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Operational and structural factors influencing enrolment in community-based health insurance schemes: an observational study using 12 waves of nationwide panel data from Senegal

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Abstract

Community-based health insurance (CBHI) has been implemented in many low- and middle-income countries to increase financial risk protection in populations without access to formal health insurance. While the design of such social programmes is fundamental to ensuring equitable access to care, little is known about the operational and structural factors influencing enrolment in CBHI schemes. In this study, we took advantage of newly established data monitoring requirements in Senegal to explore the association between the operational capacity and structure of CBHI schemes—also termed 'mutual health organizations' (MHO) in francophone countries—and their enrolment levels. The dataset comprised 12 waves of quarterly data over 2017–2019 and covered all 676 MHOs registered in the country. Primary analyses were conducted using dynamic panel data regression analysis. We found that higher operational capacity significantly predicted higher performance: enrolment was positively associated with the presence of a salaried manager at the MHO level (12% more total enrolees, 23% more poor members) and with stronger cooperation between MHOs and local health posts (for each additional contract signed, total enrolees and poor members increased by 7% and 5%, respectively). However, higher operational capacity was only modestly associated with higher sustainability proxied by the proportion of enrolees up to date with premium payment. We also found that structural factors were influential, with MHOs located within a health facility enrolling fewer poor members (−16%). Sensitivity analyses showed that these associations were robust. Our findings suggest that policies aimed at professionalizing and reinforcing the operational capacity of MHOs could accelerate the expansion of CBHI coverage, including in the most impoverished populations. However, they also suggest that increasing operational capacity alone may be insufficient to make CBHI schemes sustainable over time.

Keywords: Universal health coverage, community-based health insurance, mutual health organization, Sub-Saharan Africa, Senegal

Introduction

As outlined by the 2030 Sustainable Development Goal 3 (Target 3.8), equitable access to quality healthcare and protection against financial risk are central elements of universal health coverage (UHC) (Sustainable Development Goal 3, 2019). Over the past two decades, in their endeavour to achieve UHC, many governments of low- and middle-income countries have engaged in reforming their public health insurance system to increase the share of individuals covered by health insurance in their population. A particular challenge for these countries has been to expand insurance coverage among informally employed individuals (i.e. people without access to payroll-based health insurance schemes due to the

informal nature of their occupation), who often constitute large segments of their population, as well as among the poor.

Over the past two decades, community-based health insurance (CBHI) has typically been considered one of the key instruments for addressing this challenge and making progress towards UHC (Mathauer *et al.*, 2017). CBHI schemes—also referred to as mutual health organizations (MHOs) in francophone countries (*mutuelles de santé*)—are autonomous, not-for-profit organizations directly owned and managed by local communities and, to the exception of a few countries where enrolment has been made compulsory (Chemouni, 2018), are based on voluntary participation. At the core of CBHI lie the values of mutual aid and community solidarity

Key messages

- While several demand-side factors have been shown to affect the performance and sustainability of community-based health insurance (CBHI) schemes (e.g. lack of information, conflicting cultural beliefs and liquidity constraints), little is known about the influence of supply-side factors at the level of community organizations that operate these schemes
- Higher operational capacity of community organizations is associated with higher levels of enrolment in CBHI, including in the most impoverished populations
- Reinforcing the operational capacity of community organizations alone may be insufficient to ensure the financial viability of CBHI schemes
- While empowering the operational capacity of CBHI schemes may advance universal health coverage, more systematic approaches, including hybrid models of governance where risk pooling is centralized at a supra-community level or mandatory rather than voluntary enrolment, are likely needed in the long run

(Soors *et al.*, 2010). While CBHI schemes have been established in various countries on all continents, they have mainly spread across Sub-Saharan Africa (SSA) (Dror *et al.*, 2016).

In addition to raising hope in policy circles aiming for UHC, CBHI schemes have been subject to much attention in the research literature. Studies investigating their effects on financial protection and health-related outcomes have shown that they could help mitigate out-of-pocket expenditures (Ekman, 2004; Jütting, 2004; Aggarwal, 2010), increase healthcare utilization (Gnawali *et al.*, 2009; Aggarwal, 2010) and, in some cases, improve health outcomes (Wang *et al.*, 2009; Aggarwal, 2010). However, conflicting results have been reported as well, suggesting that these effects vary across populations and settings (Fink *et al.*, 2013; Raza *et al.*, 2016). Importantly, CBHI schemes have been pointed out for being confronted with low take-up and high dropout rates, jeopardizing their viability (Ekman, 2004; Soors *et al.*, 2010; Platteau *et al.*, 2017). Although low uptake of health insurance is not solely associated with CBHI (e.g. this is also the case for compulsory schemes where enforcement is weak; Schieber *et al.*, 2012; Banerjee *et al.*, 2021), threats to viability are automatically more significant when pooling is confined at the community level, limiting the capacity for risk-sharing.

Another issue intrinsically linked to the nature of CBHI relates to the tension between the necessity to keep premium fees sufficiently low to allow enrolment of the poor—which limits the levels of financial protection and benefits package offered, thereby limiting the attractiveness of these schemes—and the fact that the poorest of the poor yet remain excluded because they cannot afford to pay for premiums, regardless of the level of fees (Acharya *et al.*, 2013).

In this context, the role of CBHI as a means to achieve UHC has legitimately been questioned (Ridde *et al.*, 2018). Major international policymakers have raised concerns about their capacity to contribute to UHC if the traditional CBHI model is not reformed to integrate mechanisms that mitigate adverse selection, in particular mandatory enrolment and higher levels of pooling to ensure effective cross-subsidization

(both from the richer to the poorer and from the lower-risk groups to the higher-risk groups) (Reich *et al.*, 2016; Mathauer *et al.*, 2017, 2020). Despite the calls for transitioning towards a model with mandatory enrolment, only a few SSA countries have taken the plunge, with varying degrees of success. For example, while solid enforcement measures have accompanied mandatory enrolment in Rwanda, leading to a spectacular increase in total enrolment rates (87% of the population) (Chemouni, 2018), rates in Ghana have stagnated at about 40% despite a promising rise in the early years following the mandate (Agyepong *et al.*, 2016) due to weak enforcement and unaddressed barriers to enrolment (e.g. poor scheme management) (Ridde *et al.*, 2018).

Despite international recommendations, many countries in SSA continue to include CBHI in their current strategies towards UHC, particularly to reach the informal sector, without reconsidering the voluntary nature of participation. Examples of such countries include Benin (Gankpe *et al.*, 2018), Cameroon (Noubiap *et al.*, 2014), Mali (Deville *et al.*, 2018) or Senegal (Deville *et al.*, 2018; Bossyns *et al.*, 2018). In Senegal, for example, political leaders decided to focus their efforts on strengthening and extending the existing network of MHOs (Deville *et al.*, 2018; Bossyns *et al.*, 2018; Daff *et al.*, 2020). In 2015, this political will translated into the creation of a dedicated National Agency to foster the development of better-performing, sustainable MHOs throughout the country. While enrolment remains voluntary and pooling remains (at least partly) limited at the community level, the Senegalese reform led to the establishment of publicly funded subsidy policies covering premiums for the poor and initiatives aimed to reinforce the operational capacity of MHOs (Daff *et al.*, 2020).

Weak operational capacity has often been highlighted as a major impediment to the good functioning and sustainability of CBHI schemes, with experts calling for a higher degree of professionalization to boost take-up rates and reduce dropouts (De Allegri *et al.*, 2009; Mladovsky *et al.*, 2015; Waelkens *et al.*, 2017; Chemouni, 2018; Ridde *et al.*, 2018). However, while many studies have focused on exploring the determinants of low enrolment from a population perspective—with multiple factors having been identified, both on the demand side (e.g. conflicting cultural beliefs, liquidity constraints, lack of information) and on the supply side (e.g. inadequate benefits package, low quality of care) (De Allegri *et al.*, 2006; Platteau and Ontiveros, 2013; Mladovsky, 2014), the role of operational capacity and structure of CBHI schemes remains largely unexplored. At a time when countries embarked on the path towards UHC may follow in the footsteps of Senegal and develop policies to strengthen the operational capacity and structure of MHOs, there is a need to explore how and to which extent such supply-side factors at the MHO level can influence scheme performance.

In this context, focusing on the case of Senegal, this study aimed to investigate the operational and structural determinants of the performance and sustainability of CBHI schemes. Specifically, we aimed to explore the association between different levels of scheme enrolment and:

- MHO's operational capacity, proxied by the presence of a salaried manager, higher levels of operating expenditure and stronger cooperation with local health facilities

- MHO's structural characteristics, namely location and history

Performance refers to the extent to which CBHI schemes succeed in increasing enrolment equitably, while sustainability refers to the schemes' capacity to be financially viable over time.

