

Institutions and Hospital Efficiency in Cameroon: A Data Envelopment Analysis

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ABSTRACT

One of the objectives of the Cameroon Health Sector Strategy is to improve the efficient use of resources in the health sector. To accomplish this goal, the government implemented a series of reforms to improve accountability among the different stakeholders of the health sector. This paper employs data from 54 peripheral public health centre (PHC) from the Cameroon 2004 PETS to examine the extent to which the observed performances of the health sector are related to the institutional reforms. We find that the average technical efficiency score is around 0.7098 and that urban PHC perform better than rural ones. We also find that compact failures have a deterrent effect on the technical efficiency of these PHC and that client-power is an effective way of overcoming these government failures. As competition between public and private healthcare facilities has a negative effect on PHC performances, this study calls for institutional mechanisms that will reduce sorting, promote equal access to quality healthcare services between rich and poor people, and advocates for the participation of the local population in the management of PHC.

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INTRODUCTION

Following the refinement of the human capital theory and its applications to issues related to welfare and development, it is now widely accepted that health can affect productivity (Strauss and Thomas, 1998), economic growth, and even the economic development (Gallup and Sachs, 2001; WHO, 2001). Beyond the role of health in the economic development, it is also accepted that the development of a society can to an extent be judged by the quality of its population's health (WHO, 2008). As a consequence, addressing the increasingly complex public health threats has always been a challenge to policy makers in most of the developing countries. To meet this challenge, most of them have engaged in a series of reforms in order to increase access to healthcare services through improved delivery. As far as Cameroon is concerned, public authorities adopted an input-focused strategy to fight against diseases, to improve equity and access to healthcare for all the Cameroonians.

But, despite the multiple administrative reforms conducted within the country and despite the resources invested in the health sector, the Cameroon healthcare system has not been successful in delivering adequate healthcare services to all the population around the country. Most of the observed shortcomings are related both to the limited accessibility of health facilities² and the inefficient use of the available human and financial resources³. Considering the

² As far as health facilities availability, Kamgnia (2001) indicated that for malaria treatment in Yaoundé, individuals resort first to a blend of modern health services (41%), then to self-medication (44%), accessorily to traditional healers (10%) and to other strategies included no-treatment (3%). Along the same lines, the 2004 PETS survey revealed that patients have to cover almost 3.9 km (respectively 5.2 km) to reach the nearest public (respectively private) health facility. Patients had to cover a mean distance of 6.2 kms to reach the nearest district hospital, 3.9 kms for the nearest Sub-divisional Health Centre, and 2.7 kms for the nearest Integrated Health Centre. This may justify why the 2006 Multiple Indicator Cluster Survey (MICS) observed that only 45 percent went to modern healthcare centres to seek care, 44 percent used self-medication, 8% non-medical structures (street vendors of drugs, traditional or religious healers, and so on), and 5% didn't seek for care.

³ The 2004 PETS survey revealed that absenteeism was an important concern in the existing health facilities and the absenteeism rate of the medical staff was estimated at around 3% in district hospitals, 8.5% in Sub-divisional Health Centres, 10.4% in Integrated Health Centres. Around the country, the highest levels of absenteeism are registered in the Far-North region (17%), in the Admaoua region (14%) and the East region (13%); Douala (1%) and the West (2%) regions being the less concerned with that phenomenon. This absenteeism finds its roots in the quest of financial compensation by many civil servants out of the hospital to consult in private clinics and health centres. As a consequence, scarcity of caregivers in state hospitals forces some patients to propose additional payments to health professionals in the hope to be consulted more promptly or to receive the timely and needed care.

limited availability of the resources to finance the rising demand for better quality and increased healthcare, recent research indicates that maximizing efficiency in hospitals is an important factor for hospital executives as the potential for cost savings is greater if the healthcare institutions are operated as efficiently as possible (Harrison et al. 2004; Rodriguez-Alvarez et al. 2004). Thus, improving the efficiency of the healthcare providers is an important issue in the Cameroon context.

The World Bank (2004) exposit that successful and efficient service delivery emerges from institutional relationships in which the actors are accountable to each other. In accordance to this view, we believe that good practices do not emerge spontaneously or naturally out of the good hearts of individual bureaucrats and politicians, but they are the result of a tough, and often conflict-ridden, process of institutional design in which the principle element is the accountability of public officials. Building on these arguments, this study seeks to determine the extent to which the institutional framework of health care provision in Cameroon determines the level of efficiency of the basic healthcare facilities.

The remainder of this paper is organised as follows. The second section presents the institutional framework of the Cameroon healthcare system and the third section describes the methodology and data. Section four discusses the results of the study and the last section concludes.

THE INSTITUTIONAL FRAMEWORK OF HEALTHCARE PROVISION IN CAMEROON

Since mid-1980s, Cameroon engaged in a strategy of *Reorientation of Primary Healthcare*; a strategy of the national health policy which included a series of reforms of its health system. Primary elements of these reforms included: (i) decentralizing authority to the district level; (ii) reorganizing and integrating healthcare delivery to provide universal access to a minimum package of essential services⁴; (iii) instituting community financing and co-management of health

⁴ To ensure a regular supply of essential drug to health facilities, health sector reforms were accompanied by a number of other measures, among which the replacement of the National Pharmaceutical office (ONAPHARM) which had gone bankrupt in 1988. New drug supply structures were created at the central and regional levels. At the central level, the *Centre Intérimaire d'Approvisionnement en Médicament Essentiels* was established with the support of GTZ and the European Union to procure essential drugs⁴. To ensure the regular supply of drugs to health facilities through the regional pharmaceutical supply centres (CAPP), 1997 saw the creation, at the central level, of a national purchasing authority of essential drug and medical supplies named *Centre National d'Approvisionnement en Médicaments et Consommables Médicaux Essentiels* (CENAME).

services. Thus the actual national health system is an outcome of those reforms with the main actors being the state, the citizens (that is the households), and the healthcare providers.

