Working paper

First come, first served: the effect of chronicity on rationing free dialysis care in Senegal

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Abstract

Background: In 2012**,** the Senegalese Ministry of Health launched a national dialysis program aiming to cover a part or all the expenses related to dialysis sessions provided in public health facilities, and social security approved dialysis centers. Given the scarcity of resources, public hospitals are practicing explicit rationing through waiting lists. This study aims to know whether the practices at hospitals level are following the national guidelines regarding selection criteria.

Methods and material: We conducted a multivariate logit regression analysis using data collected from 201 patients interviewed in eight centers (four public and four private). The central hypothesis was that if national recommendations are fully respected, chronicity will be a strong predictor of the inclusion in the national dialysis program regardless the other socioeconomic determinants such as the respondents' wealth index or insurance distribution.

Results: Results show that patients are enrolled on a first-come-first-served basis. Patients who are dialyzed for less than one year are 23% ($p<0.01$) less likely to be enrolled than patients under dialyzed for 1 to 5 years and 48% ($p<0.01$) less likely to be enrolled than patients under dialysis for 5 years and over. Socioeconomics determinants of the inclusion in the national dialysis program such as wealth and insurance distribution are also favorable to the poorer. The most important is chronicity, the less likely are wealthiest and insured patients to be enrolled.

Conclusion: Overall results indicate that decisions made at hospitals level follows recommendations and are favorable to the poorest so far, even though the study highlights some disparities. However, a central waiting list steered by the UHC agency, more transparency, information sharing, and precise accountability mechanisms might improve equity in access to dialysis care.

Keywords: *Non-Communicable Diseases, ESDR, Free Healthcare Policy, UHC***,** *Explicit Rationing, Regulation*

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Introduction

Free Health Care (FHC) policy is the removal of formal fees at the point of service without means or income assessment (1). Initiated in the early 90s in many Sub-Saharan African (SSA) countries, FHC has broadly targeted vulnerable populations such as children and women or conditions such as tuberculosis, Human Immunodeficiency Virus (HIV) or malaria. This choice was totally in line with the Millennium Development Goals (MDGs) and the global health challenges back then. Sustainable Development Goals (SDG) however set a broader agenda, by promoting Universal Health Coverage (UHC) for all, while maintaining interest for maternal and infant care (2). That implies enhancing access to needed health services for everyone without any financial hardship (3).

FHC policies focus less on equity in access to healthcare compared to exemption policy, which requires income assessment. When a government decides to remove user fees, they generally want to reach two objectives: the increase of health services utilization, particularly for poor people and the reduction of out-of-pocket expenditures. Evidence showed that FHC policies generally achieved the former (4)(5)(6), while results were quite unclear or mixed for the latter (7)(8)(9).

For many SSA countries, FHC policies, subsidized by national governments or by donors have been an essential step towards UHC. Depending on countries, the benefits package could include services related to immunization, treatment for HIV/AIDS, tuberculosis, malaria, maternal or infant care, some of them limited these benefits to primary care while others expanded the basic package at hospitals level (2). However, beyond these policies, other countries have developed contributory schemes or Social Health Insurance (SHI) separately for civil servants and private sector employees. Given that contributions to these schemes were directly deduced from payrolls, it makes it difficult for the informal sector to be covered by compulsory schemes. Therefore, some countries opted for voluntary schemes such as Community-Based Health Insurance (CBHI).

Senegal has this exact fragmented resource pooling system with on the one hand civil servants and private sector employees, and CBHI or FHC on the other hand. The country had removed fees for maternal, child, and geriatric care. In 2012, the Ministry of Health had targeted End-Stage Renal Disease (ESDR), as a part of the national FHC policy which was a very bold move given that non-communicable diseases (NCDs) are known to be cost driver, regardless the country. In fact, like many developing and emerging countries, Senegal is experiencing progress in chronic diseases. Between 2000 and 2017, the country has observed a shift in the burden of disease with a decrease of communicable diseases (-15.4%) and an increase of non-communicable diseases (+47%) and chronic diseases (+13.2%) in terms of Disability -Adjusted Life Years (DALYs)(10).

