Mutual Health Insurance and the Contribution to Improvements in Child Health in Rwanda

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Abstract – The mutual health insurance (*Mutuelle de Santé*) system in Rwanda is one of the most extensive community based health insurance schemes operated in Sub-Saharan Africa covering over 90 per cent of the population. Several studies, so far, have documented the success of the *Mutuelle de Santé* in addressing the two prime objectives of health insurance in a low-income setting, namely to increase access to health care and to reduce the burden of catastrophic health spending particularly for the poorer groups of society. This paper builds on these earlier works on the *Mutuelle de Santé* but despite considering the overall population, it aims to provide more detailed insights on the effects of the *Mutuelle* by concentrating on the contribution of the insurance towards improvements in child health in Rwanda.
In order to identify the effect of health insurance enrolment on measures of care and health we propose an instrumental variable approach. The analysis in this paper is based on data from the 2010 Rwandan Demographic and Health Survey (RDHS) and administrative records on insurance coverage. Overall, our results do confirm the positive perceptions and show that *Mutuelle* enrolment increases the probability of small children receiving medical treatment when ill. Furthermore, we also find a positive effect on children's health status documented through improvements in height-for-age z-scores. Unlike some studies from other contexts we do not find any indications that insurance coverage leads households to reduce preventative measures, quite to the contrary, our results rather suggest that insured households are more precautionary.

Key words – Child Health, Community Based Health Insurance, *Mutuelle de Santé*, Rwanda

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1 Introduction

Providing universal access to health care remains a challenge for governments in many low income countries. In these contexts, negative health shocks can have quite dramatic consequences for the individual, often with long-term effects, not only in respect to health but for development more general. The group that comes to mind here in particular are small children, where negative health shocks might directly affect physical and cognitive development. Several studies, for example, point to the importance of early childhood experiences for future skills development and economic performance in adulthood (see e.g. Behrman and Rosenzweig, 2004; Case et al., 2005; Alderman et al., 2006; Heckman, 2006; Hoddinot et al., 2008; Oreoupolous et al., 2008; Currie, 2009; Maluccio etn al., 2009; Alderman, 2010; Almond and Currie, 2010; Schultz, 2010). Given the potential long-term consequences of negative health shocks of small children, it would be important to take measures to limit the influence of any adverse consequences. A health insurance scheme granting access to care could be one of these measures, which if working effectively, could provide an important contribution to child development and consequently also long-term economic development. However, thus far, the empirical evidence based on this proposition from low income countries, particularly in the African region is still sparse.

In the Sub-Sahara African context, Rwanda is currently operating one of the most elaborate community based health insurance schemes (*Mutuelle de Santé*, thereafter also referred to as *Mutuelle)* covering over 90 per cent of the population. Empirical studies that have been conducted on the *Mutuelle de Santé*, so far, document an overall positive effect of mutual health insurance (MHI) enrolment, leading to an increase in health care utilization and a reduction of out-of-pocket expenditure (see e.g. Shimeles, 2010). The *Mutuelle* thus clearly seems to serve the primary objectives of health insurance, namely to increase access to health care and to reduce the burden of catastrophic health spending. However, the existing empirical literature on the *Mutuelle de Santé* still shows important gaps. These are, on the one hand, related to the methodological rigour with which some of these earlier studies have been conducted but on the other hand also related to the scope or questions that these studies addressed. Given the prime objectives of health insurance mentioned, previous studies almost exclusively focused on two dimensions, one, the level of protection the insurance provides, i.e. how well it protects households from catastrophic spending in case of illness and, two, the impact on household behaviour i.e. health seeking behaviour. While both these areas are important, a comprehensive assessment of a health insurance scheme should also be

concerned with a third dimension, namely the potential implications of insurance for health outcomes. In light of the before mentioned child health-development nexus, a more detailed investigation of the impact of health insurance on young children would therefore also be of importance. Thus, using the case of the *Mutuelle de Santé*, the objective of this research paper is to follow through a potential causal chain from health insurance enrolment to improvements in child health with the aim of assessing the contribution of insurance coverage on the latter.

Considering that the *Mutuelle de Santé* is a pre-existing scheme which does not allow for a randomized assessment this endeavour is not without difficulties. Given that the decision to join the mutual health insurance scheme is determined by unobserved factors which could simultaneously also affect the choice of health care practises for the child and consequently the potential health outcomes, any estimated effect of health insurance enrolment on health care behaviours or outcomes might be subject to selection or omitted variable bias. In light of these potential biases we aim for a band estimate (upper and lower bound of a potential impact) derived from the use of alternative methods of estimation. As part of this, and as a means to limit the influence of the sources of bias mentioned, we propose an instrumental variable approach to estimate the impact of the *Mutuelle* on child health care and -status, where the exogenous variation in the decision to join the mutual health insurance scheme comes from variations in the *Mutuelle* coverage rates at the health sector level.

While previous studies on the *Mutuelle de Santé* have largely been based on cross-sectional data from the 2005/6 Living Conditions Survey (EICV II), this paper uses more recent, albeit still cross-sectional, data from the 2010 Rwandan Demographic and Health Survey (RDHS) together with administrative records on health insurance coverage provided by the Ministry of Health of Rwanda. Data from the 2005 RDHS is used to test the sensitivity and robustness of the estimates.

The results of our analysis do provide evidence of a positive impact of health insurance enrolment on child health in Rwanda. Our results indicate that insured children are less likely to suffer from diarrhoea, fever and/or acute respiratory infections. This is likely to be linked to the observation that insured households actually seem to be more inclined to use preventative measures, i.e. have a higher probability of children sleeping under a bed net or also using methods for drinking water purification, for example. Similar to earlier studies which concentrated on access to health care exclusively, we also find that children enrolled in the *Mutuelle* are more likely to receive medical treatment when ill. The positive effects on disease prevalence, prevention and treatment are consequently also reflected in improvements

in the child's health status where we find a positive impact of the *Mutuelle de Santé* in improving the height-for-age z-scores of insured children. At large we find that the coefficients obtained from the instrumental variable regressions are larger than the estimates obtained through the OLS and probit regressions. This would point towards selection issues and a potential underestimation of the impact of health insurance enrolment, if this bias is not accounted for.

The remainder of this paper is structured as follows. Section 2 provides a brief background on the *Mutuelle de Santé* scheme in Rwanda. Section 3 presents a conceptual framework of the transmission channels, from health insurance coverage to the improvements in children's health status, at which we focus on in this paper. Section 4 provides some first empirical insights on the direction and strength of the potential linkages by reviewing previous studies conducted on the *Mutuelle de Santé* as well as other studies that have assessed the impact of health insurance schemes on utilization, health behaviour and/or health outcomes in developing countries more general. Sections 5 and 6 describe the evaluation strategy and data sources used for analysis. The results are discussed in Section 7 and Section 8 concludes.

2 The Mutual Health Insurance Scheme in Rwanda

2.1 Historical Evolution

Over the past decades, Rwanda has experimented with a range of approaches in order to finance and operate a sustainable health care system. User fees were, for example, introduced as early as the mid-seventies. Following the 1994 Genocide, however, these were abandoned and primary health care was provided free of charge in most facilities. Yet, only two years later, the country re-introduced the direct payment system. For the vast majority of the population[1], this reversal meant that health care was no longer affordable and consequently health care utilization dropped again. So, while in 1997 on average every third person went for one consultation per year, two years on by 1999 it was only every fourth (Schneider, 2005). In 1999 then, aiming to make health services more accessible to the poor again, the government started the testing of pre-payment, community based, mutual insurance schemes

[1] The poverty rate at the time was beyond 60 per cent.

in three districts of the country.[2] Given the positive results of the one year pilot phase[3], efforts to establish more community based schemes, called *Mutuelle de Santé*, increased and gradually expanded throughout the country. The *Mutuelle de Santé* scheme, as known in its current form, was formally launched in 2005.[4] Since then the enrolment into the scheme has also gradually increased (see Figure 1). By 2007 already 75 per cent of the population were enrolled in the community scheme (Ministry of Health, 2010). In light of the rapid expansion of the scheme, the mutual health insurance law was passed in 2007 and henceforth provides the guiding legal framework for the system. The law no 65/2007 not only regulates the cross-subsidization of the *Mutuelle* and other schemes but also stipulates health insurance as being compulsory for the population. This latter regulation seems to have further contributed to advance MHI enrolment which by now covers over 90 per cent of the population in Rwanda (Ministry of Health, 2011).

