initial response is given by Figure 3, which shows the relationship between expenditures per capita (in CFAF) in a regional delegation and the number of patients visiting local health centers per 1,000

inhabitants in a region. We compare the effects of initially budgeted and executed health expenditures (3A) and actual or effective health expenditures (3B).[19]

As shown in Figure 3(A), and contrary to World Bank (2004, figure 6.8 p. 133) results, public resources allocated to regional delegations (RHD) in the central budget appear to have a negative impact on health center output. Regions that were officially allocated the highest per-capita health expenditures present the lowest ratio of patients having received health services in the region. This result supports empirical observations of the weak correlation between official health expenditures and health indicators in several countries (see World Bank, 1993 and Filmer et al., 2000). In certain cases, it has even been observed that an increase in health expenditures is associated with a decrease in health indicators.

However, this negative conclusion does not hold once leakage of health expenditure is taken into account, and the reverse is actually true. Indeed, as illustrated in Figure 3(B) public expenditures do in fact have a strong positive impact on health output when they make it to the service delivery point. The main difference between Figures 3(A) and (B) is that in the second figure only effective public expenditures (that is, those that reach the regions) create this positive health impact. Public expenditures could therefore contribute to the improvement of the population's health, provided they reach them. The tricky part is how to make sure that public resources *actually* reach their intended beneficiaries especially when it is the governmental apparatus itself that prevents those resources to travel their full path.

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[19] Regional production is the number of consulting declared by health centers reported in the "Monthly Report of Activities" (RMA) sent to the MoH and consolidated by the DSIS. Figure 3 fits a simple regression line that does not control for all other variables that influence health production. Also as noted by a referee, BET, an apparent outlier, could be driving the relationships. Excluding BET, the slopes still keep the same signs and become even steeper.
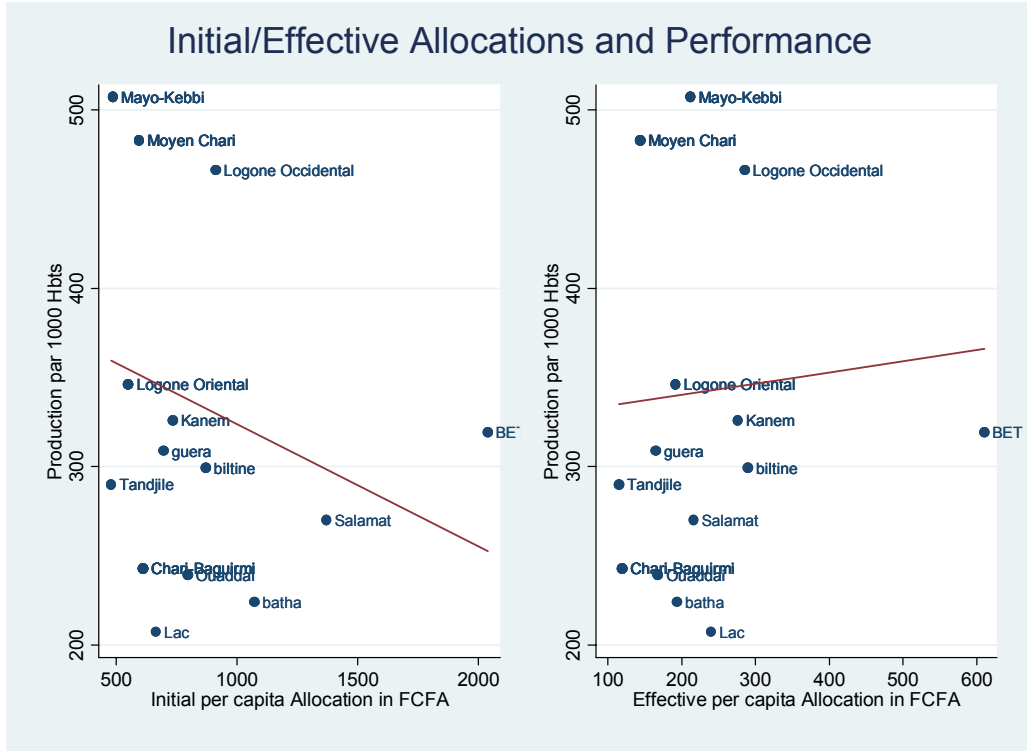
Figure 3: Operating Expenditures: Planned vs. Effective Resources and Performance