The two terms ESRD and kidney failure are used to describe " the irreversible loss of kidney function which, without treatment, is likely to lead to fatal complications such as hyperkalemia or pulmonary edema over days or weeks"(11). Kidney failure is the outcome of Chronic Kidney Disease (CKD). We identify five stages in the evolution of CKD; each one is characterized by a specific level of estimated Glomerular Filtration Rate (eGFR), the best measure of the kidney function. At stage 5, also called ESDR or kidney failure, patients need Renal Replacement Therapy (RRT) to survive. An RRT can be hemodialysis (HD), peritoneal dialysis (PD) or renal transplantation. In Senegal, the leading causes of kidney failure are diabetes and high blood pressure(). According to the Institute for Health Metrics and Evaluation, impaired kidney function, high blood pressure, and high fasting plasma glucose are three of the ten risk factors causing the most deaths and disability combined (10). CKD leads to 2.4 million death per year worldwide (12). It is becoming a public health threat that needs to be dealt with by supporting prevention among people at higher risk and by ensuring access to RRT to people with kidney failure.

Table 1| the evolution of Chronic Kidney Disease

Stages of Chronic Kidney Disease		**eGFR***
Stage 1	Kidney damage with normal kidney function	90 or higher
Stage 2	Kidney damage with mild loss of kidney function	89 to 60
Stage 3a	Mild to moderate loss off kidney function	59 to 45
Stage 3b	Moderate to a severe loss of kidney function	44 to 30
Stage 4	Severe loss of kidney function	29 to 15
Stage 5	Kidney failure / End-Stage Renal Disease (ESDR)	Less than 15

**estimated Glomerular Filtration Rate*
Sources: National Kidney Foundation (USA).

Dialysis can extend life expectancy, but it impairs substantially Quality of Life (QOL) (13)(14)(15). In developed countries, where survival seems guaranteed, QOL is at the core of medical decisions and resources allocation unlike in developing countries where the priority remains in access and survival; "preserving life is the concern—QOL is not the major focus" (16). However, ensuring a better quality of life is a way to control the evolution of the disease, and removing the financial stressor might be a way to offer a better quality of life to patients.

The biggest challenge for developing countries is to provide dialysis for every ESDR patient. In 2015, 10% of the world's population suffered from CKD according to the US National Kidney Foundation, about 2 million people had access to dialysis in 2010, yet, Linayage and his co-authors estimated than this only represented half of those who needed it (17). At least 2 million people die each year because of the lack of treatment (18). Access to dialysis is not guaranteed even in developed countries. Developing countries practiced rationing due to limited capital and human resources combined. Evidence is rare regarding RRT rationing in poor limited-resources settings, particularly in SSA countries.

However, even if resources are scarce, many LMICs countries have implemented national maintenance dialysis programs. These programs cover a part or all expenses related to RRT in public health facilities (Thailand, Taiwan, Brazil, India, Algeria, Tunisia, Gabon, South Africa, Senegal)(19). When deciding who will receive RRT or not, decision-makers face two conflictual goals: utility maximization versus equity maximization (20). In South Africa, for example, where rationing has always been practiced, "Life or death" committees have been implemented to take final decisions about who will receive RRT or not (21). In 2009, national guidelines emphasized that the first criterion for receiving dialysis is to be eligible for renal transplantation(22), which excludes individuals with poor health outcomes. A retrospective study found that among these eligible patients, youngest people (aged between 20 and 40), non-diabetic, the richer, and white people were more likely to get RRT than others. South Africa has, therefore, chosen utility maximation over equity (20).

Senegal has experienced one of the best progress regarding the number of dialysis centers in SSA (2 in 2000 versus 13 in 2017) (23). In Dakar, an estimated number of 8000 people suffer from CKD, around 10% of them need dialysis, and this is the tip of the iceberg. At least one thousand new cases of patients in need of dialysis are registered each year(24). Only 592 patients had dialysis sessions in 2017 (23). The annual average cost of dialysis sessions was $ 13518 before the exemption. In comparison, Senegal GDP per capita was US$ 1033 in 2017. Since 2012, the Senegalese government has launched a national program which covers a part of dialysis expenses performed in a public hospital to reduce inequalities in access and financial hardship. According to national guidelines, every Senegalese resident or not, diagnosed with ESDR by a nephrologist is entitled to free hemodialysis sessions in RRT public facilities. After his diagnostic, the patient fills in a subscription form on the waiting list and send a hand-written request letter to the director of the hospital. The patient is then placed on the reserve list if there is no available place. Knowing that every hospital manages his waiting list, a patient can subscribe to each one of them. Based on national guidelines, places are attributed on a first-come-first-served basis (25) by a committee at the hospital level. Meanwhile, the patient can seek assistance in the private sector.