Our analysis leveraged a novel, rich panel of quarterly administrative data that covered all 676 MHOs registered in Senegal over 3 years (12 waves between 2017 and 2019). Such a nationwide panel of activity data at the MHO level is unique in SSA. The use of administrative data for secondary analysis is relatively new in the social sciences (Connelly *et al.*, 2016), including in health policy and systems research (Hung *et al.*, 2020; Masefield *et al.*, 2020). Such data, which are not originally generated for research purposes—routinely collected for registration, transaction or record-keeping by administrative systems (Elias, 2014)—have several advantages. First, they usually provide larger sample sizes than surveys (Card *et al.*, 2010). As is the case in this study, they may even cover the entire population of interest. Second, they may provide information difficult to collect (e.g. information on groups or entities reluctant to participate in surveys or information less likely to be disclosed to a primary researcher; Goerge and Lee, 2002). Third, they can provide necessary information more quickly and at a lower cost than conducting a new survey, which is especially relevant in low-income settings (Hung *et al.*, 2020; Masefield *et al.*, 2020).

Yet, administrative data also present some challenges for academic research. Access is often rendered difficult by legal and ethical issues (Stevens and Laurie, 2014), and datasets typically require substantial management efforts—such as cleaning or restructuring—before analysis. This implies, for example, that researchers may have to start exploring a research question without full knowledge of the data, which carries an opportunity cost (Connelly *et al.*, 2016). In addition to addressing an underexplored topic in the UHC literature, the present study contributes to sharing experiences and expanding the evidence base generated from administrative data in health policy and systems research.

Methods
Study setting
In SSA, CBHI has become popular in policy circles where mandatory enrolment in health insurance schemes is perceived to conflict with the prerogatives of the State or the values prevailing in the population, e.g. where this is deemed 'a too intrusive state interference in the individual sphere' (Fonteneau *et al.*, 2017). This is typically the case in Senegal, which has a long-standing tradition of CBHI (starting as early as the 1980s in the region of Thiès) and where expanding CBHI was put on top of the political agenda by President Macky Sall during his electoral campaigns in 2012 and 2019. Since his election in 2012, CBHI has been propounded as one of the core strategies to achieve UHC (Deville *et al.*, 2018). This has translated into the creation of a National Agency in 2015, whose missions include structuring and accelerating the development of CBHI through sustainable MHOs (*mutuelles de santé*; Appendix, p. 2). MHOs in Senegal target all individuals not covered through formal-sector protection schemes,

free healthcare initiatives (mainly for children, elders and the disabled) or private health insurance, including workers in rural and informal sectors (95% of the active population) and unemployed individuals (Deville *et al.*, 2018). This corresponds to about 80% of the total country population (Fonteneau *et al.*, 2017), i.e. 12 205 077 individuals in 2017 (Agence Nationale de la Statistique et de la Démographie. Rapport projection de la population du Sénégal, 2016).

In line with conventional CBHI schemes, insurance coverage is not automatic, and enrolment is voluntary. However, in contrast to traditional CBHI schemes, the model established by the National Agency has three specific features. First, the benefits package and insurance premium are standardized at the national level. The scheme's benefits package covers a range of essential health services and drugs delivered or prescribed by contracted providers, including health posts (primary care), health centres (primary and secondary care), referral hospitals (tertiary care) and private pharmacies. These include outpatient care (consultations, surgery and diagnostic tests), maternal care (ante-/post-natal care and family planning), hospitalization and transport. Limitations of the benefits package include long-term treatments for chronic diseases (e.g. cancer, diabetes, chronic asthma and chronic mental health), which are not covered as a prudential rule to limit the financial risks associated with overconsumption and, more generally, due to limited financial capacity (Ouattara and Ndiaye, 2017). Second, the State fully subsidizes user fees and insurance premiums for the poor. Specifically, this involves two categories of individuals: (a) the beneficiaries of the 'Programme National des Bourses de Sécurité Familale' (National Family Security Grant programme—PNBSF), a programme through which the poorest households of the country receive quarterly cash transfers (25 000 Francs CFA—about USD 45); (b) the holders of the 'Carte d'Egalité des Chances' (Equal Opportunity Card—CEC), which is delivered to people living with disabilities and gives them access to various subsidized social services. The State subsidizes only 50% of the insurance premium for all other enrolees. In addition, the State fully covers the co-payments of PNBSF and CEC enrolees for health services and drugs included in the benefits package. For regular enrolees, the scheme only covers 80% of health services and generic drugs and 50% of specialty drugs. Third, the scheme is organized so that MHOs only handle the insurance premiums for health services and drugs delivered or prescribed by health posts and health centres (i.e. for the first two levels of care). The rest of the fund, dedicated to health services and drugs delivered or prescribed by referral hospitals, is pooled at the departmental level and managed by the MHO departmental unions. As such, larger financial risks associated with (more costly) tertiary care can be pooled by larger groups (Deville *et al.*, 2018; Bossyns *et al.*, 2018; Daff *et al.*, 2020).

By the end of 2016, the national programme had led to the creation of 676 MHOs in all 552 municipalities of Senegal (Daff *et al.*, 2020). However, despite these efforts, the share of the population enrolled in MHOs remains below the planned objectives. According to recent estimates, only 26% of eligible individuals were covered in 2017 (Agence de la CMU, 2020), leaving many households at risk of catastrophic health expenditures. To address this issue, the government recently launched a new 'Strategic Development Plan towards UHC' (2017–2021), one of the objectives of which

is to accelerate the professionalization of MHOs. This plan includes, among other initiatives, subsidies supporting the recruitment of salaried managers to reinforce their operational capacity. Prior to 2017, MHOs were largely operated voluntarily. Community members in charge of the day-to-day running of the scheme (i.e. enrolling members, collecting premiums, managing finances and reimbursing providers) would only receive modest compensatory allowances as financial conditions permit. However, transition to a higher degree of professionalization has since been fostered by the National Agency. In 2017, the Agency committed to fully covering the salary of one manager per MHO for 6 months to support the professionalization of management activities (75 000 Francs CFA per month—about USD 135, standardized at the national level). In return, MHOs committed to sustaining the transition efforts towards professionalization by continuing to pay the wages past these 6 months.

Data sources
A major implication of the government's development plan has been the setup of rigorous data monitoring requirements for MHOs. Since the first quarter of 2017, each MHO in Senegal has been required to deliver a quarterly report of their activities. This is done using standardized forms that summarize the progress of several indicators, including operational (e.g. number of enrolees), financial (e.g. amount of membership fees received) and administrative variables (e.g. number of meetings held by the Executive Board). The National Agency in charge of structuring the development of CBHI collects these reports through each of its 14 regional branches, where their content is checked and transcribed electronically. Such a detailed data collection process at the MHO level, nationwide and over several years is time- and resource-consuming and requires a strong political commitment. We are not aware of the existence of similar microdata elsewhere in SSA. We collated all reports from the start of 2017 to the end of 2019, which amounted to 12 waves of quarterly panel data covering all functioning MHOs in the country. Of the 676 MHOs registered in Senegal, 22 were identified as having discontinued their operations before the studied period and were therefore not included in the analysis. In addition, we excluded the 26 MHOs located in the departments of Foundiougne and Koungheul. MHOs in these two departments are subject to a special regime of governance that translates into a different implementation of the CBHI scheme through so-called departmental health insurance units (*Unités Départementales d'Assurance Maladie*; UDAM) (Bossyns *et al.*, 2018). The UDAM system is a model of larger-scale insurance units at the department level (rather than the community level, on which this study focuses), with specific features: (a) centralized scheme management at the department level; (b) advanced technical assistance to MHOs; (c) advanced degree of professionalization and (d) longer-term financial and technical partnerships with external development partners. These specificities create two challenges for our analysis. First, due to major structural differences, the performance of MHOs based in UDAM departments cannot be assessed through the same lens as regular MHOs. Second, due to centralized management, some variables of interest are unavailable at the MHO level in the UDAM departments. Finally, we excluded 10 MHOs for which enrolment was

reserved for members of professional guilds. The performance of these MHOs cannot be directly compared to those of regular MHOs due to restricted enrolment conditions. As a result, the sample for analysis included 618 MHOs located in 43 departments in all 14 regions of Senegal. Further description of the dataset is provided in Appendix, p. 3. Other variables used for data analysis, i.e. control variables at the community, health district, departmental or regional level, were collected from publicly available databases and reports published by the National Agency of Statistics and Demography and the Ministry of Health and Social Action of Senegal (Appendix, p. 4).

Performance and sustainability indicators
We selected three performance and sustainability indicators at the MHO level. First, we focused on the total number of enrolees to indicate the MHO's capacity to reach its target population. This number includes all individuals enrolled in the CBHI scheme in the community, i.e. household heads who registered as MHO members and (either all or some of) their household members. Second, we selected the enrolment of poor MHO members as an indicator of the scheme's capacity to provide equitable access to financial risk protection. 'Poor members' refer to financially disadvantaged individuals for whom the State fully subsidizes user fees and insurance premiums, i.e. the beneficiaries of the PNBSF and CEC social programmes. For all other members ('regular members'), the State only subsidizes 50% of insurance premiums (Daff *et al.*, 2020). Third, as an indicator of the scheme's capacity to be sustainable over time, we examined the proportion of regular enrolees up to date with their premium payment ('up-to-date enrolees'). Financial viability is key to envisioning the transition from a CBHI scheme that heavily relies on public subsidies to a successfully self-financed one.