THE STATE

The reform of the health sector through the Reorientation of Primary Healthcare led to the reorganisation of the Cameroon national health system into three levels: the central, the intermediate, and the peripheral (see on Table 1). At the central level of this pyramidal structure, the Ministry of Public Health defines and regulates the implementation of the National health policy. Halfway between the top and the peripheral level, the state apparatus is made of ten regional representation of the Ministry of Health. These representations are in charge of the definition of programs according to the policy orientations given by the central level. At the peripheral level, each region is divided into health districts that are in charge of implementing health programs⁵. The state provides both human and financial resources to public healthcare facilities and financial resources to some private healthcare facilities.

The bulk of the budget of public healthcare facilities comes from the budgetary allocations by the Ministry of Economy and Finance. With the exception of salaries which are paid directly to all government staff by the Ministry of Economy and Finance, resources allocated to government Ministries are made in the form of vouchers which may be cashed in any public treasury in the country. To ensure an effective and proper use of these financial and human resources, the government arranged some accountability mechanism between him and healthcare providers in such a way that he can "*compacts*" with them. For example, the Ministry of Public Health is responsible for administrative and technical supervisions of healthcare centres while the Ministry of Economy and Finance is in charge of the financial control. As far as the financial control is concerned, it is aimed at making sure that the use the budget is conform to budget authorizations. The supervision by the Ministry of health is aimed at ensuring an efficient management of healthcare centres.

About 74.63% of health centres reported to have been supervised at least once in 2003. Provided each health facility is supposed to be supervised four times in a year, table 2 reveals an uneven distribution of the number supervisions

⁵ Each health district is split up into health areas, the later being made of villages with 5 to 10 thousand inhabitants in the rural zone and with 10 to 30 thousand inhabitants in the urban zone.

visits both around regions and types of health centres. Information collected from the sub-divisional offices of the Ministry of Public Health reveals that the main objectives of these visits were oriented towards the control of pharmacies (15.9%), the supervision of healthcare services and the functioning of the health centre (4.54%), the monitoring of the personnel performances (4.54%), the financial control (3.4%)⁶, and the technical supervision (3.4%).

Table 1: Cameroon health system pyramid

Level	Administrative units	Competences	Healthcare Facilities and categories	Dialogue structures
Central	Central services of the MoPH	-Formulation of concepts, policies and strategies; -Co-ordination; -Regulation	- Referral General Hospitals; - University Teaching Hospital; - Central Hospitals.	Boards of Directors or Management Committees
Intermediary	Regional delegations	Technical support to health district and to programs	Regional Hospitals and the like	Regional Special Funds for health promotion
Peripheral	Health Districts services	Implementation of programs	-District Hospitals -Sub-divisional Medical Centres -Integrated Healthcare Centres	District/ Sub-divisional Management Committee
MoPH= Ministry of Public Health				

At the end, supervision, monitoring and evaluation activities seems to be weak, since activities related to the adequate use of resources the effectiveness of healthcare services seems rarely mentioned. Supervisors report that, at the end of the supervision process they either send congratulations in case of satisfactory results or guidance and orientations to those whose performances were not satisfactory; sanctions being rarely given.

⁶ This financial control refers to the control of resources generated by user fees and the control of accountability documents on the use of the allocated state budgets.

Table 2: Supervision visits by region and type of healthcare facility

Region	Type of health facility			
	DH	CMA	CSI	Total
Yaoundé	2	2	2	2
Douala	4	4	4	4
Center	2	2	3	2
Adamaoua	5	7	4	5
East	1	1	1	1
Far-north	2	6	4	4
Littoral	4	4	4	4
North	3	3	3	3
Northern-West	3	3	3	3
West	3	3	3	3
South	4	4	5	4
Southern-West	1	2	1	1
Overall	3	3	3	3
Source: Cameroon 2004 PETS Survey				

CITIZENS

Households are expected to play an important role in the definition, planning and implementation of the national healthcare policy. As a consequence, their “*voice*” was institutionalized through their participation in the political process and their “*power*” as clients through the capacity to monitor the provision of healthcare services was institutionalized through two channels. The first one was the institution of users’ fees and the free choice of the provider. The second one was instituted by Cameroon authorities in 1999 through community participation in the management and functioning of health centres. In each health district and for each healthcare unit two representatives of the local community participate in collaboration with health professional as members of the Management Committee to the financial management of resources generated by user fees and drugs sales in the public healthcare centres. The session meetings of the Management Committees are supposed to take place four times in a year.