Many authors assessed FHC policies in SSA over the years regarding the evolution of service utilization, policy implementation, or equity issues. To the best of our knowledge, except Senegal, only 3 SSA countries have implemented national dialysis program (South Africa, Gabon and to a lesser extent, Nigeria) (26). Very few papers have, therefore, assessed these programs. The objective of this paper is to know if national guidelines are consistent with decisions made at the hospital level by identifying the main determinants of the inclusion in the program. We hypothesize that, if recommendations are respected, chronicity should be a dominant predictor compare with Socio-Economic Status (SES), for instance. This paper is the very first that attempts to evaluate this FHC policy.

Material and Methods

Dakar is the most populated region and encompasses many patients and HD centers. Considering that the study population is specific, we included all the HD centers (public and private) of Dakar. The moment we requested authorizations, four public hospitals, and four private centers, provided HD sessions in Dakar. We conducted a cross-sectional study between October 2018 and February 2019 in the eight-functioning dialysis centers (four public, four private) of Dakar. Interviews with HD patients were conducted in four municipalities of the capital. We, therefore, interviewed HD patients who were present, aged 18 and over and undergoing HD for at least one month. HD sessions might be scheduled differently according to the type of health facility. In each center, we attended day sessions (between 8 am and 2 pm) and stayed at least three days depending on the size of the center. We interviewed all the patients who were able to respond until the end of all sessions. A total of 201 HD patients were then consulted. Five patients declined our request. Interviews lasted for about 20 to 30 minutes and were conducted either in Wolof or in French. To complete, we use the 2015 Demographic Health Survey (DHS) to determine the respondents Socio-Economic Status (SES).

To understand the determinants of access to free dialysis care, we firstly conducted a multivariate analysis using an outcome binary model: a logit model. This empirical strategy will allow us to evaluate the likelihood of being dialyzed in public facilities depending on some characteristics. We use the following equation:

$$Y_i = \alpha_i + \beta_1 \text{Duration}_i + \beta_2 X_i + \varepsilon_i$$

- Y represents a binary variable that takes the value one if a patient is included in the program (free care), 0 otherwise (the patient is not formally excluded from the program, but for some reasons is having dialysis in a private center).
- Chronicity is represented by the variable **Duration** and **X** is a set of control variables, including the wealth index, age, transportation costs, insurance distribution, employment status, educational level, and marital status).

Secondly, we determine Average Marginal Effects (AMEs) and Marginal Effects at representative values of duration using the Stata command ***margins,*** and eventually, we did some post estimation analysis.

Definition of some control variables and statistical analysis

The sample includes 201 patients (91 men and 110 women), aged between 18 and 76 years old (mean age=49.4 years, median value=49.5). Only 29% (n=59) of our sample is part of a patient organization. Around 73 % (n=146) of the sample are married; the rest of them had never been married (n=29), 12.5% are widower (n=15) or divorced (n=10). The study revealed that 27 % (n=55) had never been to school or had a traditional education, while 17% have a degree. The majority do not have a job, that is 68% of our sample (n=136).

Chronicity

We define chronicity as the state of being chronic or having a long duration. We consider chronicity as the duration of hemodialysis, that is the time between the patient had his very first dialysis session and the day of the interview. Chronicity is represented by the categorical variable DURATION taking value 1 if the duration is inferior to 1 year, 2 when the duration ranges from 1 to 5 years and 3 when the duration is superior to 5 years.

The duration ranges from 1 month to 20 years in the sample (mean value=3.6 years, median value=3 years). In public facilities, the mean duration is 5.29 years, that is more than twice the duration in private facilities (**Table** 2). The mean duration in center 4 and 8 can be explained by the fact that they have been created very recently (in 2018 and 2016 respectively). However, this has a different implication according to whether the center is public or private.

Table 2| Distribution of duration per center

Type	Centers	Mean Duration (Years)	Min	Max	Median
Public	1	6.24	0.42	14	6
	2	5.2	0.50	9	5
	3	4.76	0.83	15	4
	4[1]	0.85	0.17	2	0.75
mean		***5.29***			***5***
Private	5	2.89	0.08	11	2
	6	2.5	0.08	20	1
	7	2.5	0.50	7	2
	8	0.94	0.02	3	0,75
mean		***2.39***			***1. 5***

Wealth Index

We calculate wealth index based on Thiede and al methodology (27), also recommended by the world bank (28) in the case of the specific and limited survey. We use a Principal Component Analysis (PCA). Using the same assets and housing conditions recorded in 2015 Demographic and Health Survey (DHS), we computed factors weight from the national survey and applied them to our specific survey, which allows calculating index scores. These indices are assessed against the 2015 national distribution of the wealth index. Our reference population (Dakar urban area) extracted from 2015 DHS is composed of 341 households. Over 50% of the DHS is gathered in the three first quintile, the wealthier representing only 27%. Compared with this distribution, our reference population concentrates 45 % of wealthy households, the most impoverished people representing 24%. Users of HD services are encompassed in quintile 4 and 5, and poor people are less represented. In the state sector, well off people represent 74% of HD services users, while the poorer and the poorest represent only 9% of our sample.