[Figure 1 about here]

2.2 Organisational Structure

The organisational structure of the *Mutuelle* is closely aligned to the decentralised administrative structure of the country (see Figure 2). The *Mutuelle* system is uniform, meaning that the administrative structure, premium payments and services covered by the *Mutuelle de Santé* are the same across all districts of the country. At the sector level, each health centre has a *Mutuelle* section staffed with an administrator and an accountant. These sections are also the first point of contact for the population and responsible for the enrolment of members. Following the decentralised structure, the *Mutuelle* scheme is coordinated and managed at the district level with each of the 30 districts in the country holding a mutual insurance fund ("*Fonds Mutuelle de Santé*"). Each *Mutuelle* office at the district level is staffed with a director, in charge of the management of the *Mutuelle* and an auditor to oversee and control the billing process at the district hospitals. At the national level, the services offered at the reference hospitals are paid for by the National Risk Pool. Considering the

[2] These districts were Kabutare (in the former Butare prefecture), Byumba (former Byumba prefecture) and Kabagayi (in the former Gitarama prefecture). In 2005 the countries administrative levels were reorganised and changed from prefectures and sectors into a structure of provinces, districts and sectors. Currently the country is divided into 416 sectors in 30 districts and 4 provinces as well as the capital city of Kigali.
[3] See Schneider and Diop (2001) for an assessment.
[4] While historically the *Mutuelle de Santé* started of as individual community based health insurance (CBHI) schemes, the system has now evolved into a more formal and uniform system to which the term CBHI in its strict definition no longer applies as such.

financing of the services provided at the sector level, services provided at the health centre are financed though membership contributions of the population enrolled. At the district, the financing is composed of funds from the district, the *Mutuelle* sections and transfers from the Risk Pool and other partners. The National Risk Pool is mainly funded by the Government and through cross-subsidization with other insurance schemes.

[Figure 2 about here]

2.3 Subscription and Services

In order to limit adverse selection, enrolment into the *Mutuelle* is based at the family level, i.e. once the decision for enrolment is taken, all family members have to be enrolled. While enrolment is based on the family level, the fees are calculated at the individual level with each member being required to pay an annual contribution of RwF 1,000 (ca. EUR 1.25) per year.[5] Under this flat premium schedule the *Mutuelle* provides access to all essential local health services upon a co-payment of RwF 200 per visit (ca. EUR 0.25).[6] Following a referral system, for ambulance services or treatment at district or tertiary hospitals, a co-payment of 10 per cent of the invoiced amount is required. In order to avoid abuse of services and to reinforce risk sharing a 30 day time period starting from the day of enrolment applies before a member can benefit from services under the *Mutuelle*. Generally, the very poor are exempted from the annual fee and co-payments, with their membership being subsidized by Government.

In the past the flat premium payment structure has been criticized, for aggravating inequality[7], and benefiting the rich more than the poor. In light of these concerns, as of July 2011 the annual subscription was changed from the flat-fee to stratified contributions based on the *Ubudehe* categories.[8] The new, stratified premium system also comes with an increase in the subscription amounts in order to ensure the financial sustainability of the *Mutuelle*

[5] In the first 3 months newborn children are covered under the scheme free of charge. Thereafter also an annual fee has to be paid for them.

[6] The services covered under the *Mutuelle*, similar to alternative insurance scheme operated in Rwanda (like RAMA or MMI) include vaccination, consultation, surgery, dental care, radiology and laboratory examinations, kinesitherapy, hospitalization, pre- and post-natal examinations, prosthesis, ambulance fees and standard drugs. Cosmetic surgeries, for example, are not covered by the *Mutuelle.*

[7] See e.g. Schmidt et al. (2006).

[8] *Ubudehe* categories are poverty or wealth categories used in the country for household classification. The identification of which household belongs to which category is usually based on a community participatory approach. The current classification comprises of 6 categories running from those in abject poverty (*umutindi nyakujya*), the very poor (*umutindi*), to the poor (*umukene*), the resourceful poor (*umukene wifashije*), the food rich (*umukungu*) and finally the money rich (*umukire*).

scheme. Under the new policy, individuals from the poorest two categories pay an individual, annual contribution of RwF 2,000 (ca. EUR 2.50). Here again, the contribution for the poorest, is paid for by Government and its partners. Individuals in category 3 and 4 pay RwF 3,000 (ca. EUR 3.75) per year and members of the richest two categories pay RwF 7,000 (ca. EUR 8.75). In addition to the amendments in the fee structure, the new policy reform also establishes the functionality of patient roaming at the health centre and district hospital level. This is particularly aimed to further increase accessibility to health services.

Despite the recent change in policy, the *Mutuelle* scheme remains to be based on the core principles of equity and solidarity. Thus, a factor which is considered key to the functioning of the system is the mandatory, family based enrolment aimed at enforcing risk sharing and limiting adverse selection into the scheme. Following expert interviews[9], non-compliance of the family enrolment is limited. This is in particular attributed to the set-up that the MHI enrolment is conducted at the sector level, in an already quite versant environment.

3 The Linkages from Health Insurance Coverage to Health Outcomes

Figure 3 below aims to provide a graphical representation of the main channels at play through which health insurance coverage or enrolment is likely to affect a child's health status. The latter is of course also influenced by other factors including genetic endowments and disposition towards disease, for example, or the current epidemiological environment if we want to take a more macro view. Unfortunately, we cannot depict or control for the full multitude of factors that influence a child's health status and thus what we propose is still a quite narrow, uni-level view that we are following through.

We are assuming that there are two main channels linking insurance coverage to final health outcomes. The first and probably clearest link between health insurance enrolment and child health runs through improved access and utilization of medical care. More specifically insurance enrolment reduces the cost of health care. By lifting the financial constraint, access to both regular preventative check-ups but particularly also treatment should be increased. This latter aspect, however, is of course conditional on the supply of health care facilities and the quality of treatment received. If we take quality of care as a given for now we would expect a direct positive influence of health insurance enrolment on the health status of children though improved access to preventative and curative medical care. A second

[9] Expert interviews with national CHBI programme staff as well as community health workers were conducted in the the period from the 1st to the 11th March 2012.

potential channel through which health insurance enrolment could affect child health outcomes could be trough changes in health behaviours. With this we mean the multitude of preventative or precautionary measures to limit disease and infection at the household level. Here, the link could actually go into two directions. In the insurance literature, a phenomenon that is commonly mentioned is the issue of moral hazard. In case of health insurance this would be presented as case where households would reduce preventative measures (ex-ante moral hazard) as health insurance makes it easier to seek health care when sick (ex-post moral hazard) and thus limits the motivation to undergo preventative actions. If this proposition holds we would consequently see a reduction in the precautionary measures taken to prevent illnesses but then again an increase in the utilization of care when sick. Therefore, in terms of final health outcomes, it might actually be a zero-sum-game as reduced prevention would be compensated by increased care. From a societal perspective moral hazard might be quite costly due to an increased use of medical care at an inefficiently high level. Unlike in other types of insurance is the idea of moral hazard in health insurance often not considered as a serious issues as people are not expected to gamble with their health or the health of their minors at least to the extent to which they would do with material assets, for example, as a loss in health is consequential (Cutler & Zeckhauser, 2000). In order to limit moral hazard, the Ministry of Health does run regular (at least bi-annual) sensitization campaigns by community health workers discussing and informing the community on inter alia on prophylactic health care measures. Concerning child health in particular topics covered include, pre- and post-natal care, nutrition, sanitation and hygiene, and disease prevention e.g. by reducing the risk of Malaria infections through the use of long lasting insecticide treated bed nets. If the advice from sensitization would be followed child illness could be reduced which in consequence would also imply a reduced need for medical treatment. Concerning the flow of information apart from running directly through sensitisation campaigns there could also be a direct interaction between prophylactic measures and health centre visits. On the one hand we assume that more and regular precautionary measures would reduce health centre visits while on the other hand these might actually also provide a potential source of information on prophylactic measures to be taken as part of the consultancies delivered there. While in terms of information there might be a potentially ambiguous effect between medical visits and preventative measures it cannot be established if the link on health insurance to prophylactic behaviours is a positive or a negative one as it depends on the relative strengths of moral hazard vis-a-vis the effectiveness of the sensitization delivered. While the linkages between insurance coverage and access to

medical care and changes in health care behaviours might be more short-term and repetitive, changes in the child's health might only be detectable after some time thus there might also a timing issue (lag) to be considered.