Operational and structural factors of interest
On the operational side, we focused on three variables aimed to be proxies for the operational capacity of MHOs: (a) the presence of a salaried manager in charge of the day-to-day operations of the scheme (including registering new members, reviewing invoices and reimbursing health posts) and the dissemination of information about the scheme in the community; while, before 2017, MHOs used to be mainly run voluntarily, significant efforts have been made to transition towards a higher degree of professionalization through the recruitment of salaried managers; (b) the amount of operating expenditure per member; these expenses notably include the transportation of Board members attending meetings and awareness-raising activities, thereby capturing a certain degree of managerial dynamism and (c) the number of contracts signed with health posts, reflecting managerial competency and trust in MHO staff by healthcare providers. In the Senegalese system, each MHO is responsible for negotiating their contracts with local providers, i.e. health posts, which deliver primary care, health centres, which provide primary and secondary care (health centres can be regarded as district hospitals; Mané, 2012), and pharmacies. Contracts with referral hospitals (tertiary care) are negotiated at an upper level by the departmental unions. However, the number of health centres is fairly low compared to the

number of health posts (in 2016, these numbers were 100 and 1458, respectively; Agence Nationale de la Statistique et de la Démographie, 2017). This is especially true in most rural regions; in 2016, for example, there were only three health centres in the regions of Kédougou and Sédhiou (Agence Nationale de la Statistique et de la Démographie, 2017). To capture a greater variation between MHOs, we only focused on the number of contracts signed with health posts. Health posts, located in urban and rural communities at the municipality or village level, constitute the country's backbone network of care provision. On the structural side, we selected two variables relating to the location or history of the MHO: (a) whether the MHO's head office was located within a health facility (i.e. a health post or centre) or not to explore whether closer proximity between care providers, eligible individuals and MHO staff could predict higher levels of enrolment and (b) whether the MHO started its activities before or after the wave of MHO creation initiated by the government in 2016 to examine the role of a pre-existing tradition of CBHI in the community.

Statistical analysis
Primary analyses
We estimated linear dynamic panel data (DPD) models to assess the association between the three indicators of performance or sustainability and the selected operational and structural factors between 2017 and 2019 using quarterly timepoints and MHOs as cross-sectional observation units. Unlike 'static' panel data models, such as fixed-effects (FE) or random-effects models, DPD models allow both current and past information to be accounted for, i.e. they model current performance indicators as a function of past performance and both past and current values of selected operational variables. Such models typically write as follows:

$$y_{it} = \delta y_{i,t-1} + \beta X_{it} + \gamma Z_i + \lambda_t + c_i + \varepsilon_{it} \qquad (1)$$

where y_{it} denotes performance indicator y for MHO i in quarter t; $y_{i,t-1}$ denotes its value in the previous quarter; X_{it} represents selected time-varying variables for MHO i in quarter t (including past values); Z_i represents selected time-invariant variables for MHO i; λ_t denotes quarter effects; c_i represents MHO (unobserved) time-invariant heterogeneity (i.e. the permanent component of the error term, commonly referred to as *unit-specific effects*) and ε_{it} denotes the transitory component of the error term. Coefficients δ, β and γ are regression parameters to be estimated. We employed an approach consisting of a two-stage sequential estimation procedure where the coefficients of time-varying regressors were estimated using Arellano–Bond estimators (first stage), and the coefficients of time-invariant regressors were subsequently recovered using linear panel data estimators (second stage) (Arellano and Bond, 1991; Kripfganz and Schwarz, 2019). Control variables were added to the models to reduce the risk of confounding effects in the second stage, including demographic and socioeconomic factors at the community level—population, urban or rural administrative status, poverty rate estimated based on household consumption, presence of another MHO (since premium prices and benefits packages are standardized at a national level, competition between MHOs is only based on location and contracts with

providers)—and supply-side factors related to care provision at the departmental or regional level. These included population per health post, geographic accessibility of basic health services (measured by the average distance between health posts and the closest health centre in each department) and the availability of basic patient services. The latter reflects, in each region, the proportion of healthcare facilities (health posts, health centres and hospitals) equipped to provide six essential health services: (a) child health: curative care services; (b) child health: growth monitoring services; (c) child health: vaccination services; (d) family planning services; (e) antenatal care services and (f) services for sexually transmitted infections. Lastly, fixed effects at the departmental level were included.

Sensitivity analyses
We also estimated standard FE models to assess the robustness of the association between performance indicators and time-varying predictors. We selected the FE specification after testing the assumption that there was a significant correlation between the unit-specific effects c_i and the selected predictors (which, if not accounted for, would lead to inconsistent estimates when using linear estimators) using Mundlak tests (Mundlak, 1978).

Subgroup analyses
We explored the heterogeneity of the association between performance indicators and time-varying predictors based on the following factors: (a) urban or rural community; (b) poverty rate in the community; (c) geographic accessibility of basic health services in the department and (d) incidence of malaria in the health district, to investigate whether reinforcing the operational capacity of MHOs could be more beneficial in areas with higher demand for health services.

Results
Descriptive statistics
Trends in performance and sustainability indicators
The total number of MHO enrolees continuously increased between 2017 and 2019 (see Figure 1). This trend was observed in both rural and urban communities regardless of the poverty rate in the community. On average, rates of enrolees were higher in rural communities by around five percentage points (pp) and in more impoverished communities by about 15 pp. From mid-2018 onwards, data suggest that this increase was driven mainly by an accelerated enrolment of poor members. The increase in the proportion of poor members in 2019 is explained, at least partly, by the extension of the national PNBSF programme, through which 166 939 additional households became eligible to free enrolment in MHOs at the national level. Proportions of poor members were higher in MHOs located in rural and more impoverished communities by around 5–10 pp and 10–20 pp, respectively. Regarding the proportion of up-to-date enrolees, there was a homogeneous decrease on average over the considered period. While 42% of enrolees had paid their insurance premium by the end of 2017, they were 32% in 2018 and only 28% in 2019.
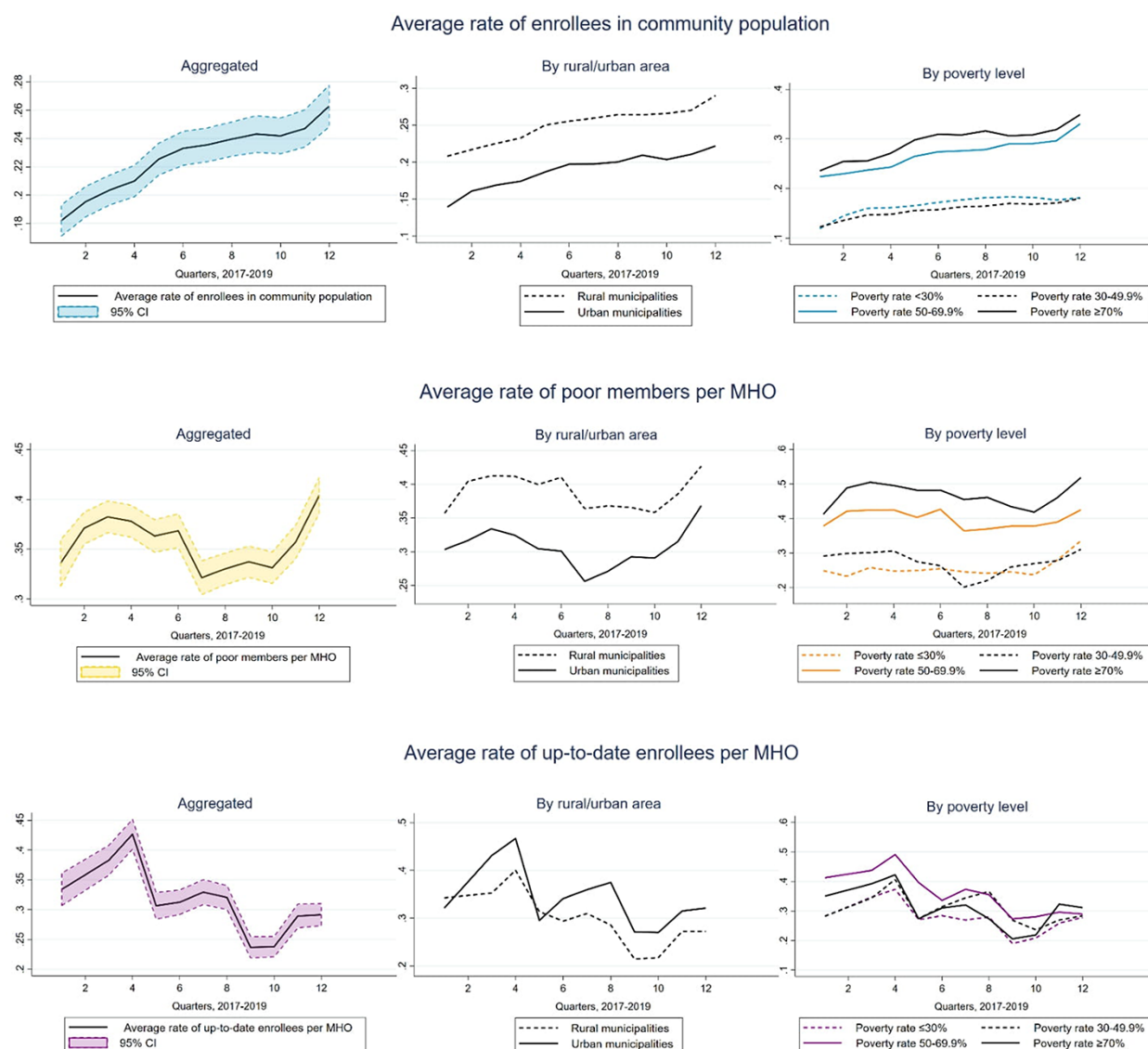
Figure 1. Trends in performance and sustainability indicators over the study period (2017-2019)

Note: Upper row: average proportion of MHO enrolees in community population; middle row: average proportion of poor members within MHOs; lower row: average proportion of up-to-date enrolees within MHOs. Left column: aggregated; middle column: stratified by urban/rural area; right column: stratified by poverty rate in the community. n(region) = 14, n(department) = 43 (all excluding Foundiougne and Koungheul), n(MHO) = 618.