Figure 3 does not control for variables other than public spending that could affect health production. We therefore examine the relationship between official/effective health resources and health services through a more comprehensive regression analysis. We estimate the following equation:

$$C_l = \beta_1 + \beta_2 Y_l + \varepsilon_l$$

Where C_l is the number of patient consultations taking place annually in a region or a district l, Y_l is a vector of region or district characteristics, and ε_l is an iid error term. In particular, Y_l includes either planned or actual non-wage recurrent health expenditures in the region or district, the number of health centers and districts, the population served, the total revenues from user fess of health centers, and salaries. Table A2 in the Appendix presents summary statistics of variables. Table A2 in the Appendix presents summary statistics of variables.

Table 7 shows the regression results for the total number of consultations in the health centers of a region (columns 1-6) or a district (columns 7-8).

Table 7: Regression of Total Consultations and Health Expenditures
(Budgeted and Effective)

	Regions						Districts	
	Budgeted Public expenditures			Effective Public Expenditures				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Budgeted Expenditure	−125.4	87.182	195.72					
	(0.31)	(0.16)	(1.13)					
Effective Expenditures				1842.50	1867.08	693.716	1185.21	851.598
				(2.99)*	(3.06)*	(2.43)*	(3.05)**	(2.51)*
Nbr of Health Centers (1000)	1.5	3.7	−3.7	0.6	1.5	−4.3	1696.23	1156.66
	(0.43)	(0.74)	(1.98)	(0.28)	(0.68)	(3.68)**	(2.57)*	−2.01
Total Population	0.17	−0.001	0.078	−0.091	−0.068	0.166	0.15	0.107
	(0.4)	(0.002)	(0.47)	(0.6)	(0.45)	(2.49)*	(2.32)*	(1.92)
Total Revenues			1204.98			990.088		491.594
			(8.39)**			(6.98)**		(4.15)**
Nbr of districts (1000)	35.6	39.0	28.9	50.1	50.1	32.6		
	(0.83)	(0.88)	(2.01)	(1.68)	(1.7)	(2.80)*		
Total salaries		-285.001	324.518		−265.612	299.158		
		(0.63)	(1.99)		(1.11)	(2.46)*		
Observations	14	14	14	14	14	14	46	46
Adj. R-squared	0.69	0.67	0.96	0.84	0.85	0.98	0.57	0.69
Prob > F	0.0044	0.012	0.0000	0.0002	0.0006	0.0000	0.0000	0.0000

Note: Absolute value of t-statistics in parentheses. * significant at 5%; ** significant at 1%

At the district level, resources effectively received are delegated credit resources.

The coefficients associated with the number of health centers and districts have been divided by 1000.

The total population is that of the district or the region depending on the model considered. Similarly with total salaries and revenues. Revenues are those reported by health centers.

Official public resources allocated to regions are used as an explanatory variable in the first three regressions, and public resources actually received are used in the others. As observed, official health expenditures do not explain health output at the regional level (columns 1-3). The coefficient of official expenditures is not significant in the first three regressions (and is even negative in the first case). Only the third

regression includes a significant variable, the total revenues of health centers in a region. This suggests that only user fees are correlated with regional health output, a result one should expect.[20]

Let us turn next to effective health expenditures as a determinant of health output at the regional (equations 4-6) and district levels (equations 7-8). In all five regressions, the coefficients of effective health expenditure are positive and strongly significant. This suggests that public expenditures have a positive impact on health output at the regional and district levels. Indeed, for a million CFAF (US$1720) of effective public expenditures received in a region, 693 more patients would receive medical consultations in primary health centers in the region (see column 6).

As previously shown (Table 3), approximately 4 billion CFAF officially budgeted for regional delegations do not reach the regional level. Using the Model 6 coefficient of effective health expenditures, we can estimate that close to 3 million patients do not visit health centers because public resources do not reach service providers. Given that primary health centers in Chad have treated about 2.5 million patients in 2003, this provides a much better grasp of the impact of public resource leakage on health services in Chad; if all public resources had reached the frontline providers, the number of patients seeking primary health care in Chad would have more than doubled.