[Figure 3 about here]

4 A Review of the Literature

Building on the relations outlined in the conceptual framework, in the following we will briefly review the findings from earlier studies on the *Mutuelle de Santé* before presenting some empirical evidence on health behaviours and health outcomes from other developing country contexts more generally. This latter review will not be exhaustive but only present a selection of studies that managed to assess different health insurance schemes with a focus on health outcomes in developing countries in methodologically sound ways which allow deducing a causal relationship between the two.

4.1 Earlier Studies on the *Mutuelle de Santé* and their Findings

One of the first studies on the mutual health insurance in Rwanda was the work by Schneider and Hanson (2006). The key focus of this work is to investigate the impact of health insurance on health care payments. Using a regression approach, the authors compare concentration indices of insured and uninsured groups in order to assess the degree of inequity on the utilisation of basic health care services. Additionally, a minimum standards approach[10] is used to assess the extent to which out-of-pocket health spending increases poverty. The analysis is based on household survey data from 3,139 households interviewed in 2000 in relation to the introduction of community based health insurance. Results using these two methods indicate that out-of-pocket health spending has little impact on the socioeconomic situation of both, insured and uninsured households. However, the lack of health insurance coverage does seem to pose a considerable obstacle to access health care particularly for the poorer groups and thus contributes to an increase in horizontal inequity in service use.

[10] The minimum standards approach quantifies the degree to which health expenditure causes household income to drop below a defined threshold, e.g. the national poverty line. See O'Donnell et al. (2008) for a detailed description of the methods.

More recently also Saksena et al. (2011) looked at the effect of MHI on health care utilization and financial risk protection. Their empirical analysis is based on more recent albeit also cross-sectional data from the 2005/6 Living Conditions Survey (EICV II). Unlike Schneider and Hanson (2006), the analysis by Saksena et al. (2011) uses a regression approach employing logistic estimations for the use of health services and ordered logistic estimations analysing the effect of health insurance on out-of-pocket payments as a share of the capacity-to-pay. The authors have addressed concerns of the endogeneity of health insurance in this set-up using Durbin-Wu-Hausman tests. Based on their analysis the authors also find that *Mutuelle* enrolment is associated with a significantly higher utilization of health services. In terms of magnitude, insured individuals use almost twice as many services as their uninsured counterparts. Contrary to the views put forward by Schmidt et al. (2006) the results by Saksena et al. (2011) indicate that MHI has a higher effect on utilization in lower compared to the higher income quintiles which would suggest that the MHI system actually decreases the utilization gap between the rich and the poor. With respect to the financial risk protection aspect of MHI the study results indicate a positive influence of health insurance. Catastrophic health expenditure was, for example, four times lower in insured compared to uninsured households. However, the study also points towards limitations concerning the financial protection as over 40 per cent of those insured did not use health services when ill. Also, 20 per cent of the insured households under study still experienced a high financial burden when seeking treatment. A positive influence of health insurance on the utilization of health services particularly among the poorer population quintiles is also confirmed by Sekabaraga et al. (2011). They find that particularly the MDG related services, like assisted birth delivery, antenatal care and immunization increased strongly. Following on from this they also document evidence of reduced child mortality and improved child health however a causal relationship between health insurance enrolment and the extent to which the health status of children has improved is not established in their study.

Similar to Saksena et al. (2011) also Shimeles (2010) has investigated the effects of MHI on the demand for modern health care and out-of-pocket catastrophic health expenditure using the cross-sectional data of the 2005/6 EICV II. Advancing from the traditional regression approach by Saksena et al. (2011), Shimeles (2010) uses a propensity score matching approach in order to draw causal inference. While the results by Shimeles also confirm a reduction in catastrophic expenditure and higher health care utilization due to the *Mutuelle*, his findings, contrary to Saksena et al. (2011), show higher health care utilization among the insured non-poor compared to the insured poor. This also applies to the health

related expenditure and would actually imply an increase rather than a decrease in inequality, in line with what has been proposed by Schmidt et al. (2006) earlier.

Lately, also Dhillon et al. (2011) studied the impact of CBHI enrolment, the removal of point-of-service co-payments and improved service delivery on heath facility utilisation rates in Mayange sector in rural Rwanda. Using the information from the monthly Ministry of Health (MoH) reports between January 2005 and September to 2007, the authors construct a panel data set on outpatient utilisation rates and staffing in three sites - Mayange, Mwago and Mareba[11]. Following a standard regression approach they find that a reduction in the financial barriers through insurance enrolment and the elimination of the co-payments increases annual per capita visits for curative care by 0.6. The regression results however also show that an increase of nursing staff, as proxy for improvements in the quality of care, in the sector does not significantly increase utilisation rates.

The four major studies on the effect of the *Mutuelle* for treatment seeking highlight an overall positive effect. However, particularly the work by Saksena et al. (2011) points towards substantial heterogeneity of the effect observed. Furthermore, there is also no uniform position on the implications of MHI for inequality even though there seems to be more support for discrimination of the poor in the Rwandese context. Such an imbalance is also found in other contexts though. In Burkina Faso for example, Prasad Gnawali et al. (2009) document that the poor are less likely to make use of their mutual health insurance coverage compared to their richer counterparts. With respect to the econometric approach, the studies improved gradually with the matching approach by Shimeles (2010) potentially also allowing to infer causality. Even though the matching approach is not without drawbacks, it is still a second best option in the absence of a randomized experiment or panel data. The IV approach proposed in this paper presents another alternative in this setting. Propensity score matching will be used in this paper as a means to check the consistency of our results. The direct comparison of the results obtained using both methods however might also allow us to infer on the relative quality of these approaches to answer the question posed in this paper.

4.2 The Impact of Health Insurance on Health Care and Health Outcomes in Developing Countries

Ekman (2004) provides a systematic review of the evidence of community based health insurance (CBHI) in low income countries focusing in particular on the question if CBHI is a

[11] The latter two are used for comparison purposes.

viable option for primary health care financing. On this the author finds little convincing evidence concluding that CBHIs can only be seen complementary to more effective financing systems. However, studies reviewed by Ekman (2004) almost uniformly show that CBHIs reduce out-of-pocket expenditure thus providing some financial protection to enrolled households. On this latter point, Chankova et al. (2008) find diverging evidence in West Africa, where MHI membership protects against catastrophic expenditures related to hospitalization but does not seem to have a significant effect on out-of-pocket spending for curative outpatient care, which is closely linked to the coverage of the schemes. In another context, namely Vietnam, the Health Care Fund for the Poor (HCFP) would be another example where the scheme seems to fail to provide sufficient financial protection (see Wagstaff, 2007). Also for one of the largest schemes in the world, the new cooperative medical scheme (NCMS) in China, Wagstaff et al. (2009) find that overall the scheme has not managed to significantly reduce out-of-pocket payments for their subscribers.