[1] Created In 2018

Table 3| Distribution of population per quintile in 2015 DHS.

Index	*DHS Total Population (%)*	*Urban (%)*	*Reference Population (%)*	*Users Of HD Services (%)*	*Users Of Private HD Services (%)*	*Users Of Public HD Services (%)*
1ST QUINTILE	25.04	36.86	6.74	0.5	.	1.15
2ND	27.2	22.92	17.6	7	6.19	8.05
3RD	21.12	17.59	27.27	15	13.27	17.24
4TH	16.34	12.27	24.63	30.5	39.82	18.39
5TH QUINTILE	10.3	10.36	23.75	47	40.71	55.17

Due to the small size of quintile 1 and 2 among the users of HD services, we gathered them with quintile 3. **WEALTH** is, therefore, a categorical variable taking value 1 if the individual is poor, while classes 2 and 3 encompasses the richer and the richest, respectively.

Tableau 4|distribution of quintile in the sample

Wealth Index	Freq.	Percent	Cum.
Poorer	45	22.50	22.50
Richer	61	30.50	53.00
Richest	94	47.00	100.00
Total	200	100.00	

Insurance distribution

Hemodialysis care is provided for free in public hospitals where patients (n=87) can receive 3 HD sessions per week, as recommended. Most of them (n=74 patients) do not have any insurance, while nine patients could benefit from the civil servant insurance scheme, three were insured by their employer, and one subscribes to mutual health insurance. Circumstances might be different in private centers, where patients are treated following their income.

Table 4| Current use of free dialysis care per duration, wealth index and insurance distribution

			FHC policy	
DURATION	**WEALTH**	**INSURANCE**	**NO**	**YES**
	Poorest	No	8	**2**
		Yes	5	**0**
	Richer	No	13	**0**
< 1 YEAR		Yes	8	**2**
	Richest	No	12	**5**
		Yes	4	**3**
	Poorest	No	3	**10**
		Yes	5	**1**
	Richer	No	9	**5**
1-5 YEARS		Yes	10	**0**
	Richest	No	11	**14**
		Yes	12	**4**
	Poorest	No	0	**10**
		Yes	1	**0**
	Richer	No	1	**9**
>5 YEARS		Yes	4	**0**
	Richest	No	4	**14**
		Yes	3	**8**
TOTAL			**113**	**87**

Out of 114 patients in private centers, 62 patients had two sessions per week, and nine could only afford one session per week. In private facilities, 53% of patients have no insurance, and 34% was under the civil servant insurance scheme. **Insurance distribution** is a binary variable taking the value 1 if the patient is insured, 0 otherwise.

Education

EDUCATION is a categorical variable taking the value 0 if the patient didn't go to school, 1 if the patient has primary level, 2 when individuals stopped at middle school (collège in French) , 3 if the patient stopped at secondary school (lycée in French) and 4 if the patient went to college.

Empowerment

The variable **EMPOWERMENT** is a binary variable taking value 1 if the patient belongs a patient organization (association de patients) 0 otherwise.

Regression analysis

The main predictors of the inclusion in dialysis FHC policy are chronicity, insurance distribution, and wealth (Table 4). Chronicity and empowerment have a positive impact on the probability of being in the program, while insurance distribution and wealth have a negative effect. Education level and transportation costs have a negative impact on inclusion, as well.