Geographical variations in performance and sustainability indicators

Figure 2 shows vast disparities across regions regarding performance and sustainability indicators (the figure was constructed using aggregated data at the departmental level; therefore, the UDAM departments were also included). At the departmental level, enrolment rates in the population varied from below 10% (in the urban departments of Dakar, Pikine and Mbacke) to above 50% (in the rural departments of Birkilane, Guinguineo and Koungheul). Proportions of poor members within MHOs varied by a factor of five: from 15% in Rufisque and Tivaouane to above 75% in Tambacounda and Oussouye. In terms of up-to-date enrolees, only one in four departments had rates above 38%. The two best-performing departments were where a UDAM is in place, i.e. Foundiougne and Koungheul, with rates reaching 75%.

Structural characteristics of MHOs

A minority of the 618 MHOs were located in urban communities (39%) and had their head office within a healthcare facility (22%). About half started their activities following the 2015 reform, i.e. on or after 2016 in practice (54%).

Associations between predictors of interest and levels of performance and sustainability

Regression coefficients for changes in performance and sustainability indicators associated with changes in operational and structural variables are plotted in Figure 3 and tabulated in Table 1. On the operational side, the presence of a salaried manager was associated with increases in the total number of enrolees (+12%, $P = 0.02$), in the enrolment of poor members (+23%, $P = 0.08$) and in the proportion of up-to-date
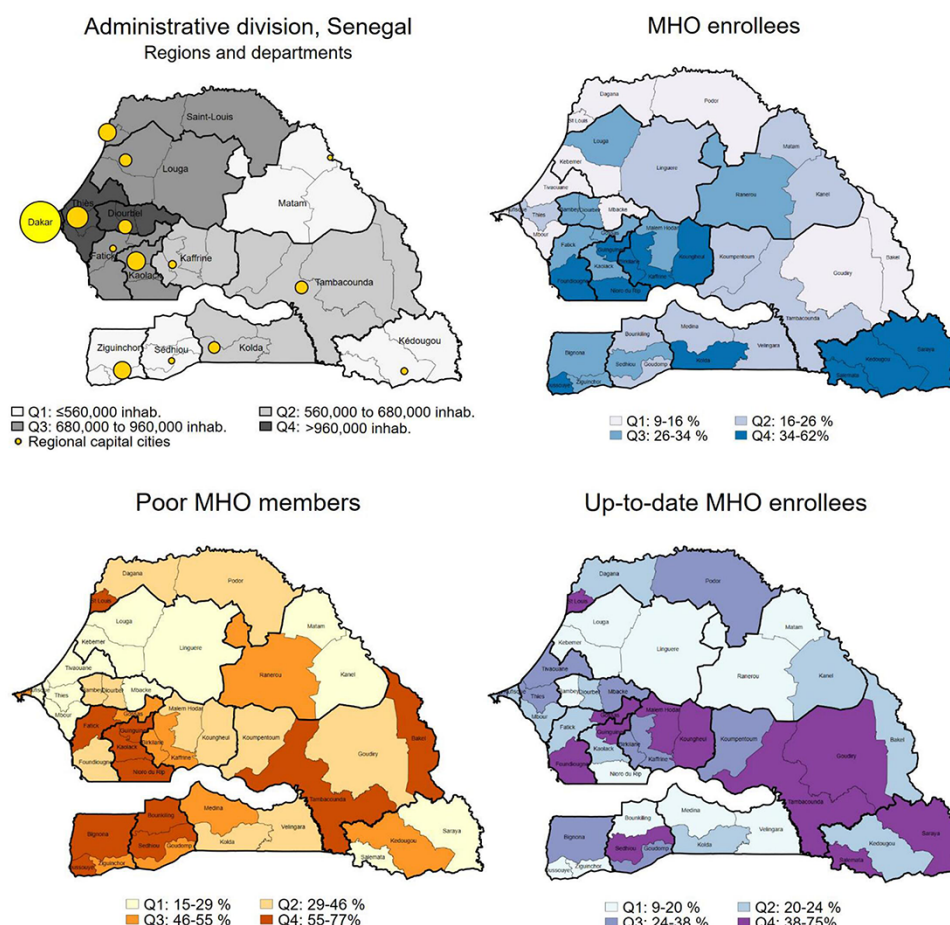
Figure 2. Geographical variations in population and performance/sustainability indicators

Note: Q1 = 1st quartile; Q2 = 2nd quartile; Q3 = 3rd quartile; Q4 = 4th quartile. *n*(region) = 14, *n*(department) = 45; *n*(MHO) = 644. Clockwise from the upper left corner: (1) population, by region, 2013, regional capital cities' point size is proportional to city population; (2) percentage of the population enrolled in MHOs, by department, 2019; (3) percentage of enrolees who paid the insurance premium, by department, 2019; and (4) percentage of MHO members registered as poor members, by department, 2019.

enrolees (+0.06 pp, $P = 0.03$). DPD estimates also indicated a positive association between the amount of expenditure spent to operate the scheme and both the enrolment of poor members and the proportion of up-to-date enrolees. However, the magnitude of these effects was modest at best: doubling the expenditure amount was associated with a 3.3% increase in the number of poor members ($P = 0.03$) and a 0.005 pp increase in the proportion of up-to-date enrolees ($P = 0.01$). Furthermore, for each additional contract signed with a health post, there was a 7% increase in the number of enrolees ($P < 0.01$) and a 5% increase in the number of poor members ($P = 0.08$). On the structural side, estimates resulting from the second stage of the sequential estimation procedure (pooled linear regression) showed that MHOs whose head office was located within a healthcare facility had, on average, fewer poor members (–16%; $P = 0.02$). Conversely, MHOs created after the government's reform in 2015 enrolled a higher number of poor members (+24% on average; $P < 0.01$). These findings were consistent when using varying sets of control variables and fixed effects (Appendix, p. 6–8).

Attrition

Seven MHOs were identified as having discontinued their activities between 2017 and 2019. Although this represented only a tiny fraction of our sample (1.1%), we could not exclude the risk of attrition bias due to plausible correlations between dropouts and performance indicators. To address this concern, we re-estimated the DPD models after imputing missing data for these seven MHOs based on hypothetical scenarios (best-case performance and worst-case performance) to assess any significant changes in our estimates. Results did not reveal any significant change, suggesting that attrition was not a threat to the reliability of our estimates (Appendix, p. 9).

Heterogeneity

Subgroup analyses did not reveal any statistically significant heterogeneous effects (Appendix, p. 10–13). Findings may nonetheless suggest that higher operational capacity led to higher benefits for the enrolment of populations living in poorer communities.

Discussion

This study is the first to quantitatively explore the operational and structural predictors of enrolment in CBHI schemes at the MHO level. Our findings suggest that operational capacity is a key predictor of scheme performance. The recruitment of salaried managers to operate the day-to-day activities of
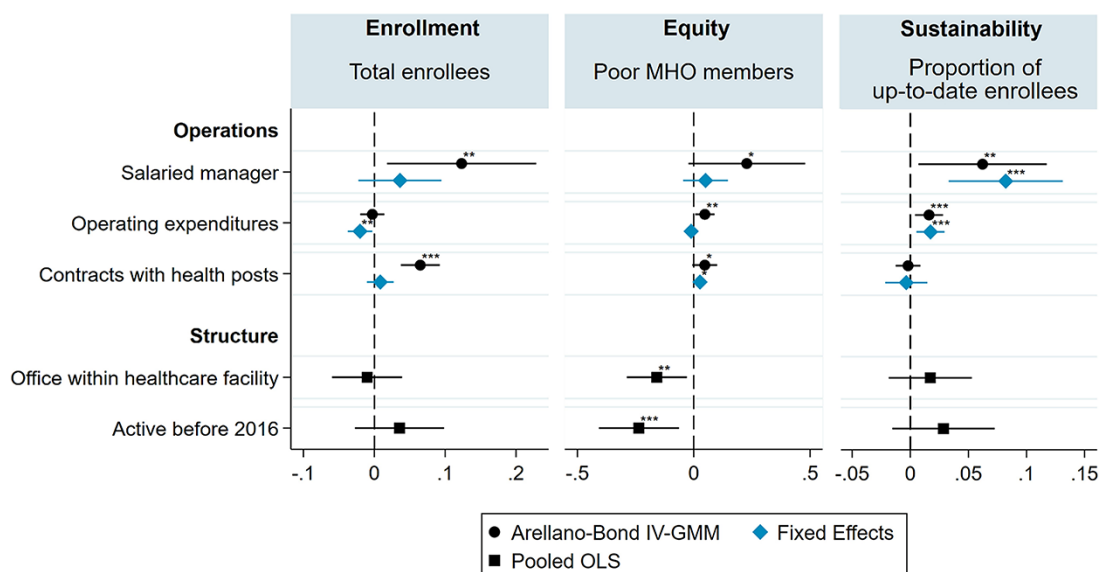
Figure 3. Associations between performance/sustainability indicators and operational/structural factors