Concerning the evidence of community based or cooperative health insurance enrolment on access to health care, studies on various schemes, by and large, document a positive effect but as already mentioned before with heterogeneity across income groups (see eg. Wagstaff et al., 2009; Aggarwal, 2010). Exemplary for Sub-Saharan Africa, Jütting (2004) assessed the impact of CBHI in rural Senegal and finds that members of the mutual health organisation show a higher probability to use hospitalization and pay substantially less for care needed. While the scheme was intended to attract the poor the analysis however reveals that the poorest members of society remain excluded. With respect to child care, using case-control studies on four MHIs in 2 districts in Mali, Miller Franco et al. (2008) find that members enrolled in MHIs are three times more likely to take children with diarrhoea to a health facility and twice as likely to have children under five sleeping under an insecticide treated bed net, thus providing positive evidence on the transmission channels outlined in section 3. On the other hand, Yilma et al. (2012), for example, find evidence for moral hazard in the Brong Ahafo region of Ghana, with health insurance enrolment actually reducing the use of bed nets particularly when the cost required for prevention, i.e. to obtain the net is high.

Moving from access to care and prevention to health outcomes more specifically, in a developed country contexts a number of studies have already examined the nexus between health insurance and health status. These are well summarized in Levy and Melzer (2008) with most evidence pointing to a positive influence of health insurance on various health measures. However, the authors also point out that most studies, so far, have not been able to establish causal links disentangling the complex relationships surrounding health insurance,

utilization and outcomes. From a meta-perspective, the multitude of health measures used in these studies (which we will see below also when reviewing some recent works in more detail) makes the comparison of results to reach a uniform conclusion more complicated. From a less developed country perspective, there is thus far still little evidence on the contribution of health insurance provisioning to improvements in population health. Wang et al. (2009) provides some evidence on the impact of health insurance on health outcomes in the case of the Rural Mutual Health Care (RMHC) scheme in China. Using panel data from a pre-post treatment-control study design, they measured health status using a 5-point categorical rating scale of self-perceived health and the EQ-5D instruments.[12] Results from difference-in-difference estimation combined with propensity score matching show that the RMHC has a positive effect on participants health status, by reducing the incidence of pain/discomfort and anxiety/depression and improving mobility among those over 55 years old. Another study to be mentioned in this regard is the work by Wagstaff and Pradhan (2005), which analyses the effect of health insurance in Vietnam on health care utilization, outcomes and non-medical consumption by applying a propensity score matching approach paired with a difference-in-difference estimator to a panel data set collected before and after the insurance programme. Concentrating on health outcomes, which the authors measure using anthropometric indicators, the authors find that for children under the age of five, health insurance enrolment increased height by on average 0.47 cm and weight by 0.15 kg per year thus significantly reducing stunting and underweight. However, disaggregating the results by income quintiles, the authors find that this beneficial effect does not translate to children in the poorest quintiles. Similarly for adults, insurance coverage seems to improve BMI, however again not in the poorest quintiles. Ansah et al. (2008) assessed the effect of removing direct health care payments on utilization and child health outcomes in Ghana. In a randomised controlled trial among 2,592 children under the age of five, the authors find that providing free care leads to higher usage of formal care however, it did not lead to measurable difference in the health outcome measured over the one year study period. The anaemia levels of children have not improved on average. Further evidence on improvements of health insurance on child health is provided by Quimbo et al. (2011), who assess those effects using data from the Quality Improvement Demonstration Study (QIDS) in the Philippines, a randomized policy experiment. Using a difference-in-difference regression model the authors find that being covered by health insurance in this context leads to a 9-12

[12] This is an assessment of the 5 dimensions, mobility, self-care, usual activity, pain/discomfort and anxiety/depression.

percentage point reduction in the likelihood of wasting and a 4-9 percentage point reduction in the likelihood of having an infection using the C-reactive protein as indicator.

Summing up the evidence, even though there are no uniform measures used, the existing studies point more towards a positive impact of insurance coverage on child health. However, this might be subject to heterogeneity particularly comparing the rich and poor. Thus far, even though the studies used anthropometric indicators to measure health outcomes, heterogeneities by age groups have not been explored, yet. Given that the years between 0 and 2 are considered key for child development a more disaggregated analysis could provide interesting insights and should therefore be pursued further.

5 Method

Following the discussion of findings from other contexts we turn to present the empirical strategy used for analysis in this paper. In order to obtain a more comprehensive picture of the impact of the *Mutuelle* on child health we will consider several interlinked aspects running through from sickness, treatment and prevention to finally health outcomes as presented in the conceptual framework in section 3. Following through the casual chain a set of indicators has be chosen to represent each aspect. Thus, being precise we will first look at the impact of *Mutuelle* enrolment on the likelihood of child sickness; second, the likelihood of the child receiving medical treatment when sick; third, the likelihood of households using water purification and the child sleeping under a bed net; and finally the impact on the child's anthropometric condition measured by the height-for-age z-score.[13]

5.1 Identification

From an econometric perspective, identifying the effect of *Mutuelle* coverage on any of the outcomes mentioned above is challenging as the decision to join the *Mutuelle* is likely to be determined by factors which we cannot observe but which could at the same time also affect the choice of health care practises and consequently also any potential health outcome. For example, the households' level of risk aversion could induce parents to choose to enrol in health insurance but at the same time also affect the level of care given to the child. Alternatively also thinking about the initial health status of the child, depending on this,

[13] The height-for-age z-score is commonly used as an indicator for stunted growth, i.e. growth retardation resulting from longstanding undernutrition or disease.

parents might decide to use more or less resources on the child. This could mean that parents with healthier children could decide to enrol more in health insurance (positive selection) or rather participate less, i.e. self-select out of health insurance. On the other hand, parents with frailer children could decide to enrol more in health insurance, in which case we would be faced with a case of adverse selection. These different incentives do leave us with an endogeneity problem and renders the estimation results subject to selection and omitted variable bias.

By controlling for as many confounding factors as possible we can at least partly address the omitted variable concern. We do, therefore, control for a range of child- (X^C), mother- (X^M), household- (X^H) and district characteristics (η^D) in our estimations. The child characteristics include covariates on the child's gender, age and breastfeeding history. The mother characteristics include the mother's age, educational attainment, marital status, and BMI. Concerning the household characteristics we control for the sex of the household head, the number of household members and the living children below the age of five, the households wealth quintile, as well as, the place of residence. In order to account for geographic differences we do include dummy variables for each of the 30 districts in the estimations.[14] Despite including a range of covariates results obtained from our estimations will still be subject to bias resulting from both time variant and invariant[15] characteristics that are not observed and can thus not directly be controlled for.

In order to address the endogeneity concern we use an instrumental variable approach in order to identify the causal impact of coverage under the *Mutuelle* and child health related behaviours and outcomes. The exogenous variation in the household- or parental decision to enrol in the *Mutuelle* hereby comes from variation in the *Mutuelle* coverage rates at the health sector level in 2010 which have been obtained from the administrative records of the Ministry of Health of Rwanda. The intuition here is that we expect that household are more likely to be enrolled in the *Mutuelle* in sectors with higher coverage rates.

While the instrumental variable approach allows to address potential endogeneity concerns, caution has to be exercised with the effect that it estimated by this approach. The instrumental variable approach does not allow estimating an average treatment effect on the treated (ATT) representative of the whole population that is surveyed but more precisely

[14] Alternatively including the population level and the number of health facilities per 100,000 people does not alter the results.
[15] Given that we only use cross-sectional data we can also not control for time invariant factors.

represents a local average treatment effect (LATE) on a specific part of the population namely the enrolled population only (compliers).