The creation of these institutions for local people representation at each level of the healthcare system was expected to guide the public healthcare

facilities towards best-practices and increase the citizen's influence (i.e., transforming citizens from "*passive consumers*" to true clients). Even so, and in spite of awareness of efforts undertaken by the Ministry of Public Health in favour of the population, households remain vulnerable to deviant behaviour among health workers (poor reception, double payments, corruption, diversion of patients, parallel sale of drugs, and the illegal practice of medicine). For instance, in 2006 Transparency International classified the health sector at the 9th rank among the 20 sectors most concerned by corruption in Cameroon. In fact, the caregiver-patient relationship is facing several unethical practices that amongst which, racketing/extortion through threats, violence/blackmail, and nonofficial payments. The 2001 Household Survey revealed that the major form of corruption in the health sector was the forced payment of non-statutory fees⁷. Satisfaction surveys in the Cameroon 2004 PETS revealed that 12% of users voice trafficking and merchandising around healthcare and health services. Among the patients who visited public health centres, 38.2% reported that consultation prices were not pasted up as requested by the MoPH and 5.0% reported that even though these prices were pasted up, they paid more than they were supposed to. When asked for experiences of corruption in health facilities, the percentage respectively varies from 21.9% in National and regional hospitals, 17.8% in district hospitals, 13.1% in Sub-divisional Medical Centres, and 3%, Integrated Healthcare Centres.

THE HEALTHCARE PROVIDERS

As far as Cameroon healthcare providers are concerned, they are also classified in three levels. At the central level, there are two hospitals of the first category and three hospitals of the second category located in Yaoundé and Douala⁸. At the intermediary level, the Cameroon national health system has ten regional hospitals offering specialized healthcare services with a capacity of almost 200 beds and a personnel made of many "specialised doctors". These healthcare units serve as the highest level of referral to districts and integrated healthcare centres.

⁷ That is unregistered billing; extra-billing of real or presumed complementary services for their supposed rapidity or quality; payment for services which in fact have not been rendered; payments for services that are officially free of charge or subsidized such as mosquito nets and HIV screening and, the issuing of fake medical certificates.

⁸ The two hospitals of the first category are the General Hospitals of Yaoundé and Douala and the three hospitals of the second category are the Central Hospital of Yaoundé, the Centre Hospitalo-Universitaire of Yaoundé, and the Laquintinie hospital of Douala.

At the peripheral level, Cameroon's authorities set the Health District as the corner stone of the health sector strategy. Among the resolutions of this strategy was the decision to stop building Sub-divisional Medical Centres (CMA) and to transform all the existing ones into District Hospitals. However, not all the CMAs were transformed into DH and actually many CMAs exist in many health districts around the country⁹. Thus, DHs, CSIs, and CMAs are the three types of healthcare centres existing at the peripheral level in Cameroon. In 2008, the number of public healthcare facilities at the level of the health districts was around 2207 (that is 164 DHs, 155 CMAs, 1888 CSIs) and private non-profit health centres were 760 (MoPH, 2009).

The DHs, CSIs, and CMAs are assigned the role of interface between the community and health services and are supposed to serve as the locus for integrated, continuous and comprehensive healthcare with the District hospital as first level of referral. The 2001 Health Sector Strategy proposed a set of reforms to be conducted to face up the health problems of the population. One of its objectives was to set up a health facility delivering the Minimum Health Package (MHP) at an hour walk and for 90% of the population and the Complementary Health Package (CHP). The MHP refers to the minimum curative, preventive, promotional, rehabilitation and management activities that should be carried out at the first level of the health pyramid by a CSI/CMA, so as to ensure the availability of quality healthcare and services to the local population.

Specifically, the minimum services offered by CMAs and CSIs are of three types. First, they provide services aimed at reducing the prevalence of some recurrent and chronic diseases and refer serious cases to the DH when needs be. Second, they provide preventive care services for pregnant women and preschool children through preventive consultations and vaccinations. Third, they provide health promotion services by organizing several activities related to individual hygiene (*vector control; food hygiene; hand and body hygiene; improvement of the living environment*) and to the monitoring and protection of potable water sources (*promotion of water purification techniques*). Though the two kinds of

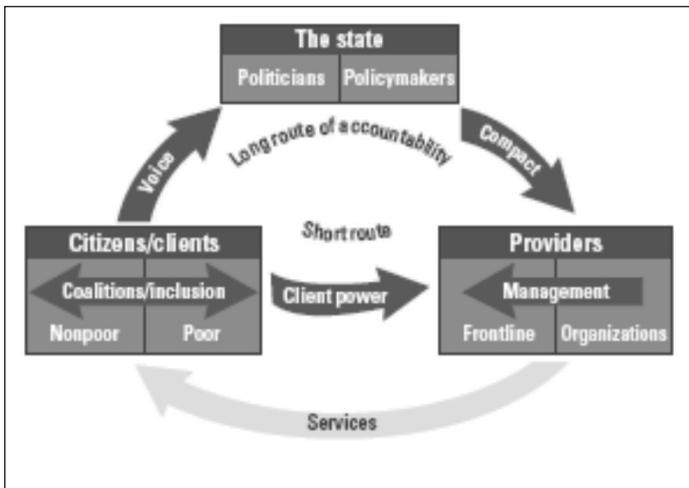
⁹ Private health centres are *de facto* integrated into the Health District. With a great number of health facilities around the country, the private sector plays an important role in the provision of health services. In this category, confessional health facilities represent around 40% of the existing healthcare services.

health facility have the same range of activities, the CMA is led by a doctor while the CSI is headed by state-registered nurse¹⁰ directing many nurses.