5.3   Leakage of Resources and Mark-up

One possible mechanism by which actual receipt of public resources would allow better access to health services is through the reduction of user fees, in particular drugs prices. Several empirical studies have shown that drugs costs constitute an important barrier to health service access. The population often does not go to health centers because they believe their resources will be insufficient to cover the total cost of the medical visit and prescribed drugs. In Chad, drugs account for roughly 75% of total medical costs for patients, and as much as 85% in rural areas. In this section, we examine the importance of leakage on the average mark-up charged by health centers on the price of medication, one of the main components of user fees.

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[20] There is no regression with "budgeted" expenditures for districts because the regions do not prepare budgets for their districts.

Most health centers have a pharmacy that sells drugs to patients. The survey collected information on 11 of the main drugs allocated by the MoH to intermediate levels and primary health centers, as well as information on drugs purchase prices at regional pharmacies and sale prices to patients.

Using this information, a simple average mark-up on drugs charged by health centers (i.e. the difference between purchase and sale prices) was calculated. The results are presented in Tables 8 and 9.

Table 8: Average Mark-up on Drugs by Facility Type (in CFA Francs)

	N	Mean	Median	Minimum	Maximum
Public	180	42.3	36.4	−655.7	244.3
Private	26	87.1	84.7	−32.9	301.7
Faith-based	38	73.0	53.4	−51.5	343.9
NGOs	5	92.4	44.3	0	217.3
Total	249	52.5	41.7	−655.7	343.9

Source: Authors' calculations using Chad 2004 PETS/QSDS Survey

Table 9: Average Mark-up by Facility Location (in CFA Francs)

	Mean	Median	Number of Health Centers
Rural	48.9	38.9	180
Other urban areas	41.4	34.1	34
Capital	81.5	64.4	35
Total	52.5	41.7	249

Source: Authors' calculations using Chad 2004 PETS/QSDS Survey

As observed in Table 8, the average mark-up on drugs sold by the 249 health centers that provided information is 52.5 CFAF (median 41.7 CFAF). Public facilities charge a much smaller mark-up, less than half that of private providers. NGOs and faith-based providers also charge higher mark-ups than public facilities. In the capital, mark-up is close to double that generally observed in rural areas,

while the lowest mark-ups are observed in urban centers other than the capital (Table 9).

5.4   Effects of Public Resource Leakage on Medication Mark-up

We have estimated the effect of public resource leakage on the mark-up charged by primary health centers. Table 10 presents regression results for the effect of public expenditures on drug mark-ups using OLS (columns 1 to 4). Because the bulk of the resources are sent to the regions which decide how to allocate them among health centers, the standard errors are clustered at the regional level to account for within-region correlation.

Our main variable of interest is a dummy indicating whether the health center was a recipient of public resources. We also include a set of facility characteristics, such as ownership status, location, the level of competition proxied by the number of health centers in a two-kilometer radius of the center, and salary levels. To reflect service quality, we also include the number of doctors in the facility, the number of beds, the availability of electricity and telephone, and if it offers housing to its personnel. We have also accounted for donor support.

One econometric issue that arises is that the level of competition among health service providers is unlikely to be exogenous; in fact, certain types of health centers are more likely to be located in certain areas. In particular, private health centers are more likely to be located in urban areas and faith-based centers in rural areas. In order to obtain consistent estimates, we have estimated the determinants of mark-up and competition using the two-stage-least-square method (columns 5-6).

Results for all the regressions show that there is a negative and significant relationship between average mark-up on drugs and effective transfers of public resources to health centers. Local health facilities that receive government transfers are able to charge lower mark-ups on medications than centers that do not receive transfers. Leakage of government resources thus appears to have a significant and negative effect on user fees and to constitute a barrier to health service access. It is

difficult with our data to figure out the reason why public resources translate into lower drugs prices and there may be several competing explanations.

The coefficient on competition does not have the expected sign since facilities that face greater competition seem to charge significantly higher mark-up. This may be explained by the fact that facilities that have more competitors are more likely to be private. Furthermore, we also observe that health centers located in rural areas tend to charge significantly lower mark-up than centers located in urban areas (omitted variable). Furthermore, the presence of doctors and of a mean of transportation in the health centers, are associated with higher mark-up, due potentially to higher costs. Access to a telephone is associated with lower mark-up, due potentially to better information.