Given that the instrumental variable approach allows us in parts to address the omitted variable and the endogeneity bias, it would be expected that this method allows obtaining an upper bound estimate on the potential impact of the *Mutuelle* on issues of child health. To verify that this is the case we will use an ordinary least squares (OLS) and propensity score matching (PSM) strategy as alternative. In the presence of bias the OLS estimates should provide us with a lower bound estimate. The PSM is an alternative ex-post evaluation approach by which enrolled children are compared to a group of non-enrolled children with similar observed (pre-treatment) characteristics.

5.2 Specification

The analysis is representative at the national level covering all 30 districts and 311 out of the 416 sectors of the county. The IV approach is implemented following a two-step procedure with the first step equation represented by

$$I_{ij} = \beta_0 + \beta_1 Z_j + \beta_2 X^C_{ij} + \beta_3 X^M_{ij} + \beta_4 X^H_{ij} + \eta^D + \varepsilon_{ij} \qquad [1]$$

with I being a dummy variable indicating if the child i is covered by the *Mutuelle* in sector j. Z_j represents the *Mutuelle* coverage rate in each sector j. Child-, mother-, household- and district effects will also be controlled for at the first stage. In light of the binary nature of the dependent variable we use a probit model for the estimation of the first stage. In order to ensure that the standard errors are correct we follow the two-stage procedure as proposed by Wooldridge (2002).

The second stage regression is specified as follows.

$$Y_{ij} = \beta_0 + \beta_1 \hat{I}_{ij} + \beta_2 X^C_{ij} + \beta_3 X^M_{ij} + \beta_4 X^H_{ij} + \eta^D + \mu_{ij} \qquad [2]$$

where Y_{ij} represents the respective outcome variables[16] and μ_{ij} will be a set of unobserved attributes of the child, mother or household like frailty, risk aversion or initiative. Despite

[16] In the case of water purification the variation will not be at the level of the child but the household thus i will be presenting the household and we do not control for child characterisitcs either. Thus, the vector X^C_{ij} will be dropped from the specification.

some outcome variables being binary the second stage regression is estimated using a linear probability model.[17] The standard errors are clustered at the sector in order to account for any variation at that level.

Similar to the second stage regression however without instrumenting insurance enrolment the standard OLS regression specification would be as follows.

$$Y_{ij} = \beta_0 + \beta_1 I_{ij} + \beta_2 X^C_{ij} + \beta_3 X^M_{ij} + \beta_4 X^H_{ij} + \eta^D + \mu_{ij} \qquad [3]$$

In this case also, standard errors are clustered at the sector level. In the case of binary dependent variables probit models are used for estimation.

In order to obtain a propensity score to be used for matching we estimate a probit model of the following functional form.

$$I_{ij} = \beta_0 + \beta_1 X^C_{ij} + \beta_2 X^M_{ij} + \beta_3 X^H_{ij} + \beta_4 X^D + \varepsilon_{ij} \qquad [4]$$

with the variables defined as in the estimations above, i.e. with I_{ij} representing a binary variable whether the child is enrolled in health insurance or not and X^C_{ij}, X^M_{ij}, X^H_{ij} and X^D representing vectors of observable child-, mother-, household and district characteristics.[18] Following this estimation a predicted value of I_{ij}, i.e. $\hat{I}_{ij}$ (propensity score) is obtained. On the basis of the estimated propensity score we use a nearest neighbour matching (with replacement) to estimate the impact. The nearest neighbour matching compares enrolled and respective non-enrolled children with the closest propensity score to estimate the effect. The nearest neighbour matching compared to alternative matching algorithms is also considered as providing a more conservative estimate. The standard errors in our matching are obtained through bootstrapping with 100 repetitions.

5.3 Outcome variables

Following the model specification we will briefly describe the main outcome variables used in this analysis and how they have been constructed.

Our first outcome variable is aimed at measuring the illness incident whereby "illness" in this case is limited to a child suffering from diarrhoea, fever and/or acute respiratory

[17] The problem here is particularly that probablilites obtained will not be restricted to lie between 0 and 1.
[18] District characteristics in this case include the population, number of health facilites and doctors per 100,000 inhabitants in the district.

infections in the two weeks prior to the survey. Hence, the variable is coded as a binary variable taking the value of 1 if the child suffered from illness and 0 otherwise. The binary variable representing the disease history, particularly when considered in light of health insurance enrolment can be subject to reporting bias, which could have a significant impact on the results. For example, households were children are not covered by health insurance might on the one hand be less affected but also less inclined to report an illness compared to households which are insured and can easily access health care in case of sickness. If such a scenario would hold, the effect of health insurance in our analysis will be overestimated. Conditional on a child having been reported as being ill, we have coded a binary variable for medical treatment. Where medical treatment means that the child has been treated at either a government- or district hospital, a government health centre, a health post or by a community health worker.[19] Similar to the illness variable the same reporting issues would also apply to this measure.

For the purpose of this paper, preventative behaviour is only measured along two dimensions, namely through a binary variable whether the household uses any method of water purification, i.e. making water safe to drink (as a means to reduce the risk of any water-borne diseases including diarrhoea) and if the child has slept under an insecticide treated bed net in the night prior to the survey conditional on the household actually owning a net for sleeping.

Finally, in order to analyse the impact of health insurance on child health we will use one of the prevailing anthropometric measures, namely the children's height for age z-score.

6 Data

A panel data set, following the observation unit over time, is not readily available. In light of these data limitations, this paper has to resort to a cross-sectional data set. However, we refrain from using data from the 2005/6 Living Conditions Survey which has already been used extensively in earlier studies; instead our analysis is based on data from the 2010 Rwandese Demographic and Health Survey (RDHS). The RDHS is a standardised and nationally representative survey that, inter alia, collects detailed level information on housing and household characteristics, maternal and child health, gender, domestic violence, family

[19] For robustness purposes we have also generated a dummy indicated whether the child has received traditional treatment. The results from this estimation have a negative tendency, i.e. Mutuelle coverage reducing traditional treatment. The detailed results on this will be provided by the authors upon request.

planning, nutrition and knowledge and behaviours related to Malaria and HIV/AIDS. The RDHS uses a two-stage sampling design analogue to other nationally representative surveys conducted in Rwanda. For the 2010 RDHS the field work took place from September 2010 to March 2011 during which period a total of 12,540 households were interviewed. Out of the total sample, our analysis concentrates on the sample of living children aged between zero and five. Our sample is further limited by only considering children that are enrolled in the *Mutuelle*, or not covered by health insurance at all, meaning that children covered under alternative schemes such as RAMA, MMI or other private health insurance schemes have been systematically excluded from the analysis.[20] The total sample of children used for analysis thus comprises of 7,889 children. The descriptive statistics of these children (separated by their insurance coverage status) are presented in Table A1 in the appendix. Based on the summary statistics presented what becomes quite obvious is that on average children that are enrolled in the *Mutuelle* are noticeably different to those not enrolled. This refers to almost all characteristics, with the exception of the child's sex, household composition and place of residence, reinforcing the necessity to control for observable characteristics in the analysis. Concerning the child characteristics, while our sample is gender balanced, we do see that children covered under the *Mutuelle* are on average 2 months younger than non-enrolled children[21]. The age difference is also reflected in a lower breastfeeding time for enrolled children. With respect to the mother characteristics, comparing the educational attainment, we see that mothers of insured children are better educated with 82.3 per cent having at least primary education while for uninsured children it is only 76.1 per cent. What is interesting is the large difference observed when considering the mothers marital status, while almost 65 per cent of mothers insured children are married, for uninsured it is only 45 per cent. The educational attainment and the marital status of the mother already seem to point to uninsured children coming from poorer or at least more vulnerable backgrounds. Looking at the wealth distribution that observation is confirmed; with on average a still higher percentage of uninsured children being found in the poorest two quintiles.[22] Moving to the outcome variables, while we do not see a significant difference in means concerning the incidence of sickness between the two groups, insured children do clearly appear more likely to be receiving medical treatment when ill. The divergence in health seeking is also observed considering prevention. While 74 per cent of children covered

[20] This represents 3 per cent of the living children in the sample.
[21] This can partly be explained by the feature that children born to insured mothers are covered by the Mutuelle for the first three months before the individual contribution has to be paid.
[22] This could be a reflection of a vicious cycle of poor health and poverty reinforcing.

under the *Mutuelle* were sleeping under a bed net, in the case of uninsured households it were only 65 per cent. The same also applies for water treatment which is distinctively more common among insured households. Concerning the health status, we also note that on average insured children are doing better than uninsured children with the former having 0.17 standard deviations better height-for-age z-score than the latter. Thus, overall the descriptive statistics do point towards a significant positive effect of the *Mutuelle* on child health.