The DH being the first level of orientation and referral, a set of additional activities to be undertaken at its level were understated in the CHP to supplement the MHP and ensure continuity of quality healthcare and services in the health district. In addition to the services offered in the CMAs and CSIs, district hospitals care for patients referred to their level and for specific cases related to cardiopathologies, diabetes, malnutrition, serious pneumonia, paediatrics, serious cases of infant dehydration, serious cases of measles, and obstetrical gynaecologic matters.

Building on the above information, the institutional framework of healthcare provision can be summarized (see on figure 1) as a situation where the state (the Principal) contracts a provider (the Agent) to deliver health services to a third party (the local population).

Figure 1: Key relationships of accountability



Source: 2004 World Development Report

Because the principal is not the recipient of the service, he is not automatically in possession of the information required to judge whether the agent is fulfilling the contract and this limits his ability to enforce that contract. In an effort to address this problem, the principal defines a monitoring system (by

¹⁰ A traduction of the French expression "Infirmier Diplômé d'Etat".

divisional and sub-divisional representatives of the MoPH) to collect the required information, process it, and define measures that can orient providers' behaviour towards good and efficient practices. Citizens can also influence the behaviour of the Agent either directly through their participation to the management committees and their "exit" options, or indirectly through the "voice" option. Our particular interest in this setting is to determine whether the above defined accountability mechanisms impact public healthcare unit performances, in terms of efficiency.

METHODOLOGY AND DATA

The methodology of this study followed a review of the existing literature on the estimation of health units' performances and identification of their determinants. Based on this, the impact of the institutional and some other environmental factors on the Cameroon peripheral healthcare centres' efficiency was assessed using both qualitative and quantitative data.

THE ESTIMATION OF EFFICIENCY SCORES

There has been an extensive amount of literature examining the performance of the healthcare sector and studies have been undertaken in all areas of the health sector, ranging from primary care to secondary care, tertiary care to nursing home care, as well as from the overall health system to healthcare providers, administration bodies, and subgroups in healthcare providers such as departments and professionals (for a review see Hollingsworth et al. 1999; Hollingsworth, 2003; and Worthington, 2004). Of the empirical studies on healthcare centres performances many have investigated the technical efficiency¹¹ which refers to the use of productive resources in the most technologically efficient manner.

Put differently, technical efficiency implies the maximum possible output from a given set of inputs. Within the context of healthcare services, technical efficiency may then refer to the physical relationship between the resources used (say, capital, labour and equipment) and some health outcomes. According to Hollingsworth et al. (1999), over 91 efficiency studies were published in peer-reviewed journals as of 1997. By the end of 2002, this number was in excess of 188 (Hollingsworth, 2003).

¹¹ See for example studies by Lopez-Valcarcel and Perez (1996), Borden (1988), Chern and Wan (2000), Biørn et al. (2003) or Chu et al. (2004).

The two most commonly used approaches are data envelopment analysis (DEA) and stochastic frontier analysis (SFA). Both are similar in that efficiency is measured relative to a best practice (or efficient) frontier. Deviations from this frontier (usually measured as a geometric distance) give measures of (relative) efficiency¹². The DEA method was first developed by Charnes et al. (1978), based on the work of Farrell (1957) on efficiency measurement. This model known as the CCR model assumes a production technology with constant returns to scale, implying that any proportional change in inputs usage results in the same proportional change in outputs. It was then extended by Banker et al. (1984).

To measure the relative efficiency of Cameroon peripheral healthcare centres, we use this model known as the BCC model which relaxes the assumption of constant returns to scale to allow for variable returns to scale. Based on the fact that resources are scarce in Cameroon, we believe that providing the services to a greater number of individuals with the actual resources spent is more important than lowering the resources spent, keeping the output at its observed level. In such a case, the output-oriented technical efficiency is the appropriate measure of performance (Kimenyi et al., 2006). A hospital will be declared inefficient if it could have produced greater amounts of its output with the same amount of resources it used. This output-oriented BCC model is formulated as follows: Let

$x^j = (x_1^j, x_2^j, \dots, x_n^j)$ be the bundle of n inputs used and $y^j = (y_1^j, y_2^j, \dots, y_m^j)$ the bundle of m outputs produced by a basic health unit $j(j=1,2,\dots,N)$.

Suppose that k is one of the observed health facilities for which we wish to measure the technical efficiency. If its observed input-output bundle is (x^k, y^k) , the relevant DEA linear program (LP) problem becomes:

¹² See Friesner et al. (2008) for a more detailed discussion.

$$\begin{aligned}
 & \text{Max } \varphi \\
 \text{st } & \sum_{j=1}^N \lambda_j x_{ij} \leq x_{ik} \quad (i = 1, 2, \dots, n) \\
 & \sum_{j=1}^N \lambda_j y_{rj} \geq \varphi y_{rk} \quad (r = 1, 2, \dots, m) \\
 & \sum_{j=1}^N \lambda_j = 1 \\
 & \lambda_j \geq 0 \quad (j = 1, 2, \dots, N); \varphi \text{ unrestricted}
 \end{aligned} \tag{1}$$

The technical efficiency score of firm k is measured by $\tau_k = \frac{1}{\varphi^*}$ where φ^*

represents optimal solution of the DEA LP problem. Due to the fact that the distribution of efficiency is likely to be affected by the definition of outputs and the number of inputs and outputs included (Magnussen, 1996), our Data Envelopment Analysis (DEA) study requires the careful selection of outputs and inputs. To date, there is no statistical technique to unambiguously determine inputs and outputs for measuring efficiency using DEA. Generally, input choice is justified by the fact that the hospital production process is largely administrative and extensively uses the qualified labour and beds to deliver the healthcare services. Based on prior research on hospital efficiency, the input and output variables used to estimate these efficiency scores, were derived from the Cameroon 2004 *Public Expenses Tracking Survey* (PETS)¹³ which covered the 2001-2002 and 2002-2003 fiscal years and collected on 144 healthcare units in twelve regions of Cameroon.