Table 4 |Determinants of access to public dialysis centers

VARIABLES	*Levels*	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	<1 Year							
Duration	*1 to 5 Years*	1.022***	1.013**	1.133**	1.202**	1.317***	1.108**	1.517***
		(0.391)	(0.405)	(0.446)	(0.474)	(0.502)	(0.517)	(0.580)
	>5 Years	2.576***	2.617***	2.760***	2.928***	3.038***	2.728***	3.082***
		(0.454)	(0.475)	(0.530)	(0.588)	(0.633)	(0.655)	(0.774)
	Poorer							
Wealth	*Richer*		-1.260***	-1.211***	-1.182***	-1.393***	-1.348***	-1.262**
			(0.441)	(0.440)	(0.454)	(0.488)	(0.491)	(0.559)
	Richest		-0.197	-0.0795	0.149	0.391	0.559	0.746
			(0.391)	(0.393)	(0.396)	(0.436)	(0.451)	(0.515)
	Noninsured							
Insurance	*Insured*			1.362***	-1.101**	-0.859*	-0.830*	-1.250**
				(0.410)	(0.452)	(0.469)	(0.469)	(0.626)
	No education							
	Primary				-0.302	-0.425	-0.541	-0.281
					(0.448)	(0.474)	(0.470)	(0.540)
Education	*Middle*				-1.256**	-1.333**	-1.442**	-1.490**
					(0.607)	(0.674)	(0.679)	(0.686)
	Secondary				-0.872	-1.155**	-1.375**	-0.972
					(0.531)	(0.578)	(0.586)	(0.680)
	College				-0.928	-1.069	-1.256*	-0.506
					(0.614)	(0.651)	(0.684)	(0.897)
	<50 years							
Age	*>50 years*					1.158***	1.335***	-1.083**
						(0.399)	(0.426)	(0.480)
	Empowered							
Empowerment	*Not empowered*						-0.844**	-0.840*
							(0.398)	(0.492)
LnTransportation costs								-0.637**
								(0.264)
Constant		1.427***	1.173***	-0.780*	-0.281	0.382	1.406*	6.210***
		(0.322)	(0.395)	(0.404)	(0.495)	(0.575)	(0.758)	(2.359)
Observations		201	200	200	200	200	200	173

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Chronicity appears to be the strongest predictor of inclusion in the program, regardless of other socioeconomic characteristics. Newly diagnosed patients are less likely to benefit from the free dialysis policy (table 5). People on dialysis for one year to 5 years are 23 % more likely to be included than people on dialysis for less than one year ($p<0.01$). The probability is twice higher when the duration is more than five years ($p<0.01$). These results are consistent with the statistical analysis, the average duration of ESDR being twice more important within the enrolled patients (See in Annexe Table 4) than among the ones in private centers. Given the limited supply and the existence of a waiting list, a patient must leave the program (after a transplant or death) so that a new individual can be dialyzed for free. Regarding these outcomes, the first come is the first served.

Tableau 5|Average Marginal effects (AMEs)

Variables	Levels	dy/dx (Margins)
Duration	< 1 year	-
	1 to 5 Years	0.232*** (0.0794)
	>5 Years	0.483*** (0.0959)
Wealth	Poorer	-
	Richer	-0.168** (0.069)
	Richest	0.109 (0.075)
Insurance	Non insured	-
	Insured patients	-0.173** (0.0806)
Observations		173

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

*Note: dy/dx (provided by Stata **margins** command) for factor levels is the discrete change from the base level*

Public hospitals cannot satisfy the demand for HD sessions and newly diagnosed patients, therefore, must rely on private centers to survive. Since sessions are cost-driven, patients practice rationing as well by having less HD session than they should. In public centers, rationing is supply-side, while it is demand-side in private facilities, particularly among more impoverished people.

Regarding socioeconomic determinants, literature provides pieces of evidence on the access to RRT(29)(30)(31)(32)(33). Although very recent, the interest in this specific aspect of the management of renal failure enabled to emphasize disparities regarding access to dialysis care. Collected evidence has shown a strong association between the socioeconomic status (level of income, level of education, skilled work, insurance distribution even age and gender) and the access to hemodialysis to the detriment of the most impoverished, unskilled workers, uninsured individuals and those with a less advanced level of education.

It is, therefore, primordial to prioritize the most vulnerable people when rationing is unavoidable. In this regard, the Senegalese dialysis care program is less favorable to insured and well- off people. Table 6 shows that in our sample, insured individuals are less likely to belong to the program even if they were diagnosed years ago. Having health insurance is associated with a 17.3% decrease in the probability of belonging to the program compare to non-insured patients. Marginal effects at typical values of duration show that when the duration is inferior to 1 year, insured patients are 15.2% less likely to be included, when it is between 1 year and 5 years, insured individuals are 22.5% less likely to belong to the program and when the duration is superior to 5 years, insured patients are 19.6% less likely to be included.

Wealth is also a predictor of the inclusion in the program, and wealthier people are less likely to be dialyzed in public facilities (p-value<0.05) compared with poorer people. When we consider the chronicity, the longer a wealthy patient has been under dialysis, the less probable he is to be part of the public cohort (table 6).

Regarding the level of education, individuals with at least a secondary school level are more likely to be included in the national program, people aged 50 and over are less likely to be dialyzed in public facilities. Marital and employment status do not impact

significantly the probability of inclusion (See Annexe, Table 1). Transportation costs, which we consider as a proxy for the distance to the public hospital or the dialysis center, is a crucial determinant. They decrease the probability of benefiting from the policy. Dakar is the only region that counts private dialysis centers, patients who cannot be treated in another region due to the lack of place must travel to Dakar to use private services.