For robustness purposes, similar regressions were run on the effect of effective transfers other than drugs (material and financing) and similar results were obtained.

Table 10: Regression Results: Mark-up and Receipt of Public Resources

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	2SLS	
	Mark-up	Mark-up	Mark-up	Mark-up	Mark-up	Competition
Received public Resources	−27.909 (2.96)**	−23.321 (2.45)**	−21.975 (2.36)**	−15.883 (2.50)**	-21.996 (1.92)*	
Private		30.881 (2.02)**	20.575 (2.53)**	14.673 (1.89)*	17.344 (0.83)	0.401 (2.30)**
Competition			9.722 (3.17)***	13.442 (2.42)**	2.199 (0.08)	
Rural				9.32 (0.52)	3.263 (0.09)	
Total salaries				0.003 (0.35)	-0.008 (0.56)	
Doctor				19.616 (5.69)***	19.910 (1.99)**	
Telephone				−39.566 (2.69)**	-57.427 (2.23)**	
Electricity				17.721 (1.68)	14.307 (0.77)	
Transportation				13.786 (1.31)	37.112 (3.09)***	
Housing				12.189 (0.92)	13.582 (1.17)	
Number of beds				−0.502 (2.73)**	-0.630 (1.22)	
Donor support Nbr				8.532 (1.15)	-3.290 (0.30)	
Capital						2.10 (13.21)***
Other urban areas						0.962 (6.31)***
NGO						0.145 (0.33)
Faith-based						-0.051 (0.37)
Donor support						-0.05 (0.39)
Age						0.007 (2.16)**
Constant	60.76 (6.24)***	56.179 (6.77)***	51.155 (6.71)***	23.906 (2.42)**	83.350 (1.55)	0.031 (0.35)
Observations	249	249	249	249	233	233
R-squared	0.03	0.04	0.06	0.12	0.24	0.52

Absolute value of t-statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

6   Conclusion

In 2003, the budget of the Chad Ministry of Health accounted for 8.4% of the total government budget, an increase of 24% over the previous year. The MoH allocates close to 60% of its recurrent budget to the regional delegations. Because of excessive centralization and major leakage of resources, the majority of this budget does not reach the regions. Regional delegations receive about 26% of the material and financial resources that were officially allocated to them, while the regional and district administration capture most of the resources allocated. Ultimately, local health centers receive less than 1% of the MoH non-wage recurrent budget officially allocated to the regions. The official health budget therefore bears no relation to the actual situation on the ground. Although the government officially allocates 680 CFAF (US$1.17) in health expenditures for the average Chadian, that person actually receives less than 10 CFAF (US$0.02).

The problem of service quality leads us to a fundamental question concerning poverty reduction: how do we ensure that the targeted recipients actually benefit from the resources? The main recommendations in this respect support the importance of an incentive system that would reward performance, as well as the importance of information systems and verification systems, the need to monitor resources to ensure that they reach their destination, and the introduction of allocation rules that would make allocation decisions more transparent. These elements are currently missing from the flow of resources in Chad's health system.

We have shown that current resource allocation seems to be linked to the discretion of regional and district administrators, and that international donor support introduces a strong crowding out effect, whereby health centers that received foreign assistance are less likely to be supported by higher administrative levels.

Also, we have shown that, contrary to pessimistic views, health expenditures do in fact have a positive impact on health services. While official expenditures seemingly have no impact on health output at the regional level, public expenditures that actually reach health centers do have a strong positive and significant impact on the number of ill individuals who seek care. We estimated that if all expenditures

officially targeted to regions had actually reached the health centers, the number of patients treated would have more than doubled.

One mechanism by which health expenditures could have an effect is through user fees. We examined the effect on medication prices and showed that leakage has a negative and significant impact on the prices of medications sold by health centers. Health centers that do not receive public support tend to charge significantly higher mark-ups on medications than centers that receive public resources.

Since the beginning of the new initiative in the context of petroleum production, health expenditures and expenditures in other social sectors have increased but without noticeable impacts on social indicators. The low percentage of public resources actually received at the operational level could certainly explain a large part of this phenomenon. Given that the country's health policy is based on districts, administrative levels and health center services, and given the absence of resources for them to function normally, it is the entire strategy that is called into question.