The following five inputs were considered for the estimation of the DEA model.

¹³ During the Cameroon 2004 *Public Expenses Tracking Survey* (PETS), questionnaires were administered to many stakeholders of the healthcare delivery chain amongst which, the central and external services of the Ministry of Public Health for questions related to budget matters, to the peripheral healthcare centres (DHs, CMAs, and CSIs), and to the beneficiaries patients households. Data are available for twelve regions of Cameroon that is the ten regions, Yaoundé, and Douala the main cities. Overall, 46 external services of the MoPH, 144 healthcare units, 1512 households, and 1440 patients were surveyed. Information was also collected on 1853 members of the personnel of the health centre.

1. **HQCAREGIVERS:** the number of highly qualified health care givers comprising the doctors and the state-registered nurses.
2. **NURSEASSIST:** the number of nurse-auxiliaries in the health centre.
3. **OMEDSTAFF:** the number other medical staff which could not be ranked within any of the above categories.
4. **ADMINSTAFF:** the number of administrative personnel working in the healthcare facility.
5. **BEDS:** the number of available beds for inpatient treatment to proxy capital input.

As far as the outputs variables are concerned, a common approach consist in choosing volume measures that do not intend to reflect the quality of the service rendered but are assumed to somehow positively influence the health status of the population. Given the quality constraints imposed by the data set and the homogeneity constraints imposed by the type of services delivered by the health centres, we consider two outputs:

1. **CONSULTATIONS:** the number of patients consulted which includes consultations for prenatal care, consultations for under-five-years children, and consultations for general care.
2. **B-DELIVERIES:** the number of birth-deliveries registered in the health centre.

Our final data set consists of annual observations regarding the functioning of 54 health centres; that is, 20 district hospitals, 17 sub-division health centres, and 16 integrated healthcare centres. Table 3 summarizes the descriptive statistics of our data set, where we observe the significant variation in the inputs and the outputs across healthcare centres. It shows that an important number of health facilities have the only a single unit of some of the inputs. While all the DH hospitals have at least one highly qualified caregiver (Doctor or State-registered-nurse), two rural CMAs has only a Doctor as a highly qualified caregiver. All the Six CSIs that had just one State-registered-Nurse as the highly qualified caregiver were also located in the rural area.

When it comes to the endowment of health care centres in Nurse-Assistants, it appears that only one rural CMA had a single Nurse-Assistant, working together with one lab-technician nurse, one State-Registered nurse and one Doctor. Nine rural CSIs had only one Nurse-Assistant, most having no doctor and at most three State-Registered-Nurses. In what concerns the outputs, there is

an important variability in the volume of services delivered by the healthcare centres of our sample.

It can be seen from table 3 that the lowest mean number of consultations was registered by the CSI. Though DHs and CMAs are not statistically different in terms of their volume of consultations, they really differ in the volume of birth-deliveries registered.

Table 3: Descriptive statistics on DEA variables

Variables	INPUTS					OUTPUTS	
	ADMINSTAFF	HQCAREGIVERS	NURSEASSIST	OMEDSTAFF	BEDS	CONSULTATIONS	B-DELIVERIES
Overall (Obs=108)							
<i>Mean</i>	7.092	7.907	7.092	4.342	33.138	3971.111	258.453
<i>Min</i>	1	1	1	1	1	45	7
<i>Max</i>	65	51	32	26	178	36119	3150
<i>Mean (urban)</i>	11.533	14.933	13.033	6.566	47.466	7717.867	597.3
<i>Mean (rural)</i>	5.384	5.205	4.807	3.487	27.62	2530.051	128.128
District Hospitals (Obs=40)							
<i>Mean</i>	8	14.325	13.425	5.875	64.95	5438.75	419.75
<i>Min</i>	1	2	2	1	15	440	7
<i>Max</i>	36	51	32	26	178	26574	3150
<i>Mean (urban)</i>	8.875	20.812	18.687	8.625	76	8526	831.50
<i>Mean (rural)</i>	7.416	10	9.916	4.041	57.583	3380.583	145.25
Sub-division Medical Centres (Obs=34)							
<i>Mean</i>	9.470	6.029	4.852	4.235	20.235	4689.471	183.764
<i>Min</i>	1	1	1	1	4	45	17
<i>Max</i>	65	17	15	15	60	36119	1080
<i>Mean (urban)</i>	19.25	11.375	8.75	5.375	20.25	11182.13	409
<i>Mean (rural)</i>	6.461	4.384	3.653	3.884	20.230	2691.731	114.346
Integrated Healthcare Centres (Obs=34)							
<i>Mean</i>	3.812	2.312	1.937	2.50	8.531	1469.438	117.343
<i>Min</i>	1	1	1	1	1	178	8
<i>Max</i>	22	6	5	8	24	6351	650
<i>Mean (urban)</i>	8.333	4	3.666	2.666	7.666	943.333	223.333
<i>Mean (rural)</i>	2.769	1.923	1.538	2.461	8.730	1590.731	92.884
Source: Cameroon 2004 PETS							

Contrary to this observation, CMAs and CSIs are much closer one to another in terms of the birth-deliveries registered and are statistically different in their volumes of consultations. An urban-rural comparison shows that rural DHs and CMAs registered lower levels of consultations and birth-deliveries.