Note (Table 1): IV-GMM: instrumental variable-generalized method of moments; OLS: ordinary least square. The figure shows regression results from linear DPD models and FE models. The markers show point estimates, and the lines show 95% confidence intervals. All dependent variables but the proportion of up-to-date enrolees are log-transformed. For DPD models, control variables include demographic, socioeconomic, and supply-side factors: (1) population in the community, (2) urban or rural administrative status of the community (*commune* or *communauté rurale*, respectively), (3) poverty rate in the community, (4) presence of another MHO in the community, (5) population per health post in the department, (6) the average distance between health posts and the closest health centre in the department, and (7) regional indicator of the availability of basic patient services. Fixed effects at the departmental level are also included. For FE models, the regional indicator of the availability of basic patient services, which varies annually, is included as a control. Additional model-specific covariates include the total number of MHO members to estimate the change in poor members. Cluster-robust standard errors are used to account for possible autocorrelation and heteroskedasticity. Full regression tables are provided in Appendix, p. 5.

Table 1. Associations between performance/sustainability indicators and operational/structural factors

	Enrolment (Total enrolees)		Equity (Poor MHO members)		Sustainability (Proportion of up-to-date enrolees)	
	DPD model	FE model	DPD model	FE model	DPD model	FE model
Operations						
Salaried manager	0.123**	0.036	0.228*	0.051	0.062**	0.082***
Operating expenditures per member	−0.002	−0.020**	0.047**	−0.011	0.016***	0.017***
Contracts with health posts	0.065***	0.009	0.047*	0.027*	−0.002	−0.003
Structure						
Office within a healthcare facility	−0.010		−0.159**		0.017	
Active before 2016	0.036		−0.236***		0.029	
Control variables						
Time-invariant	Yes	No	Yes	No	Yes	No
Time-varying	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	No	Yes	No	Yes	No
Time effects	Yes	Yes	Yes	Yes	Yes	Yes
n (MHO)	475	475	460	471	467	474
n (observations)	1615	1642	1613	1665	1622	1660

*P < 0.1,
**P < 0.05,
***P < 0.01.

the scheme was identified as a primary factor, being associated with higher levels of total enrolees, increased enrolment of poor members and higher collection of premium fees. The consistency in the direction of the estimates of both DPD and FE models suggests that these associations were robust. Such findings are in line with previous studies having identified weak managerial capacity as one of the leading causes hampering the successful development of CBHI in SSA (De Allegri *et al.*, 2009; Mladovsky *et al.*, 2015; Waelkens *et al.*, 2017;

Chemouni, 2018). Estimates of the association between operating expenditure and performance indicate, for their part, that higher levels of MHO activity may be beneficial for the enrolment of poor members but not necessarily so for that of regular members. While breaking down MHOs' expenditures to investigate the role of specific items was not feasible, we identified that these spendings include office-related expenses (e.g. rent, bills and consumable goods), logistics (e.g. transportation of Board members attending meetings)

and awareness-raising activities. Given the current poverty-based subsidy policy in Senegal, a possible explanation could be that poorer households, who can enrol for free, are more responsive to such awareness-raising activities. However, it is noted that these effects are substantially smaller than those of salaried managers, with supplemental sensitivity analyses suggesting that they may also lack robustness (further details below). Because the Senegalese system requires that operating expenditure be restricted to only a small fraction of MHOs' revenues (15% of the total amount coming from premiums, including fully subsidized premiums), little variation may explain these results. While such effects are limited, operating expenditure dedicated to the transportation of Board members and awareness-raising activities is crucial to ensure that communities remain involved in CBHI governance as scheme professionalization is going forward (Ridde *et al.*, 2018). Furthermore, the positive correlation between the number of contracts signed with health posts and the enrolment of both regular and poor members highlights the importance of successful partnership and cooperation between MHOs and local health facilities. Contracts with health posts are not automatic and result from negotiations between MHOs and providers on a case-by-case basis. As such, long-lasting contracts with multiple providers indicate higher levels of trust from the latter and reflect, at least partly, good management competency (Mladovsky *et al.*, 2015). Subgroup analyses finally hint that reinforcing operational capacity particularly benefits enrolment in MHOs located in poorer communities. Although further investigation is needed, professionalization initiatives may lead to pro-poor effects, which are crucial to reducing inequalities and fostering convergence between territories.

A significant, positive association was also found between the proportion of up-to-date enrolees and both the presence of a salaried manager and the amount of operating expenditure. However, the magnitude of these effects was minimal, indicating that higher operational capacity alone may not be sufficient to ensure the sustainability of CBHI schemes. This finding suggests that more effective strategies are needed to improve the collection of premium fees and reduce the number of dropouts among regular members, assuming that a share of those who are not up to date with premium payment voluntarily dropped out. Because MHOs do not delineate enrolment at the individual level in their activity reports (they only report aggregated numbers), we could not use re-enrolment as a sustainability indicator. The share of enrolees up-to-date with premium payment, which we used as a proxy for re-enrolment, has the disadvantage of possibly excluding members who did not necessarily plan to drop out. For example, some members might have had to defer their payment (e.g. due to financial constraints) while still intending to renew their membership. Moreover, the benefits of signing more contracts with health posts may also come at a cost in terms of sustainability. As a complementary analysis, we estimated the association between each operational variable and the value of financial assets declared by MHOs (Appendix, p. 14). 'Financial assets' refer to the sum of the bank account balance and the amount in cash reported each quarter by MHOs. Although the results must be interpreted with caution given higher rates of missing data, signing more contracts was negatively associated with financial assets (-12%, $P = 0.04$). This result suggests that there might be a trade-off between diversifying the care options to make the scheme

more attractive and containing the additional costs incurred by the multiplication of contracts at the MHO level.

Finally, findings indicate that structural factors may also play a role in the performance of CBHI schemes. MHOs whose head office was located within a healthcare facility enrolled, on average, fewer poor individuals. While the reasons behind this finding are unclear, one of them might be that closer proximity between care providers and MHO staff increases the latter's accountability in reimbursing on time the health services delivered to MHO members by the former. Yet, in Senegal, State subsidies covering poor members' expenses are frequently delayed (Kato *et al.*, 2018). Healthcare facility-based MHOs may have a higher disincentive in enrolling them because payment delays may negatively affect the MHO–provider partnership in the long run (loss of trust). This interpretation could be further reflected in the fact that healthcare facility-based MHOs have, on average, lower levels of financial assets (Appendix, p. 14). Another reason might be that these MHOs enrol regular members more easily simply because of convenience (i.e. regular members are more likely to enrol when they are sick and need to consult at the health facility). Lastly, the association could also result from the fact that such MHOs are more common in urban than in rural areas (27% vs. 18%, respectively), where the proportions of individuals eligible for social programmes are higher. Further investigations are needed to understand this association. Provided that geospatial data can be available at the MHO level, the analysis could also be extended to explore how geographical proximity between head offices and healthcare providers influences performance.

A significant strength of this study lies in providing compelling new data on a topic of broad interest. As we are not aware of similar nationwide microdata on MHO operations in SSA, we believe the findings are valuable to the many countries of the region currently embedding CBHI in their strategies towards UHC. Importantly, the study holds the potential to initiate new avenues of research. It particularly highlights the opportunity to use secondary administrative data as an alternative to survey data for quantitative investigations in health policy and systems research. In recent years, discussions around the availability and promise of new types of 'big data' for research purposes in the social sciences have flourished (Card *et al.*, 2010; Einav and Levin, 2014; Connelly *et al.*, 2016). While there is no single definition of big data, these generally refer to data generated by social media, business data (e.g. supermarket transactions), GPS tracking data and—although a little less present in the mainstream discussions—administrative data (Connelly *et al.*, 2016). For example, it has recently been argued that administrative data generated by non-governmental organizations (NGO) 'present an important but largely unrealised opportunity to provide new research insights in critical areas, including the evaluation of health policy and programmes' (Masefield *et al.*, 2020). Such data promise to open up new research perspectives in low-income settings. Their volume and immediacy represent significant untapped potential for secondary analysis, especially when resources are limited or no other data source is available (e.g. information on groups that are hard to reach) (Masefield *et al.*, 2020).