7 Results and Robustness Checks

In the following, we will discuss the results related to each of the steps set out in the conceptual framework with briefly looking at the disease incidence before turning to the treatment seeking behaviour and prevention and finally to the child health outcome.

7.1 Results

While the focus should be on the results obtained through the IV regression approach, for comparison purposes we have also run standard OLS/*probit* estimations and propensity score matching as outlined in section 5.2. For the ease of comparison, results of each of the different approaches are presented in separate tables for each outcome under consideration. The results for the sickness incidence are presented in Table 1. The probit result (column 1) shows a negative and statistically significant effect of mutual health insurance enrolment on sickness. The coefficient would suggest that being covered by health insurance reduces the likelihood of suffering from a disease in the two weeks prior to the survey by 2.5 per cent. In the case of the IV we do also find a negative and significant effect however the coefficient obtained is somewhat larger suggesting that the participation in the *Mutuelle* actually decreases the probability of suffering from disease by 7 per cent. The propensity score matching results provides further assurance on the direction of the effect. The magnitude is also slightly higher than the *probit* results obtained. The larger magnitude of the IV estimate does suggest a downward bias in the initial *probit* estimation, which could be a sign of parents with frailer children selecting into the scheme (adverse selection).

Considering the health seeking behaviour conditional upon sickness (results presented in Table 2), we see that estimates from all three approaches, *probit*, IV and matching are positive and statistically significant at the 99 per cent confidence level. The *probit* estimate obtained (column 1) implies that conditional upon illness enrolment in the *Mutuelle* would

increase the probability of the child receiving treatment at a medical facility by 19.7 per cent. The IV estimate raises this probability to 26.5 per cent. Again, the higher IV estimate could be a sign of the adverse selection mentioned above persisting. In a sense that would imply that frailer children are selected into the scheme but then in case of illness they are less likely to seek care. This could be a result of other constraints that these households are face beyond the mere cost for treatment, concerning, for example, the cost of travel to the health facility.

The results of the effect of *Mutuelle* coverage on bed net use are presented in Table 3. Consistently throughout all three approaches we do find a positive and statistically significant effect of *Mutuelle* enrolment on the likelihood of the child sleeping under an insecticide treated bed net in the night prior to the survey. However, we see a quite significant disparity in the magnitude of the effect attributed to the *Mutuelle*. While the *probit* results would suggest a quite small effect of an increase in the likelihood by 4.3 per cent, the IV coefficient actually indicates that insured children are over 32 per cent more likely to sleep under a bed net than their uninsured counter parts. Consistently with what we have seen before, the larger IV coefficient would suggest a downward bias in the initial *probit* estimation. While before we have argued that the downward bias might be coming from a higher frailty of insured children, in the case of bed net use, it could actually also be that parents with healthier children select-out of the health insurance scheme while at the same time being more actively using preventative health care methods. In addition to the use of bed nets, we also find a positive impact of health insurance coverage on the use of methods for water purification as an alternative prophylactic measure to reduce the disease incidence (see table 4). Here also the probit estimates are lower than the IV point estimate which suggests that insured households are in fact 20.7 per cent more likely to treat drinking water.

Finally, the results of the impact of the *Mutuelle* on children's health status are presented in Table 5. The standard OLS estimate (column 1) would suggest that children that participate in the *Mutuelle* would improve the child's height-for-age z-score by 0.138 standard deviations (SD). The instrumental variable regression renders an effect somewhat lower than the OLS estimate. It implies that health insurance coverage would actually lead to a 0.056 SD increase in children's height for age z-sores. Also, this effect is statistically significant however only at a 10 per cent level of significance. This positive contribution of health insurance on height-for-age is also confirmed by the propensity score estimate providing further assurance to the effect. The 0.056 SD increase in children's height translates into a 0.29 cm increase in height on average, which is slightly lower than the effect identified by Wagstaff and Pradan (2005) in Vietnam.

[Tables 1 to 5 about here]

7.2 Assessing the instrument's strength and validity

From the first stage regression results presented in Table A2 it can be seen that children with mothers with higher educational backgrounds are more likely to be enrolled in the *Mutuelle*. Also marital status of the mother does seem to strongly positively influence the likelihood of enrolment. Also in line with what has already been observed from the descriptive statistics health insurance coverage is significantly positively correlated to the wealth level of the households with children from richer households being more likely to be enrolled than poorer ones. Considering the instrument chosen it proves relevant for all specifications. The instrument is significant at the 1% level and displays a non-immaterial effect on the probability of being covered by the *Mutuelle* with households in sectors with higher coverage rates being more likely to be enrolled. Regressing the instrument on *Mutuelle* enrolment (without controls) shows that the instrument actually explains 11.4 per cent of the variation in enrolment.

Moreover we assess the strengths of the instrument using the first-stage F statistic. If the instruments were weak the standard IV point estimate would be weak as well as the ensuing hypothesis tests.[23] The null hypothesis is that the instrument is weak. For all the estimations, the F-statistic (at a 5% significance level) of the instrument chosen ensured that the maximal bias of the IV estimator relative to OLS was no bigger than 5%. This fits the definition of a strong instrument according to Stock, Wright and Yogo (2002).

8 Conclusion

This paper aimed to investigate the effects of enrolment in *the Mutuelle de Santé* on the health of children aged five and below. In order to identify the effect of health insurance enrolment on measures of care and health we propose an instrumental variable approach. The analysis in this paper is based on data from the 2010 Rwandan Demographic and Health Survey (RDHS) and administrative records on insurance coverage and health facility

[23] A set of instruments is defined as being weak if the concentration parameter is small enough that inferences based on conventional normal approximating distributions are misleading. The concentration parameter is a unitless measure of the strength of the instruments (Stock, Wright, and Yogo, 2002). One measure of wheather a set of instruments is strong is whether the concentration parameter is sufficiently large.

infrastructure. The results of our analysis do provide evidence of a positive impact of health insurance on child health in Rwanda. Our results indicate that insured children are less likely to suffer from diarrhoea, fever and/or acute respiratory infections. This is likely to be linked to the observations that insured households actually seem to be more inclined to use preventative measures, i.e. have a higher probability of children sleeping under a bed net. Similar to earlier studies which concentrated on access to health care, we also find that children enrolled in the *Mutuelle* are more likely to receive medical treatment when ill. The positive effects on disease prevalence, prevention and treatment are consequently also reflected in improvements in the child's health status where we find a positive impact of the *Mutuelle de Santé* in improving the height-for-age z-scores of insured children. At large we find that the coefficients obtained from the instrumental variable regressions are larger than the estimates obtained through the OLS and *probit* regressions. This would point towards selection issues and a potential underestimation of the impact of health insurance enrolment, if this bias is not accounted for.

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Appendix

[Tables A1 to A2 about here]

Tables and Figures

Table 1: Probit, IV and PSM Estimates – Impact of *Mutuelle* Enrolment on Disease Prevalence

	Probit (Marginal Effects)	IV	PSM
	(1)	(2)	(3)
Mutuelle Enrolment	-0.025	-0.070	-0.028
	(0.013)*	(0.013)***	(0.017)*
Other Controls	Yes	Yes	
N	*7,888*	*7,888*	*7,870*
Pseudo R^2	*0.072*		
1st Stage F		*29.6*	

Source: RDHS 2010 and administrative records, MOH.