THE IDENTIFICATION OF FACTORS EXPLAINING THE EFFICIENCY SCORES

The second step of this study is to relate the inefficiency scores to a number of explanatory variables, including observed characteristics of the hospitals and environmental variables. Since efficiency scores computed from the DEA model are censored at zero and one, an OLS regression that assumes a normal and homoscedastic distribution of the disturbance and the dependent variable would produce biased and inconsistent parameter estimates because the expected errors will not equal to zero. Thus, to identify the characteristics associated with the efficiency measures, the Tobit model emerges as the appropriate analytical tool for censored variables (Ferrier and Valdmanis, 1996).

The explanatory variables can be classified in three categories the institutional factors, the healthcare centres' specific factors, and other environmental factors. As far as institutional factors are concerned, it is recognized by the economic literature that principal-agent problems that are prevalent in the public sector can result in inadequate combination of inputs and outputs and negatively affect the productivity (Hofmarcher et. al., 2002). To account for these problems two explanatory variables have been identified:

1. SUPERVISION captures the ability of the State apparatus to influence the functioning of the health centre (*COMPACT*). It is a binary variable indicating whether or not the health facility was supervised by central administration in 2003¹⁴. Table 6 show that around 38.80 percent of the health facilities of our sample were supervises in 2003. It is believed that this mechanism can have either a positive influence or a negative influence on the functioning of the health facility. In fact, if the control mechanism is done according to the rules, it is expected to have a positive influence on the efficiency scores.

On the contrary, if there is corruption and collusion between the supervisor and the supervised, as it often the casse, the supervision will have no effect of the functioning of the health centre. It can even worsen the use of resources since the presence of the sub-division (even department and regional) representatives of the MoPH usually lead to stopping of work and unexpected

¹⁴ Ideally, the number of times the health facility could have also been used. But because of missing values in the latter, we decided to consider only the binary variable.

budget expenses. And the better the supervisor is received in the health facility, the greater the number of supervision visits in that health centre.

2. MANAGEMENT COMMITTEE captures the ability of the local community to guide public healthcare facilities towards best-practices (*CLIENT-POWER*). According to the Cameroonian healthcare policy, Management Committees are supposed to hold a minimum of four meetings per year. Although some health centres registered a mean number of five meetings, some others (exactly three of them) didn't hold any meeting. As defined, this variable is expected to have a positive influence on the performances of the health centre.

Another common explanation of differences in the efficiency of public enterprises is related to organizational factors. The following three indicators account for healthcare centres' specific factors.

3. HCMGRADE captures the qualification of the head of the health facility. Although it is stated that peripheral healthcare centres are headed either by a Doctor (DHs and CMAs) or by a State-Registered Nurse, we found from the information collected from the personnel of the health centre that among the health facilities that were led by a Doctor, DHs represented 43.58%, CMAs represented 35.89% and CSI were 20.51%. Consequently we defined a binary variable (coded one if the head is a Doctor and zero if not) which is expected to have a positive influence on the performances of the health centre.

4. ABSENTEEISM rate was also captured from information gathered on the personnel of the health facility. We believe that absenteeism of the personnel is an indication of management failures for the leader of the health centre and the whole public administration. The highest it is, the highest the wastage of public resources devoted to pay the absentees. Personnel absenteeism translates into low service quality in terms of increased waiting time for patients and it is likely reduce the frequentation of public health facilities.

Table 4: Descriptive Statistics of determinants of Technical Efficiency scores

Variables	Obs.	Mean	Std. Dev.	Min	Max
SUPERVISION	108	0.1944	0.3976	0	1
MAN. COMMITTEE	108	5.4074	3.1446	0	10
HCMGRADE	108	0.7222	0.4499	0	1
ABSENTEEISM	108	0.1672	0.1808	0	0.6666
HCEXPERIENCE	108	14.425	11.384	1	54
NBPRIVATEHC	108	15.592	21.746	0	177
NBPUBLICHC	108	22.657	38.478	0	188

Source: Authors' construction from the results

5. HCEXPERIENCE refers to the number of year since the creation of the health centre. Table 4 shows that on average, the health centres of our sample have lasted four 14 years. Around 29.63% have lasted more than 14 years. Considering the very low rate of equipments renewal in developing countries public sector, especially in Cameroon, this variable is also expected to reduce the frequentation of public health facilities, especially in areas where competition with the private sector prevails.

The other environmental factors which are expected to capture this competition are presented below:

6. NBPRIVATEHC refers to the number of private healthcare centres within the sub-division and it is a proxy of market competition. Although the classical argument assumes that increased competition in the market place will enhance efficiency, our model hypothesizes that the greater the number of private health centres, the higher the competition within the local market. Then, given the more healthcare choices available, this would result in a reduction in number of visits to public health centres, and hence decrease their efficiency.