As shown in this study, administrative data enable us to build datasets that cover the entire population of interest, which is often not possible with survey data. Moreover, while

conducting panel surveys can be costly for researchers, administrative data open up the opportunity to build panel datasets rapidly and at a reduced cost. Facilitating the construction of panel data may promote the study of behavioural and social change processes, which is highly valuable for evaluating social programmes and developing (better-targeted) policies (Card *et al.*, 2010). To better exploit these resources, further collaborations need to be fostered between data owners, such as governments and NGOs, and researchers (Masefield *et al.*, 2020). These collaborations would particularly benefit the development of research programmes to inform health policies in low-income countries and for marginalized groups, improving health and reducing health inequalities. They may also help enhance data quality, inducing the broader use of administrative data for research purposes. While survey data typically comply with rigorous collection standards, concerns may be raised about administrative data's (lack of) reliability. For example, a threat to reliability may result from implementing a performance management system (PMS). A PMS can be defined as 'a set of management control mechanisms used by executives and employees with the overall purpose of facilitating the delivery of organizational goals by influencing people's behaviour and performance' (Broadbent and Laughlin, 2009). These systems involve a performance-based reward element—either extrinsic, e.g. a bonus, or intrinsic, e.g. a sense of achievement—linked to the generated performance information. Studies have shown that PMSs often have unintended consequences, favouring various forms of information manipulation (Franco-Santos and Otley, 2018). In this context, there is a need to carefully evaluate the extent to which (lack of) quality may jeopardize research outcomes when considering secondary analyses of administrative data.

Despite the innovative nature and strengths of the data used in this study, some limitations need to be acknowledged. A first limitation concerns the restricted choice set of performance indicators available at the MHO level. Enrolment in MHO, which we treated as a proxy for insurance coverage, has some weaknesses. Many individuals listed as 'enrolees' in the data turned out not to be up-to-date with premium payment and, therefore, were *de facto* no longer covered by the scheme. Moreover, MHO members may sometimes be denied access to care when MHOs incur arrears hampering providers from being reimbursed on time (Kato *et al.*, 2018). Similarly, enrolment of poor members, which was selected as a marker of equitable access to care, has some weaknesses. Due to the lack of information on wealth or income at the individual level, we could not precisely examine how enrolment varied across income groups. Data only allowed us to distinguish between members required to pay insurance premium fees ('regular members') and members for whom fees are fully covered by the State ('poor members'). The latter are either PNBSF or CEC beneficiaries, social programmes reserved for the most financially disadvantaged groups. As such, the selected indicator—although admittedly imperfect—yet captures people who are among the poorest of the poor (i.e. it is reasonable to assume that, on average, 'poor members' are poorer than 'regular members'). The MHO systematically checks the eligibility of new enrolees to the free healthcare programmes so that regular members cannot deceitfully pose as 'poor members'. It is also worth mentioning that, while using microdata at the MHO level allowed us to estimate the associations of interest more accurately

than using aggregated data, there is a data limitation issue regarding the performance indicators. Both performance indicators could be improved by benefiting from target population estimates at the MHO or community level. Rather than examining the number of individuals enrolled (total enrolees and poor members), such information would allow the proportion of target populations enrolled in MHOs to be tracked, better indicating the scheme's success. While such estimates were not available, we checked the associations between the predictors of interest and (a) the proportion of targeted individuals enrolled in the community using the yearly projected population to approximate the target community population for the denominator (Appendix, p. 15–17) and (b) the proportion of targeted poor individuals enrolled in the community, using estimates of the number of individuals eligible for the PNBSF or CEC programmes at the departmental level (Appendix, p. 18). Although the results of these sensitivity analyses must be interpreted with caution, given the approximations made to calculate the missing denominators, the associations were overall consistent with those obtained previously when using the number of enrolees and poor members.

Lastly, one cannot ignore the risk that our data suffer from limitations similar to those generated by administrative systems ruled by PMS. Indeed, it is possible that (at least some) salaried managers inflated the performance data. While the National Agency could mitigate some data limitations (e.g. missing data, inconsistencies and typos), it is difficult to evaluate how much MHO performance might have been overestimated. MHOs in Senegal do not benefit from any performance-based reward system, which suggests that this risk—while not excludable—is minimal. Ideally, regular audits are necessary to verify the consistency of reported information. Yet, assuming that a proportion of salaried managers did report inflated performance (e.g. to signal a high capacity of achievement), the association between operational capacity and performance would be overestimated.

A strength of the study also resides in the type of data analysis used. Our analysis fully leveraged the longitudinal nature of panel data. By estimating DPD models, we were able to account for potential reverse causality issues inherent in the nature of the associations explored. For example, it is plausible that MHOs with more enrolees could negotiate new contracts with health posts more easily. If unaccounted for, such issues could threaten the reliability of our estimates. Nevertheless, the analysis had some limitations. While rates of missing data were low for performance indicators, they were higher for reported operational and financial variables (Appendix, p. 3). Missingness was negatively associated with operational capacity, highlighting the crucial role of managers in data management (Appendix, p. 19). To explore possible bias in estimated associations, we assumed that data were at least missing at random and performed additional sensitivity analyses using multiple imputation methods (Appendix, p. 20; White *et al.*, 2011). To the exception of operating expenditure, the effects of which became no longer significant and should therefore be interpreted with caution, our estimates were consistent. Another limitation of the analysis could be due to autocorrelation and heteroscedasticity in our models; however, they were controlled by using cluster robust standard errors.

The findings have important policy implications for the design of CBHI schemes in SSA. They suggest that policies

aimed at professionalizing and reinforcing the operational capacity of MHOs may accelerate the expansion of health insurance coverage in populations not covered through formal health protection schemes. Paired with subsidies that allow premium fees for the poorest to be waived—and assuming a strong commitment from the State to send these subsidies on time, which otherwise hampers the enrolment of new members (Kato *et al.*, 2018)—such policies can lead to an equitable increase in CBHI enrolment, which may, in turn, increase financial risk protection across these populations. In particular, the recruitment of salaried managers, who play a crucial role in disseminating information in the community and operating the scheme, is to be supported. This echoes previous analyses of the failures of current CBHI schemes, calling for a higher degree of professionalization of their management activities (De Allegri *et al.*, 2009; Mladovsky *et al.*, 2015; Waelkens *et al.*, 2017; Chemouni, 2018; Ridde *et al.*, 2018). While the findings suggest that professionalization policies can boost enrolment in voluntary CBHI schemes, particularly in SSA countries relying on similar CBHI models where subsidy policies for the poor are in place, they also hint that such policies could be beneficial for other types of schemes as well. For example, the literature reports that weak managerial capacity also constitutes a barrier to enrolment in countries where insurance is mandatory but where enforcement is weak (e.g. Ghana; Kotoh and Aryeetey, 2018).

Nevertheless, while reinforcing operational capacity appears necessary, UHC targets will likely not be achieved without also addressing other supply-side hindrances alongside. By focusing on the operational and structural characteristics of CBHI schemes, we shed light on a category of supply-side factors that had largely been underexplored in previous investigations of the determinants of scheme enrolment. However, other supply-side factors also play a crucial role and should not be neglected. On the care provision side, several dimensions of care quality have been shown to strongly predict enrolment and retention in CBHI schemes (Dror *et al.*, 2016). Healthcare providers' lack of technical competence (Criel and Waelkens, 2003; Schneider, 2005), negative attitudes (e.g. preference given to cash-paying uninsured patients and rudeness) (Basaza *et al.*, 2008; Turcotte-Tremblay *et al.*, 2012) and poor healthcare facilities or services (e.g. dirty premises and shortage of medicines) (Criel and Waelkens, 2003; Basaza *et al.*, 2008; Dong *et al.*, 2009; Turcotte-Tremblay *et al.*, 2012; Mladovsky, 2014) have all been identified as significant barriers. In low-income settings, while much of global health policy has focused on increasing access to health services, evidence suggests that quality is often the main constraining factor for the majority (Das, 2011; Das *et al.*, 2016). Regarding the design aspects of the scheme, people's dissatisfaction with the insurance benefits package is also an essential hampering factor (Basaza *et al.*, 2008; Turcotte-Tremblay *et al.*, 2012). In particular, the exclusion of medical care for chronic diseases (which require long-term follow-up and treatment), as is currently the case in Senegal, was reported to be a weakness in several studies (Basaza *et al.*, 2008; Kyomugisha *et al.*, 2009).

Given the persistent low take-up and high dropout rates, a legitimate question remains whether voluntary enrolment in CBHI schemes can successfully lead to UHC (Mathauer *et al.*, 2017). Despite being popular among policy circles in SSA, a consensus in the literature is that CBHI schemes are likely to be insufficient. Major international policymakers argue that higher pooling and mandatory enrolment are two *sine qua non* conditions to address adverse selection and allow financial viability (Mathauer *et al.*, 2017; 2020). In Senegal, the fact that higher proportions of up-to-date enrolees are achieved in the UDAM departments of Foundiougne and Koungheul (75%) concurs with the first condition. In these departments, some MHO activities are maintained at the community level to ensure good reach and trust from local populations (registration of new members and information campaigns). In contrast, scheme management and pooling are centralized at the departmental level, strengthening the scheme's financial viability and enabling more efficient operation through economies of scale. Regarding the second condition, while Rwanda's success story appears as a solid supporting case, lessons learned from other countries suggest that mandates alone are by no means a silver bullet to achieving UHC. In South-East Asia, for example, the experience of the Philippines and Vietnam shows that establishing mandatory, subsidized health insurance for the most vulnerable populations does not necessarily translate into higher health services utilization in these populations (Vilcu *et al.*, 2016). In the Philippines, lower utilization rates were observed in the poorest 25% of the population targeted by the programme despite automatic enrolment, while, in Vietnam, the poor still had lower utilization rates than other insured people (Vilcu *et al.*, 2016). Importantly, a mandate does not guarantee actual scheme enrolment. The case of Ghana, where enrolment rates in the National Health Insurance Schemes stagnate at about 40% of the population, highlights the need for accompanying enforcement measures and efforts to address the barriers that deter populations from joining the scheme (Ridde *et al.*, 2018). Recent work conducted in Indonesia to boost enrolment in the contributory portion of the nationally mandated insurance programme shows that overcoming some of these barriers is not an easy task, even when intensive interventions are implemented (e.g. offering assisted registration and free insurance for a year only resulted in a 30% initial enrolment rate; Banerjee *et al.*, 2021). Future research should further explore the potential impacts of mandatory enrolment in CBHI on both the economic welfare and health of target populations (e.g. through modelling studies; Riumallo-Herl *et al.*, 2018).