Although this study focuses on the health sector, its conclusions regarding the problems of delivering public resources probably also concern other sectors, such as education, agriculture and public works. A major reform of the public management and public expenditure system is required in order for service facilities and the population in general to benefit from the public resources allocated in the national budget. The implications of this are important for poverty reduction and growth.

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Appendix

Table A1: Public Resources Reaching Regional Health Delegations
(in Million CFAF)

	Financial Resources	Material Resources		Total
	Delegated Credits	Deliveries from Centralized Credits	Ad Hoc Requests	
Regional Delegation				
Batha	51.08	16.08	0.10	67.26
B.E.T.	39.79	12.42	2.45	54.66
Biltine	45.72	18.64	1.32	65.69
Chari-Baguirmi	151.77	22.06	7.06	180.89
Guéra	59.78	0.00	1.47	61.25
Kanem	77.82	17.70	0.00	95.52
Lac	60.48	14.08	0.00	74.56
Logone Occidental	141.76	17.05	0.24	159.05
Logone Oriental	86.46	17.05	0.38	103.89
Mayo Kebbi	137.29	20.19	57.52	215.00
Moyen Chari	105.42	23.34	0.00	128.76
Ouaiddaï	85.33	24.76	0.49	110.58
Salamat	39.19	0.00	8.56	47.75
Tandjilé	63.26	0.00	0.00	63.26
TOTAL	1145.15	203.38	79.60	1428.13
% Operation RHD	14.3	2.5	1.0	17.8
% RHD (Excl Sal.)	20.9	3.7	1.5	**26.1**
% Operation MoH	8.5	1.5	0.6	10.7

Source: Authors' calculations using Chad 2004 PETS/QSDS Survey

Table A2: Descriptive Statistics

Variable	N	Mean	S.D.	Min	Mdn	Max
Regions						
Nbr of Consultations	14	129.5	108.9	17.3	93.6	363.6
Official Expenditures	14	390.7	208.74	186.4	309.76	955.02
Effective Expenditures	14	104.36	52.66	49.7	86.13	218.1
Nbr of Health Centers	14	46.79	27.43	13	45	106
Total Population	14	560.16	390.88	91.4	466.65	1563.46
Total Revenues	14	113.92	105.4	7.48	88.36	361.54
Number of districts	14	3.43	1.55	2	3	7
Total salaries	14	182.86	146.9	50.3	109.7	557.86
Districts						
Nbr of Consultations	52	51.3	37.0	5.7	41.5	167.6
Effective Expenditures	46	14.28	11.02	4.26	11.38	66.16
Nbr of Health Centers	48	13.65	7.25	1	11	38
Total Population	50	156.84	68.49	34.61	152	347.32
Total Revenues	52	30.67	30.69	0	19.21	120.38

Source: Authors' calculations using Chad 2004 PETS/QSDS Survey.
Note: Number of consultations and total population are in thousand. Expenditures, total revenues and total salaries are in million CFA francs.

Variable	N	Mean	S.D.	Min	Mdn	Max
Health Centers						
Received public resources	281	0.27	0.44	0	0	1
Private	281	0.32	0.47	0	0	1
Competition	281	1.22	1.89	0	0	10
Rural	281	0.68	0.47	0	1	1
Total salaries	281	339.23	448.99	0	183	3779
Doctor	281	0.23	0.78	0	0	6
Telephone	281	0.14	0.35	0	0	1
Electricity	281	0.34	0.47	0	0	1
Transportation	281	0.52	0.5	0	1	1
Housing	281	0.37	0.48	0	0	1
Number of beds	281	2.88	9.59	0	0	134
Donor support Number	281	0.21	0.46	0	0	2
Capital	281	0.19	0.39	0	0	1
Other urban areas	281	0.14	0.34	0	0	1
NGO	281	0.02	0.16	0	0	1
Faith-based	281	0.16	0.36	0	0	1
Donor support	281	0.19	0.39	0	0	1
Age of clinic	261	16.3	15.1	0	10	69

Source: Authors' calculations using Chad 2004 PETS/QSDS Survey
Note: Salaries are in thousands of CFA francs and on a monthly basis.