7. NBPUBLICHC refers to the number of public healthcare centres within the sub-division. It also proxies market competition and the same arguments on the number of private HC apply to it.

8. URBAN is a binary variable which accounts for geographic heterogeneity between rural and urban areas.

RESULTS AND DISCUSSION

THE LEVELS OF EFFICIENCY

The technical efficiency scores (TE) estimated using the multi-stage DEA method are presented on table 5. Healthcare centres are declared on the efficient frontier if $TE=1$ and the healthcare centres whose TE is less than 1.00 are less efficient relative to the other ones on the frontier. The lower the efficiency score, the higher the scope for the potential increase in the volume of healthcare services delivered (without changing the actual levels of inputs) relative to the best practice. It emerges from table 4 that there is significant variation in the levels of efficiency scores across the types of healthcare centres. The mean TE 0.7098 implies that on average, the health centres of our sample may be able to increase their volume of services delivered by 29.02% using the same volume of inputs. This potential gain in efficiency is 33.05% for DHs, 31.55% for CMAs, and 22.99% for CSIs. A rural-urban comparison reveals that the potential gains in efficiency are greater in rural areas, the Integrated Healthcare Centres presenting the biggest potential gain in efficiency. This implies that on average, urban healthcare centres perform better than rural ones.

Secondly, the mean scale efficiency 0.7788 indicates that the average size of the healthcare centres was not far from the optimal size and that additional productivity gains around 21.44% for DHs, 20.84% for CMAs, and 20.16% for CSIs would have been feasible if, assuming no other constraining factors, these healthcare centres adjust their level of operation to the optimal scale. Thus by eliminating pure technical inefficiency, a 22.12% (21.44% for DHs, 20.84% for CMAs, and 20.16% for CSIs) proportionate expansion in consultations and birth-deliveries beyond what is actually achieved is feasible if the input and output bundles are suitably altered. In addition, the DEA analysis also evaluates the set of hospitals which construct the production frontier. The detailed results of Technical Efficiencies and Scale Efficiencies (SE) reveal that out of 54 healthcare centres of our sample, 17.50% of DHs, 8.82% of CMAs, and 28.12% of CSIs were overall technical and scale efficient ($TE=1$ and $SE= 1$).

Third, Returns to scale show that 22.50% of District Hospitals, 20.59% of Sub-division Health Centres, and 34.37% of Integrated Health Centres are delivering healthcare services at the most productive scale size that is, these health facilities operated at constant returns to scale (CRS). About, 22.50% of DHs, 26.47% of CMAs, and 34.37% of CSIs are producing healthcare services in a region of Increasing RTS and could expand their size accordingly. Around, 55% of DHs, 52.94% of CMAs, and 31.25% of CSIs are producing in the region of Decreasing RTS and would be better off by contracting their size accordingly so that they can operate at optimal scale size.

Finally, an institution-wise comparison of the efficiency scores reveals that supervised healthcare centres have achieved lower average efficiency scores (TE and SE) as compared to non-supervised ones. Though these differences are not statistically significant, the analysis shows that this pattern of TE and SE is observed both in rural and urban areas.

As far as the second aspect of institution is concerned, table 4 reveals that health facilities whose MANAGEMENT COMMITTEE meetings took place at least four times in the year as expected have achieved higher average TE as compared to the other healthcare centres; this pattern is observed only in the rural sector.

THE DETERMINANTS EFFICIENCY OF LEVELS

The results reported in table 6 show that most of the health centre specific factors have a significant effect on the health centre's efficiency. For instance age of the healthcare centre (HCEXPRIENCE) has a negative effect on the level of efficiency. This result may be considered as evidence that the ancientness of the infrastructures (buildings and equipment) may be viewed as an indication of low quality or risk for patients.

Table 5: Descriptive Statistics of Efficiency scores

TECHNICAL EFFICIENCY										
	URBAN			RURAL			OVERALL			GLOBAL
	DH	CSI	CMA	DH	CSI	CMA	DH	CSI	CMA	
Mean	0.671	0.8263	0.4948	0.3511	0.3050	0.3318	0.6695	0.6845	0.7701	0.7098
SCALE EFFICIENCY										
Mean	0.6931	0.8368	0.6916	0.7856	0.7916	0.7984	0.7486	0.8023	0.7784	0.7788
RETURNS TO SCALE (%)										
Constant	12.50	25.00	00.00	29.17	19.23	42.31	22.50	20.59	34.375	25.93
Increasing	37.50	25.00	30.33	12.50	26.92	34.61	22.50	26.47	34.375	27.78
Decreasing	50.00	50.00	00.67	58.33	53.85	23.08	55.00	52.94	31.25	48.29
OVERALL EFFICIENT HEALTH CENTRES (%)										
	6.25	25.00	00.00	25.00	3.84	34.61	17.50	8.82	28.12	18.52
INSTITUTION-WISE COMPARISON OF EFFICIENCY SCORES										
TE and SUPERVISION										
Yes	0.6836	0.765	0.4573	0.6281	0.6115	0.8225	0.6466	0.6499	0.7540	0.6961
No	0.6680	0.8877	0.5323	0.6821	0.6661	0.8449	0.6762	0.7153	0.7863	0.7185
SE and SUPERVISION										
Yes	0.5623	0.777	0.693	0.8298	0.7662	0.7602	0.7406	0.7689	0.7476	0.7598
No	0.7233	0.897	0.6903	0.7709	0.8135	0.8366	0.7509	0.832	0.8091	0.7909
TE and EFFECTIVENESS of the MANAGEMENT COMMITTEE										
Yes	0.682	0.9035	0.4812	0.6676	0.6935	0.8120	0.6724	0.7460	0.7630	0.7403
No	0.6644	0.595	0.522	0.6695	0.5226	1	0.6672	0.5371	0.8088	0.6511
SE and EFFECTIVENESS of the MANAGEMENT COMMITTEE										
Yes	0.7203	0.8451	0.6152	0.7573	0.7719	0.7721	0.745	0.7902	0.7488	0.7687
No	0.6768	0.812	0.8445	0.814	0.8361	1	0.7516	0.8313	0.9378	0.7983
Source: Authors' construction from the results										