Tableau 6|Marginal effects at representative values of duration

Duration	Variables	Levels	dx/dy (Margins)
< 1 year		Richer	-0.125**
			(0.058)
1 – 5 years		Richer	-0.207**
			(0.091)
> 5 years		Richer	-0.216**
	Wealth		(0.091)
< 1 year		Richest	0.109
			(0.074)
1 – 5 years		Richest	0.135
			(0.091)
> 5 years		Richest	0.099
			(0.074)
< 1 year		Insured	-0.152**
			(0.0 716)
1 – 5 years	***Insurance***	Insured	-0.225**
			(0.109)
> 5 years		Insured	-0.196*
			(0.100)
Observations			173

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

*Note: dy/dx (provided by Stata **margins** command) for factor levels is the discrete change from the base level*

Patients who belong to a patient organization are 11% more likelyto receive free dialysis sessions than patients who do not. HD patients are gathered into two organizations that always raise awareness on ESDR and its costs while advocating for the implementation of new public centers to eliminate Out-Of-Pocket payment (OOP). One of these organizations steers a private hemodialysis center where patients benefit from HD sessions at a lower price. The employment and marital status do not appear to influence the inclusion in the program, and patients over 50 years are 15% less likely to be dialyzed in public facilities (See in Annexe Table 6).

Further analysis

Post-estimation analysis shows that our model predicts very well the binary outcome (either or not an individual is included in the program). The overall rate of correct classification is estimated to be 83.24%. Of all the individuals that are effectively participating to the program, our model predicted 79.49% (that is called sensitivity), and of all the individuals that are not included (yet), our model predicted 86.32% (that is called specificity). The area under the roc curve (AUC) indicates the accuracy that is the ability of our model to identify people currently in the program and people who are not (See Figure and Table 5 in Annexe). Higher is the AUC, better the model is at predicting the model. In our study, the AUC is 0.8908. The goodness of fit test indicates a small difference between the observed and the estimated frequencies.

Discussion

Global health actors advocated for the removal of user fees since the late 90s, which were inequitable and limited access to healthcare to the poorest. After the first user fees removal, FHC policies have increased services utilization, while evidence about equity issues remains unclear.

FHC policies are usually in line with countries' health challenges. In developing countries, these challenges were malaria, tuberculosis, HIV, maternal, and infant mortality. Because they are cost drivers, chronic conditions are often unpopular in developing countries in terms of public health policies; that is the reason why a few of them are targeting NCDs.

The national dialysis program is fully funded by the Senegalese government. A specific funding managed separately by the UHC Agency is dedicated to replacing the forgone user charges income. Public resources are not enough to absorb all the demand, and not every patient can benefit from public services. Thus, the agency uses explicit rationing through waiting lists.

Nevertheless, once a patient is included in the program, he is entitled to 3 HD sessions a week, which is the regular number for the treatment to be effective. A waiting list is opened in every public health facility so that a new patient can join the cohort whenever a place is available. Our results are consistent with this context and confirm the initial hypothesis since the duration of HD is a strong predictor of the inclusion in the FHC program. The main other determinants are the wealth index and the insurance distribution; both have an adverse impact on the inclusion in the dialysis program, and this negative effect increases with chronicity. However, table 2 illustrates a critical gap between a recently opened center (center 4) and the other public facilities in terms of the mean duration. This situation might be related to accountability mechanisms since this center is public but accountable to the ministry of the army and not to the ministry of health. That situation may give to headers a discretionary power when allocating resources. Another explanation might be a transparency issue and a lack of information sharing between patients on a waiting list and health authorities regarding the opening of the new center. The consequence is that a well-off and newly diagnosed patient can have an unfair advantage by "cutting in line" to get a place in public hospitals, often at the considerable detriment of a poorer waiting for a place for years and who has no choice but to rely on private centers. The longer people seek assistance in private centers; the higher is the risk of financial hardship; consequently, many patients end up underdialyzed (having 1 dialysis session per week instead of 3), which impairs their quality of life subsequently. In the worst-case scenario, the patient dies.

This situation should draw the attention of public health authorities on the urge to strengthen dialysis supply by increasing the number of dialysis units and the health workforce, but also to promote prevention actions against ESDR, particularly among individuals with high blood pressure or diabetes Meletus. At first glance, multiplying dialysis care centers is the easiest part, but the core challenge is the availability of the health workforce. For instance, according to the staff interviews, the center 4 could only provide two sessions per week (instead of 3) for 11 patients due to the insufficient dialysis nurses when it could be receiving 11 more, three times a week .