Finally, there is a need to explore further the impact of professionalization initiatives aimed to reinforce the operational capacity of CBHI schemes. Our findings suggest that such initiatives need to be accompanied by more effective strategies to limit dropouts among contributing members. Without the latter, it is unlikely that CBHI schemes embarked on a transitional path towards professionalization can become self-sufficient in the long run. In Senegal, feedback from the implementation of the National Agency's plan to promote the professionalization of MHOs suggests that this issue is central. While MHOs had committed to keeping financing their manager's salary up to the amount covered by the Agency in 2017 (75 000 Francs CFA per month), some MHOs eventually had to lower this amount in the months that followed due to financial hardship. More research is needed on this account, as existing interventions aimed to boost take-up rates and/or limit dropouts have yielded mixed results (Asuming, 2013; Panda *et al.*, 2015; Bonan *et al.*, 2017; Chemin, 2018; Bocoum *et al.*, 2019). On the MHO side, it could be worth

exploring the impact of linking managers' salaries to some degree of performance, e.g. through incentives or bonuses contingent on enrolling or retaining regular members in the scheme. On the demand side, recent developments in the field of behavioural public policy, which have led to the emergence of new types of behaviour change interventions, may constitute a promising avenue for further research (Oliver, 2015; Gauri, 2018). For example, new types of liberty-preserving interventions have shown promising effects in 'boosting' people's decision-making capacities when facing complex information (Rouyard *et al.*, 2022). In the present context, one such intervention could consist, for example, of testing the use of 'experience-based formats' (Hogarth and Soyer, 2015) to communicate more effectively the risks associated with enrolling vs not enrolling in insurance schemes. Experience-based formats are user-friendly simulators that allow people to explore the likelihoods of possible outcomes related to particular (risky) situations, leading to a better understanding of the risk information (Hogarth and Soyer, 2015). Using such tools may help increase retention rates by promoting better-informed choices among regular enrolees. This may reduce the number of dropouts caused by a poor understanding of the insurance concept; recent evidence has shown that some types of individuals tend to drop out of insurance schemes if they do not experience health shocks during the first year of enrolment (i.e. if they incur negative payouts; Platteau and Ontiveros, 2021). In a context where the political agenda of many countries does not align with the international policy recommendations advocating mandatory enrolment in health insurance schemes, there is a need to evaluate the potential of such alternative, innovative strategies to boost (sustained) take-up rates.

Supplementary data

Supplementary data are available at *Health Policy and Planning* online

Data availability

The data underlying this article were provided by the National Agency for Universal Health Financial Protection of Senegal by permission. Data will be shared on reasonable request to the corresponding author with permission of the National Agency for Universal Health Financial Protection of Senegal.

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Author contributions

TR, YM, BMD and RN conceptualized and designed the study. BMD, SD and KFD supervised the data collection process. TR, SD and KFD verified the data. TR performed the data analysis with support from YM, LD, JT and RN. All co-authors contributed to the interpretation of the findings. TR wrote the initial draft of the manuscript and all co-authors contributed to revising it. All co-authors approved the final version of the manuscript and accept responsibility to submit it for publication.

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References

Acharya A, Vellakkal S, Taylor F *et al.* 2013. The impact of health insurance schemes for the informal sector in low-and middle-income countries: a systematic review. *The World Bank Research Observer* **28**: 236–66.

Agence de la CMU. 2020. Analyse situationnelle des organisations mutualistes à base communautaire dans le cadre de la Couverture Maladie Universelle de janvier 2017 à septembre 2019. Ministère de la Santé et de l'Action Sociale, République du Sénégal, Dakar, Senega.

Agence Nationale de la Statistique et de la Démographie. 2017. Annuaire des statistiques sanitaires et sociales du Sénégal 2016. Ministère de la Santé et de l'Action Sociale, République du Sénégal.

Agence Nationale de la Statistique et de la Démographie. Rapport projection de la population du Sénégal. 2016. 2013-2063. Ministère de la Santé et de l'Action Sociale, République du Sénégal, Dakar, Senegal.

Aggarwal A. 2010. Impact evaluation of India's 'Yeshasvini' community-based health insurance programme. *Health Economics* **19**: 5–35.

Agyepong IA, Abankwah DNY, Abroso A *et al.* 2016. The "Universal" in UHC and Ghana's National Health Insurance Scheme: policy and implementation challenges and dilemmas of a lower middle income country. *BMC Health Services Research* **16**: 1–14.

Arellano M, Bond S. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies* **58**: 277–97.

Asuming P. 2013. Getting the poor to enroll in health insurance, and its effects on their health: evidence from a field experiment in Ghana. Columbia University working paper.

Banerjee A, Finkelstein A, Hanna R *et al.* 2021. The challenges of universal health insurance in developing countries: experimental evidence from Indonesia's National Health Insurance. *American Economic Review* **111**: 3035–63.

Basaza R, Criel B, Van der Stuyft P. 2008. Community health insurance in Uganda: why does enrolment remain low? A view from beneath. *Health Policy* **87**: 172–84.

Bocoum F, Grimm M, Hartwig R, Zongo N. 2019. Can information increase the understanding and uptake of insurance? Lessons from a randomized experiment in rural Burkina Faso. *Social Science & Medicine* **220**: 102–111.

Bonan J, Dagnelie O, LeMay-Boucher P, Tenikue M. 2017. The impact of insurance literacy and marketing treatments on the demand for

health microinsurance in Senegal: a randomised evaluation. *Journal of African Economies* **26**: 169–91.

Bossyns P, Ladrière F, Ridde V. 2018. Une assurance maladie à grande échelle pour le secteur informel en Afrique subsaharienne. Six ans d'expérience au Sénégal rural 2012–2017. *Studies Health Service Organ Policy* **34**. Antwerp, Belgium: ITG Press.

Broadbent J, Laughlin R. 2009. Performance management systems: a conceptual model. *Management Accounting Research* **20**: 283–95.

Card D, Chetty R, Feldstein MS, Saez E. 2010. *Expanding Access to Administrative Data for Research in the United States*. American Economic Association, Ten Years and Beyond: Economists Answer NSF's Call for Long-Term Research Agendas. http://dx.doi.org/10.2139/ssrn.1888586.

Chemin M. 2018. Informal groups and health insurance take-up evidence from a field experiment. *World Development* **101**: 54–72.

Chemouni B. 2018. The political path to universal health coverage: power, ideas and community-based health insurance in Rwanda. *World Development* **106**: 87–98.

Connelly R, Playford CJ, Gayle V, Dibben C. 2016. The role of administrative data in the big data revolution in social science research. *Social Science Research* **59**: 1–12.

Criel B, Waelkens MP. 2003. Declining subscriptions to the Maliando mutual health organisation in Guinea-Conakry (West Africa): what is going wrong? *Social Science & Medicine* **57**: 1205–19.

Daff BM, Diouf S, Diop ESM *et al.* 2020. Reforms for financial protection schemes towards universal health coverage, Senegal. *Bulletin of the World Health Organization* **98**: 100–8.

Das J. 2011. The quality of medical care in low-income countries: from providers to markets. *PLoS Medicine* **8**: e1000432.

Das J, Holla A, Mohpal A, Muralidharan K. 2016. Quality and accountability in health care delivery: audit-study evidence from primary care in India. *American Economic Review* **106**: 3765–99.

De Allegri M, Sanon M, Sauerborn R. 2006. "To enrol or not to enrol?" A qualitative investigation of demand for health insurance in rural West Africa. *Social Science & Medicine* **62**: 1520–7.

De Allegri M, Sauerborn R, Kouyaté B, Flessa S. 2009. Community health insurance in sub-Saharan Africa: what operational difficulties hamper its successful development? *Tropical Medicine & International Health* **14**: 586–96.

Deville C, Hane F, Ridde V, La TL. 2018. Couverture universelle en santé au Sahel: la situation au Mali et au Sénégal en 2018. Working Paper (No. 40).

Dong H, De Allegri M, Gnawali D, Souares A, Sauerborn R. 2009. Drop-out analysis of community-based health insurance membership at Nouna, Burkina Faso. *Health Policy* **92**: 174–9.