This result evidences the fact that absenteeism of health centre's personnel undermines the provision of services and the effectiveness of public spending in service delivery (Kimenyi and Shughart II, 2006). Both authors assert that absenteeism is evidence of bureaucratic laxity, which can be traced to weak monitoring of public service providers. Table 6 shows that health centres managed by a Doctor are less efficient than those led by lower categories of health

personnel. This is counterintuitive as it is expected that the quality and effectiveness of service delivery is determined by the qualification of staff providing service.

As far as competition variables are concerned, both the number of private and public health centres in the sub-division have a negative effect on the level of efficiency of public health facilities. This result is consistent with our hypothesis that, with an increase in the number of private health centres, patients have more choices in terms of healthcare providers and some may shift their demand to the private sector. The resulting reduction in the demand for healthcare services in the public sector will lower the latter's level of efficiency. The same arguments may be used to justify the negative effect of the number of public health centres in the sub-division.

When it comes to the institutional variables SUPERVISION has a coefficient that is not statistically differed from zero while MAN. COMMITTEE is statistically significant. The insignificance of supervision visits implies that the accountability relationships between the supervisor and the supervised are not designed in such a way that the supervisor can create incentives for good performance. For instance, only 9.09% of the sub-divisional officers reported that they resorted to blames and sanctions when the results of the supervision were not satisfactory.

Table 6: Determinants of Technical Efficiency

Variables	Coefficients	T-student
<i>Institutional factors</i>		
SUPERVISION	-0.0556	-0.92
MAN. COMMITTEE	0.0284***	2.92
<i>Health Centre specific factors</i>		
HCMGRADE	-0.2517***	-3.22
ABSENTEEISM	-0.4139***	-2.79
HCEXPERIENCE	-0.0050*	-1.74
<i>Competition factors</i>		
NBPRIVATEHC	-0.0025*	-1.74
NBPUBLICHC	-0.0191**	-2.38
URBAN	0.0533	0.79
Constant	1.2492***	7.95
Sigma	0.2962	--

Note: Dependent variable=Technical Efficiency Scores . No of obs=108;
 $F(8,100)=4.69$; / $\text{Prob}>F=0.0001$; Pseudo $R^2 = 0.2882$; Log pseudo-likelihood = -40.249228

This result can be considered as an indication of failures in the long-route of accountability relationships, specifically in the COMPACT. As far as the influence of the number of meetings of the Management Committee is concerned, the positive and significant coefficient confirms the idea that "...*engaging clients in an active role as monitors can improve performance tremendously*" (World Development Report, 2004; p.64).

CONCLUSION

In this paper, we analysed the performances of a sample of Cameroon public health centres using a two-stage procedure, including the estimation of efficiency scores through the DEA method and the identification of their explanatory factors. Results indicate that the average public health centre present technical efficiency score of 0.7098.

A comparison of the average efficiency showed that urban healthcare centres perform better than rural ones and that Integrated Healthcare Centres were more efficient than the Sub-division Medical Centres, the latter performing better than the District Hospitals. Since only 18.51% of the health centres were overall technical and scale efficient, there is therefore room for gain in technical and scale efficiency; the highest potential gain in technical efficiency being for DHs followed by CMAs and CSIs.

A Tobit regressions analysis demonstrated that the observed differences in technical efficiency scores across healthcare centres can be explained both by health centres' specific factors, environment-related and institutional factors. For instance, the rate of absenteeism of the personnel of health centre emerges as an important determinant of the level of efficiency. Being an indication of poor resource management by the *Government* failure or a failure of *the Compact*, this may be overcome through the reorientation of administrative supervision visits toward an effective control of the presence of health centres' personnel and the monitoring of their performances at work. For example, instead of paying bonuses to all the personnel as a share of resources generated by the health facility, Cameroon authorities may institute a kind of performance-based payment system of these bonuses.

Another way of overcoming government failures is to increase *Client-power* through participation and choice so they can hold those responsible to account. This has been demonstrated through the positive influence that Management Committees advocates for the promotion and the strengthening of these institutions all over the country especially in rural areas. Further, the results reveal that competition created by the increased availability of public and private healthcare facilities around the country reduces public health centres performances. This highlights the fact that enabling many providers to compete in

healthcare service delivery allows healthcare seekers to exit the public sector when they are dissatisfied with the services delivered. Though this supports the idea that *Client-power* can be strengthened by a choice-oriented policy, it highlights the necessity of setting institutional mechanisms that will reduce sorting as the ability to choose depend on the affordability of the price charged for the service.

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