Note: The probit and IV estimations control for: Child's gender, age and breastfeeding time in months, mother's age, educational attainment and marital status, the sex of the household head, the number of members in the household and the number of children under five, the households wealth level, the place of residence, as well as district dummy variables. The instrument chosen in the IV-Regression is the *Mutuelle* coverage rate at the health sector level. The PSM uses a nearest-neighbour matching. The propensity score for the matching controls for child, mother and household characteristics, with the latter comprising a range of variables on household possessions including land holding and livestock.

The standard errors (in parenthesis) of the probit- and IV regressions are robust and clustered at the sector level, in the case of PSM they are bootstrapped (100 repetitions). * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2: Probit, IV and PSM Estimates – Impact of *Mutuelle* Enrolment on Medical Treatment conditional on Illness

	Probit (Marginal Effects)	IV	PSM
	(1)	(2)	(3)
Mutuelle Enrolment	0.197	0.265	0.139
	(0.029)***	(0.035)***	(0.038)***
Other Controls	Yes	Yes	
N	*1,541*	*1,541*	*1,525*
Pseudo R^2	*0.076*		
1st Stage F		*15.81*	

Source: RDHS 2010 and administrative records, MOH.
Note: The probit and IV estimations control for: Child's gender, age and breastfeeding time in months, mother's age, educational attainment and marital status, the sex of the household head, the number of members in the household and the number of children under five, the households wealth level, the place of residence, as well as district dummy variables. The instrument chosen in the IV-Regression is the *Mutuelle* coverage rate at the health sector level. The PSM uses a nearest-neighbour matching. The propensity score for the matching controls for child, mother and household characteristics, with the latter comprising a range of variables on household possessions including land holding and livestock.
The standard errors (in parenthesis) of the probit- and IV regressions are robust and clustered at the sector level, in the case of PSM they are bootstrapped (100 repetitions). * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Probit, IV and PSM Estimates – Impact of *Mutuelle* Enrolment on the Use of Bed Nets

	Probit (Marginal Effects)	IV	PSM
	(1)	(2)	(3)
Mutuelle Enrolment	0.043	0.322	0.045
	(0.012)***	(0.133)**	(0.015)***
Other Controls	Yes	Yes	
N	*7,409*	*7,409*	*7,355*
Pseudo R^2	*0.066*		
1st Stage F		*26.22*	

Source: RDHS 2010 and administrative records, MOH.
Note: The probit and IV estimations control for: Child's gender, age and breastfeeding time in months, mother's age, educational attainment and marital status, the sex of the household head, the number of members in the household and the number of children under five, the households wealth level, the place of residence, as well as district dummy variables. The instrument chosen in the IV-Regression is the *Mutuelle* coverage rate at the health sector level. The PSM uses a nearest-neighbour matching. The propensity score for the matching controls for child, mother and household characteristics, with the latter comprising a range of variables on household possessions including land holding and livestock.
The standard errors (in parenthesis) of the probit- and IV regressions are robust and clustered at the sector level, in the case of PSM they are bootstrapped (100 repetitions). * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Probit, IV and PSM Estimates – Impact of *Mutuelle* Enrolment on the Use of any Method for Water Purification

	Probit (Marginal Effects)	IV	PSM
	(1)	(2)	(3)
Mutuelle Enrolment	0.140	0.207	0.167
	(0.012)***	(0.100)**	(0.015)***
Other Controls	Yes	Yes	
N	*4,367*	*4,367*	*4,284*
Pseudo R^2	*0.072*		
1st Stage F		*17.43*	

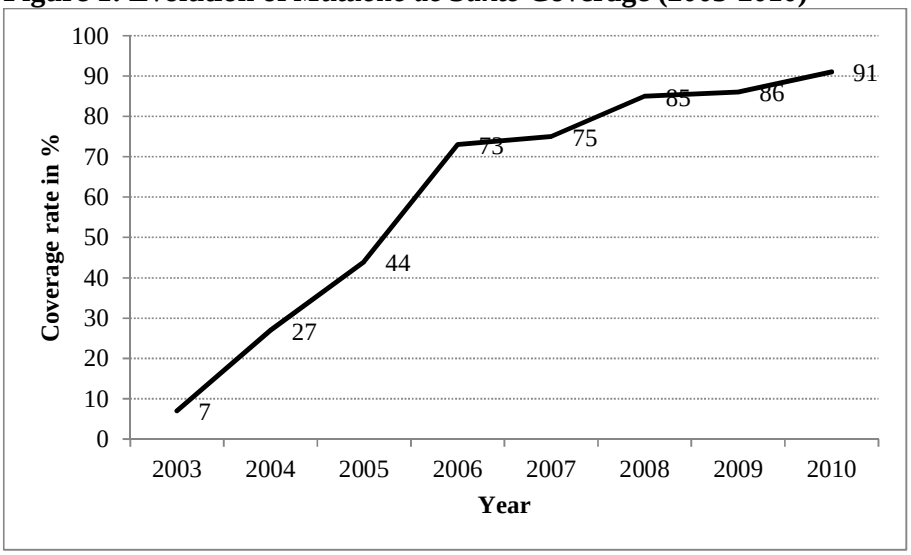
Source: RDHS 2010 and administrative records, MOH.
Note: The probit and IV estimations control for: mother's age, educational attainment, and marital status, the sex of the household head, the number of members in the household and the number of children under five, the households wealth level, the place of residence, as well as district dummy variables. The instrument chosen in the IV-Regression is the *Mutuelle* coverage rate at the health sector level. The PSM uses a nearest-neighbour matching. The propensity score for the matching controls for child, mother and household characteristics, with the latter comprising a range of variables on household possessions including land holding and livestock.
The standard errors (in parenthesis) of the probit- and IV regressions are robust and clustered at the sector level, in the case of PSM they are bootstrapped (100 repetitions). * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: OLS, IV and PSM Estimates – Impact of *Mutuelle* Enrolment on Height-for-age Z-scores

	OLS	IV	PSM
	(1)	(2)	(3)
Mutuelle Enrolment	0.138	0.056	0.105
	(0.052)***	(0.095)*	(0.062)*
Other Controls	Yes	Yes	
N	*3,895*	*3,895*	*3,867*
Pseudo R^2	*0.192*		
1st Stage F		*14.42*	