Dror DM, Hossain SS, Majumdar A *et al.* 2016. What factors affect voluntary uptake of community-based health insurance schemes in low-and middle-income countries? A systematic review and meta-analysis. *PLoS One* **11**: e0160479.

Einav L, Levin JD. 2014. The data revolution and economic analysis. In: Lerner J, Stern S (eds). *Innovation Policy and the Economy*, Vol. 14. Chicago: University of Chicago Press, 1–24.

Ekman B. 2004. Community-based health insurance in low-income countries: a systematic review of the evidence. *Health Policy and Planning* **19**: 249–70.

Elias P. 2014. Administrative data. In: Dus A, Nelle D, Stock G, Wagner G (eds). *Facing the Future: European Research Infrastructures for the Humanities and Social Sciences*. Berlin: SCIVERO, 47e48.

Fink G, Robyn PJ, Sié A, Sauerborn R. 2013. Does health insurance improve health? Evidence from a randomized community-based insurance rollout in rural Burkina Faso. *Journal of Health Economics* **32**: 1043–56.

Fonteneau B, Vaes S, Van Ongevalle J. 2017. Toward redistributive social protection? Insights from Senegal and Morocco. Leuven: BeFind, Acropolis, Working Paper n 21.

Franco-Santos M, Otley D. 2018. Reviewing and theorizing the unintended consequences of performance management systems. *International Journal of Management Reviews* **20**: 696–730.

Gankpe GF, Gankpe EC, Baleba AN, Zinsou L, Mesenge C. 2018. Les mutuelles de santé reproduisent-elles les inégalités de santé au Bénin? *Santé Publique* **30**: 389–96.

Gauri V. 2018. eMBeDding for impact and scale in developing contexts. *Behavioural Public Policy* **2**: 256–62.

Gnawali DP, Pokhrel S, Sié A *et al.* 2009. The effect of community-based health insurance on the utilization of modern health care services: evidence from Burkina Faso. *Health Policy* **90**: 214–22.

Goerge RM, Lee BJ. 2002. Matching and cleaning administrative data. In: Ver Ploeg M, Moffitt RA, Citro CF (eds). *Studies of Welfare Populations: Data Collection and Research Issues*. Washington, DC: National Academy Press, 197–219.

Hogarth RM, Soyer E. 2015. Communicating forecasts: the simplicity of simulated experience. *Journal of Business Research* **68**: 1800–9.

Hung YW, Hoxha K, Irwin BR, Law MR, Grépin KA. 2020. Using routine health information data for research in low-and middle-income countries: a systematic review. *BMC Health Services Research* **20**: 1–15.

Jütting JP. 2004. Do community-based health insurance schemes improve poor people's access to health care? Evidence from rural Senegal. *World Development* **32**: 273–88.

Kato T, Mano Y, Nakamura R *et al.* 2018. *Monitoring Governance, Management and Operational Capacity of Mutual Health Organizations in Three Regions of Senegal: Findings from the 2017 Survey*. Dakar: Universal Health Financial Protection Agency.

Kotoh AM, Aryeetey GC, Van Der Geest S. 2018. Factors that influence enrolment and retention in Ghana' National Health Insurance Scheme. *International Journal of Health Policy and Management* **7**: 443–54.

Kripfganz S, Schwarz C. 2019. Estimation of linear dynamic panel data models with time-invariant regressors. *Journal of Applied Econometrics* **34**: 526–46.

Kyomugisha EL, Buregyeya E, Ekirapa E, Mugisha JF, Bazeyo W. 2009. Strategies for sustainability and equity of prepayment health schemes in Uganda. *African Health Sciences* **9**: S59–65.

Mané PYB. 2012. Performance des centres de santé publics au Sénégal. *Santé Publique* **24**: 497–509.

Masefield SC, Megaw A, Barlow M *et al.* 2020. NGO data for better research outcomes: a scoping review of the use and secondary analysis of NGO data in health policy and systems research. *Health Research Policy and Systems* **18**: 1–22.

Mathauer I, Mathivet B, Kutzin J, World Health Organization. 2017. Community based health insurance: how can it contribute to progress towards UHC? In: *Community Based Health Insurance: How Can It Contribute to Progress Towards UHC?* Geneva: World Health Organization.

Mathauer I, Torres LV, Kutzin J, Jakab M, Hanson K. 2020. Pooling financial resources for universal health coverage: options for reform. *Bulletin of the World Health Organization* **98**: 132–39.

Mladovsky P. 2014. Why do people drop out of community-based health insurance? Findings from an exploratory household survey in Senegal. *Social Science & Medicine* **107**: 78–88.

Mladovsky P, Ndiaye P, Ndiaye A, Criel B. 2015. The impact of stakeholder values and power relations on community-based health insurance coverage: qualitative evidence from three Senegalese case studies. *Health Policy and Planning* **30**: 768–81.

Mundlak Y. 1978. On the pooling of time series and cross section data. *Econometrica* **46**: 69–85.

Noubiap JJN, Joko WYA, Obama JMN, Bigna JJR. 2014. Community-based health insurance knowledge, concern, preferences, and financial planning for health care among informal sector workers in a health district of Douala, Cameroon. *The Pan African Medical Journal* **16**: 17.

Oliver A. 2015. Nudging, shoving, and budging: behavioural economic-informed policy. *Public Administration* **93**: 700–14.

Ouattara O, Ndiaye P. 2017. *Potentiel des mutuelles de santé la mise en œuvre de la Couverture Maladie Universelle au Mali et au Sénégal*. Coordination MASMUT zone UEMOA. https://academic.oup.com/heapol/article/35/4/388/5718854.

Panda P, Chakraborty A, Dror DM. 2015. Building awareness to health insurance among the target population of community-based health insurance schemes in rural India. *Tropical Medicine & International Health* **20**: 1093–107.

Platteau JP, De Bock O, Gelade W. 2017. The demand for microinsurance: a literature review. *World Development* **94**: 139–56.

Platteau JP, Ontiveros DU. 2013. Understanding and information failures: lessons from a health microinsurance program in India. Research Paper, 29.

Platteau JP, Ontiveros DU. 2021. Cognitive bias in insurance: evidence from a health scheme in India. *World Development* **144**: 105498.

Raza WA, Van de Poel E, Bedi A, Rutten F. 2016. Impact of community-based health insurance on access and financial protection: evidence from three randomized control trials in rural India. *Health Economics* **25**: 675–87.

Reich MR, Harris J, Ikegami N *et al.* 2016. Moving towards universal health coverage: lessons from 11 country studies. *The Lancet* **387**: 811–6.

Ridde V, Antwi AA, Boidin B *et al.* 2018. Time to abandon amateurism and volunteerism: addressing tensions between the Alma-Ata principle of community participation and the effectiveness of community-based health insurance in Africa. *BMJ Global Health* **3** (Suppl 3): e001056.

Riumallo-Herl C, Chang AY, Clark S *et al.* 2018. Poverty reduction and equity benefits of introducing or scaling up measles, rotavirus and pneumococcal vaccines in low-income and middle-income countries: a modelling study. *BMJ Global Health* **3**: e000613.

Rouyard T, Engelen B, Papanikitas A, Nakamura R. 2022. Boosting healthier choices. *BMJ* **376**: e064225.

Schieber G, Cashin C, Saleh K, Lavado R. 2012. *Health Financing in Ghana*. Washington, DC: The World Bank.

Schneider P. 2005. Trust in micro-health insurance: an exploratory study in Rwanda. *Social Science & Medicine* **61**: 1430–8.

Soors W, Devadasan D, Durairaj V, Criel B. 2010. Community based health insurance and universal coverage: multiple paths, Many Rivers to Cross. *Background Paper #48 to the World Health report 2010*. World Health Organization, Geneva.

Stevens L, Laurie G. 2014. The Administrative Data Research Centre Scotland: a scoping report on the legal & ethical issues arising from access & linkage of administrative data. *Edinburgh School of Law Research Paper, (2014/35)*.

Sustainable Development Goal 3. 2019. Targets and indicators [internet]. New York: United Nations. https://sustainabledevelopment.un.org/sdg3, accessed 30 August 2021.

Turcotte-Tremblay AM, Haddad S, Yacoubou I, Fournier P. 2012. Mapping of initiatives to increase membership in mutual health organizations in Benin. *International Journal for Equity in Health* **11**: 1–15.

Vilcu I, Probst L, Dorjsuren B, Mathauer I. 2016. Subsidized health insurance coverage of people in the informal sector and vulnerable population groups: trends in institutional design in Asia. *International Journal for Equity in Health* **15**: 1–29.

Waelkens MP, Coppieters Y, Laokri S, Criel B. 2017. An in-depth investigation of the causes of persistent low membership of community-based health insurance: a case study of the mutual health organisation of Dar Naïm, Mauritania. *BMC Health Services Research* **17**: 1–18.

Wang H, Yip W, Zhang L, Hsiao WC. 2009. The impact of rural mutual health care on health status: evaluation of a social experiment in rural China. *Health Economics* **18**: S65–S82.

White IR, Royston P, Wood AM. 2011. Multiple imputation using chained equations: issues and guidance for practice. *Statistics in Medicine* **30**: 377–99.