Senegal is one step away from providing universal access to hemodialysis. Even if there are more dialysis centers compared to the beginning of this policy, efforts remain to be made, and the government must ensure that each region has at least one dialysis center to reduce transportation costs, which constitute a barrier to access to free health care. In 2010, when the first exemption policy occurred, there were only ten nephrologists and 28 specialized nurses for an estimated population of 13 Million people. Seven years later, the number of nephrologists was multiplied by 2.5, and the number of specialized nurses was multiplied by 7 (23).

Evidence is weak regarding dialysis rationing in SSA countries. In South Africa for example, where half patients do not receive dialysis care (21), the national guidelines mentioned that only patients that are eligible for a kidney transplant are accepted onto dialysis programs, which is patients who have better health outcomes(22). However, life or death decisions are also made at the state committees level, and selection criteria involve socioeconomic characteristics such as age, gender, income, race, either or not the patient has dependents, employment status, distance to the dialysis care center, education, criminal record, poor compliance or substance abuse (21). The selection process has, therefore, been criticized due to the lack of equity and ethics (34).

The Thai government introduced dialysis in the benefits package of civil servants and social security scheme since 1980 and 1990 respectively and in the Universal Health Coverage Scheme (UHCS) in 2005 after a cost assessment. Societal dialogue engaged right before the introduction of dialysis in UHCS suggested that if rationing were needed, vulnerable people should be the priority. To ensure that access to dialysis was universal, the Thai government decreed one condition: patients do not get to choose between PD and HD. Dialysis will be provided for free only if the patient accepts to receive a PD, which is considered less expensive and more accessible than HD. This was the only trade-off to ensure that every citizen in need of dialysis was satisfied. The success of this policy has a lot to do with patients' empowerment and the increase of health workforce and dialysis units, which limited rationing(35).

Compared with Thailand, Senegal has not achieved universal access to dialysis yet, but at least, this study demonstrates that the policy is fairly implemented. The first registered is the first dialyzed in public facilities regardless of his medical conditions or his socioeconomic status. If ever a public hospital decides not to follow this recommendation, it is at least for the sake of most vulnerable people.

CONCLUSION

There is no such thing as a perfect rationing process of scarce health resources; some populations will always be left behind. However, health authorities should prioritize vulnerable people if rationing is needed. In Senegal, clear guidelines may help decision making at the hospital level, and accountability mechanisms are an excellent way to make sure that "life or death" decisions are always justified by rank on a waiting list, or by medical reasons. The waiting list should be centralized at the national level and maintained by the UHC agency, which will be responsible for the inclusion of patients in the national dialysis program based on objective and transparent criteria. Transparency also includes information sharing and participatory mechanisms. More efforts need to be made regarding the inclusion of the most vulnerable people; if the main objective of this policy is to reduce inequalities in access to dialysis care, a waiting list is far from enough.

Ethical Issues

The study was approved by the National Committee of Ethics in Health Research (reference N°000105/MSAS/DPRS/CNERS), the Ministry of Health and every center. The respondents were assured about the confidentiality of information given, and informed consent was obtained.

Annexes

Table 1|Twoway frequency table FHC POLICY-INSURANCE DISTRIBUTION

	INSURANCE DISTRIBUTION		
FHC POLICY	No	Yes	Total
NO	47.33	74.29	56.72
YES	52.67	25.71	43.28
TOTAL	100.00	100.00	100.00

Table 2|Twoway frequency table FHC POLICY-WEALTH INDEX

	WEALTH INDEX			
FHC POLICY	**Poorer**	**Richer**	**Richest**	**Total**
No	48.89	73.77	48.94	56.50
Yes	51.11	26.23	51.06	43.50
TOTAL	100.00	100.00	100.00	100.00

Table 3| Twoway frequency table CENTERS-WEALTH INDEX

	WEALTH INDEX			
CENTERS	Poorer	Richer	Richest	**TOTAL**
1	37.78	16.39	14.89	20.50
2	6.67	6.56	22.34	14.00
3	4.44	3.28	7.45	5.50
4	2.22	0.00	6.38	3.50
5	17.78	32.79	11.70	19.50
6	26.67	22.95	12.77	19.00
7	0.00	13.11	10.64	9.00
8	4.44	4.92	13.83	9.00
TOTAL	100.00	100.00	100.00	100.00