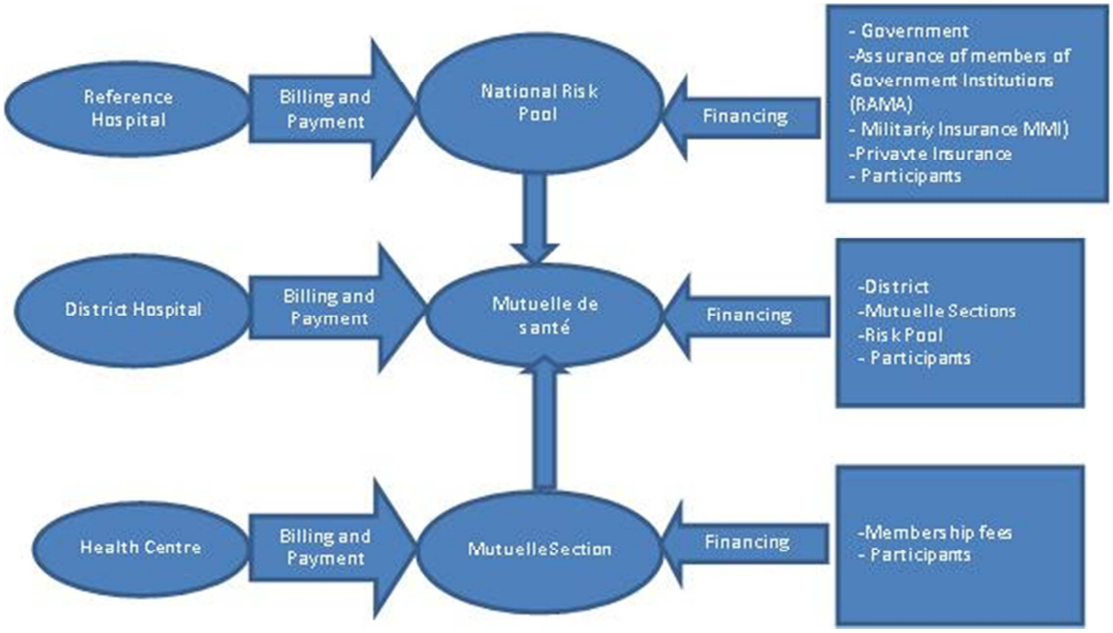
Source: RDHS 2010 and administrative records, MOH.
Note: The probit and IV estimations control for: Child's gender, age and breastfeeding time in months, mother's age, educational attainment, BMI and marital status, the sex of the household head, the number of members in the household and the number of children under five, the households wealth level, the place of residence, as well as district dummy variables. The instrument chosen in the IV-Regression is the *Mutuelle* coverage rate at the health sector level. The PSM uses a nearest-neighbour matching. The propensity score for the matching controls for child, mother and household characteristics, with the latter comprising a range of variables on household possessions including land holding and livestock.
The standard errors (in parenthesis) of the probit- and IV regressions are robust and clustered at the sector level, in the case of PSM they are bootstrapped (100 repetitions). * significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1: Evolution of *Mutuelle de Santé* Coverage (2003-2010)



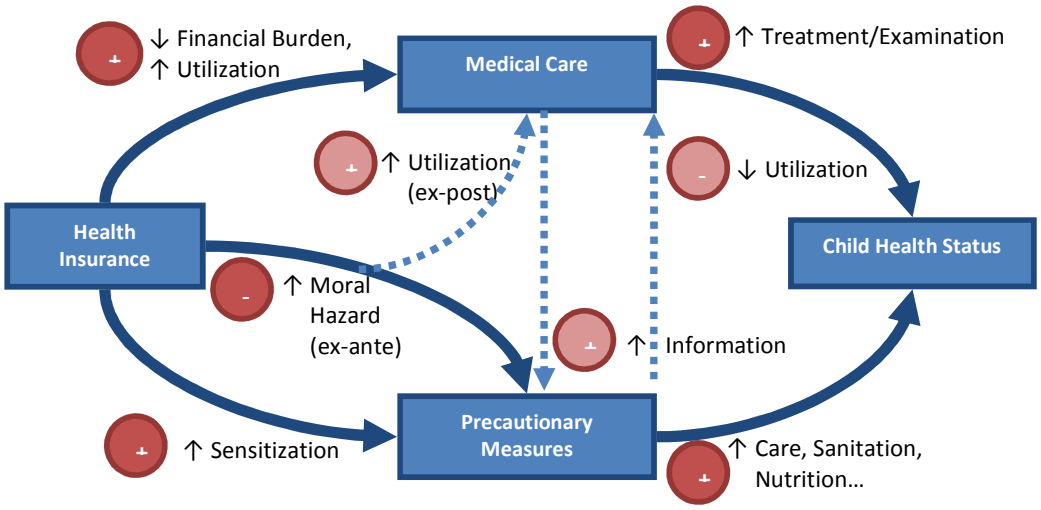
Source: Ministry of Health, 2011.

Figure 2: Organisational Structure



Source: Ministry of Health, 2011.

Figure 3: From Health Insurance to Health Outcomes



Source: Authors representation.

Table A1: Descriptive Statistics by *Mutuelle* Enrolment

	2010						
	Not Enrolled			Enrolled			
Variable	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**P-value**
Child Characteristics							
Gender (male, dummy)	2,178	0.517	0.500	5,711	0.507	0.500	0.424
Age (in months)	2,178	31.627	16.224	5,711	29.653	17.377	0.000***
Time breastfeed (in months)	2,178	10.554	13.203	5,711	8.628	12.155	0.000***
Maternal Characteristics							
Age (in years)	2,178	30.944	6.880	5,711	30.591	6.544	0.035**
No education (dummy)	2,178	0.239	0.426	5,711	0.177	0.382	0.000***
Primary (dummy)	2,178	0.704	0.456	5,711	0.746	0.435	0.000***
Secondary or higher (dummy)	2,178	0.057	0.232	5,711	0.077	0.267	0.002***
Married (dummy)	2,178	0.449	0.497	5,711	0.644	0.479	0.000***
BMI	1,102	22.435	2.866	2,854	22.711	3.033	0.010***
Household Characteristics							
Male head (dummy)	2,178	0.754	0.431	5,711	0.832	0.374	0.000***
# of members	2,178	5.414	1.881	5,711	5.508	1.942	0.053*
# of children under 5	2,178	1.797	0.730	5,711	1.772	0.700	0.158
Poorest	2,178	0.321	0.467	5,711	0.206	0.404	0.000***
Poorer	2,178	0.233	0.423	5,711	0.214	0.410	0.060*
Middle	2,178	0.176	0.381	5,711	0.212	0.409	0.000***
Richer	2,178	0.140	0.347	5,711	0.204	0.403	0.000***
Richest	2,178	0.129	0.336	5,711	0.165	0.371	0.000***
Place of residence (rural, dummy)	2,178	0.874	0.332	5,711	0.878	0.327	0.634
Health Characteristics							
Sick 2 weeks prior to survey (dummy)	2,178	0.325	0.469	5,710	0.307	0.461	0.118
Medical treatment (dummy)	432	0.417	0.494	1,109	0.653	0.476	0.000***
Traditional treatment (dummy)	346	0.084	0.278	726	0.040	0.196	0.003***
Height-for-age z-score (SD)	1,092	-1.750	1.327	2,808	-1.537	1.281	0.000***
Slept under bednet (dummy)	2,178	0.646	0.478	5,711	0.739	0.439	0.000***
Treat water (dummy)	2,177	0.392	0.488	5,708	0.516	0.500	0.000***

Source: RDHS 2010.

Note: The p-values represent the result of the t-test on the equality of means for each variable. * p<0.10; ** p<0.05; *** p<0.01.

Table A2: Results of 1st Stage Probit Estimation

	Probit (1)	Marginal Effects (2)
Sector coverage rate	0.040	0.001
	(0.001)***	(0.000)***
Child is male	-0.022	-0.006
	(0.033)	(0.009)
Child age	-0.007	-0.002
	(0.001)***	(0.000)***
Time breastfeed	-0.01	-0.002
	(0.001)***	(0.000)
Mother's age	-0.008	-0.002
	(0.004)**	(0.001)**
No education	*Ref.*	*Ref.*
Primary	0.089	0.026
	(0.056)	(0.016)
Secondary or higher	0.18	0.052
	(0.010)*	(0.029)*
Married	0.453	0.131
	(0.047)***	(0.013)***
Male head	0.027	0.008
	(0.050)	(0.015)
# of members	0.011	0.003
	(0.013)	(0.004)
# of children under 5	-0.115	-0.003
	(0.035)***	(0.010)***
Poorest	*Ref.*	*Ref.*
Poorer	0.232	0.067
	(0.057)***	(0.017)***
Middle	0.427	0.123
	(0.062)***	(0.018)***
Richer	0.595	0.172
	(0.071)***	(0.021)**
Richest	0.706	0.204
	(0.087)***	(0.025)***
Rural	-0.034	-0.010
	(0.112)	(0.032)
Constant	-0.008	
	(0.224)	
District Controls	Yes	Yes
N	*7,889*	
Pseudo R^2	*0.130*	

Source: RDHS 2010 and administrative records, MOH.
Note: Robust standard errors clustered at the sector level in parenthesis.
* significant at 10%; ** significant at 5%; *** significant at 1%.