Tableau 4|Two sample TTEST

	OBS1	OBS2	PRIVATE	PUBLIC	DIF
MEAN DURATION	114	86	2.388	5.287	-2.899***

Figure 1 |ROC curve

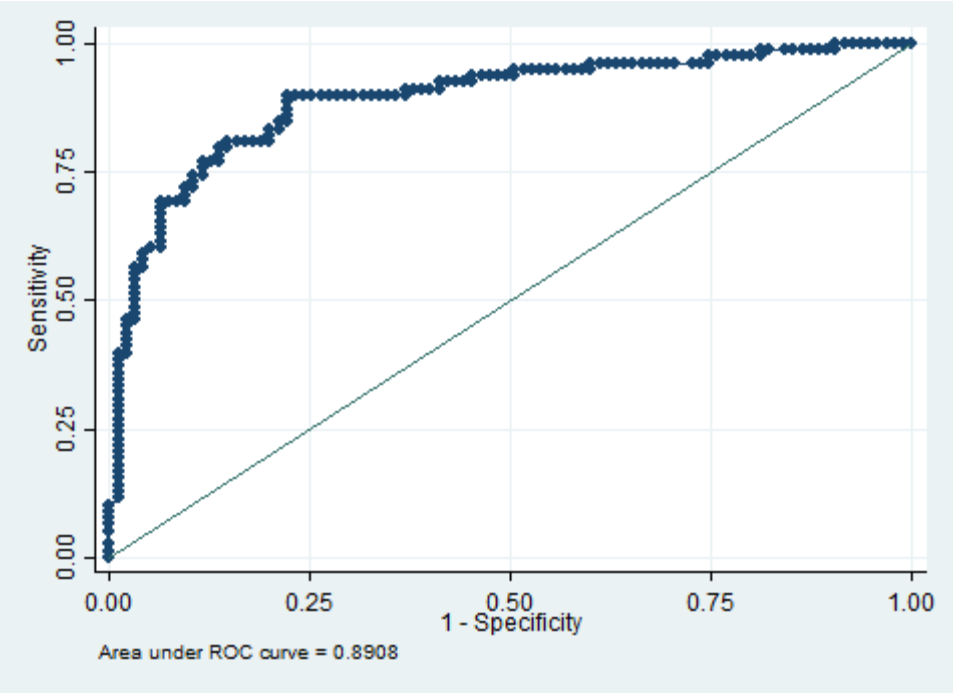

Tableau 5| Classification and goodness-of-fit test

CLASSIFIED	D	~D	TOTAL
+	62	13	75
-	16	82	98
TOTAL	78	95	173

Classified + if predicted Pr(D) >= .5

True D defined as poli != 0

Sensitivity	Pr(+| D)	79.49%
Specificity	Pr(-|~D)	86.32%
Positive predictive value	Pr(D| +)	82.67%
Negative predictive value	Pr(~D| -)	83.67%
False + rate for true ~D	Pr(+|~D)	13.68%
False - rate for true D	Pr(-| D)	20.51%
False + rate for classified +	Pr(~D| +)	17.33%
False - rate for classified -	Pr(D| -)	16.33%
Correctly classified		83.24%

Logistic model for POLICY, goodness-of-fit test (1)

number of observations = 173
number of covariate patterns = 168
Pearson chi2(155) = 192.37
Prob > chi2 = 0.0222

Logistic model for POLICY, goodness-of-fit test (2)

(Table collapsed on quantiles of estimated probabilities)

number of observations = 173
number of groups = 10
Hosmer-Lemeshow chi2(8) = 3.85
Prob > chi2 = 0.8700

Tableau 6| Average Marginal Effects (AME)

Variables	Levels	dy/dx
	1 to 5 Years	0.232***
Duration		(0.0794)
	>5 Years	0.483***
		(0.0959)
	richer	-0.168**
Wealth		(0.0751)
	richest	-0.109
		(0.0690)
Insurance	*Insured patients*	-0.173**
		(0.0806)
	Primary	-0.0391
		(0.0755)
	Middle	-0.200**
Education		(0.0837)
	Secondary	-0.133
		(0.0920)
	College	-0.0702
		(0.122)
Age	*>50 years*	-0.145**
		(0.0623)
Empowerment	*Not empowered*	-0.117*
		(0.0676)
Ln Transportation costs		-0.0849**
		(0.0353)
Employment	*No*	-0.0649
		(0.0688)
Marital status	*Divorced*	-0.189
		(0.146)
	Widower	0.0278
		(0.0957)
	Bachelor	-0.0335
		(0.0873)
Observations		173

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: dy/dx for factor levels is the discrete change from the base level.

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