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Mutual Health Insurance and its Contribution to Improving Child Health in Rwanda

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Mutual Health Insurance and its Contribution to Improving Child Health in Rwanda

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Abstract – Rwanda is among the few countries in Sub-Saharan Africa and the developing approaching universal health insurance coverage. To date, over 90 per cent of the population are enrolled in the *Mutuelles de Santé* - a system that started off from a number of stand-alone community based health insurance schemes and gradually evolved into a unified social health insurance plan. The country has also made remarkable progress in ameliorating child health, particularly since 2005, which coincides with the year when the *Mutuelles de Santé* was standardised and raises the question to what extent the insurance scheme did contribute to the observed improvements. In order to address this issue we conduct a quantitative impact evaluation using nationally representative micro-data from the 2005 and 2010 Rwandan Demographic and Health Surveys (RDHSs) and also consider potential channels from which improvements could originate.

Our results suggest the following: The *Mutuelles de Santé* improves access to preventative and curative health services. Insured households are more sensitive to health issues, in the sense that they are more inclined to use bed nets and ensure safe drinking water. Despite a weak effect on health outcomes overall, the insurance scheme seems to have contributed to improvements in stunting and mortality, at the critical ages (before the age of two).

Key words – Health Insurance, Child Health, *Mutuelles de Santé*, Rwanda

***JEL* codes** – I11, I38, J13

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1 Introduction

A growing strand in the empirical literature argues that early childhood experiences are determinant for future physical and cognitive development. Periods of prolonged under nutrition or illness, for example, have been found to lead to an unrecoverable reduction in height or lower educational achievements (see e.g. Behrman and Rosenzweig, 2004; Case et al., 2005; Alderman et al., 2006; Heckman, 2006; Oreoupolous et al., 2008; Currie, 2009; Maluccio et al., 2009; Alderman, 2010; Almond and Currie, 2010; Schultz, 2010). Some studies even go as far and argue that shocks in early childhood then influence earnings capabilities (see e.g. Hoddinot et al., 2008). The period that is considered as being crucial for later development and well-being in most of these studies are the years from birth up until two (some argue up until three) years of age. In light of the potential negative long-term consequences and the provisions of the Millennium Development Goals (MDGs), policy makers in low income countries are increasingly trying to mitigate child ill-health through targeted interventions including vaccination campaigns, supplementary feeding or cash transfer programmes. In addition to these concentrated efforts, in recent years there has also been a global push to expand health insurance coverage in low-income settings (see e.g. WHO, 2005) which is ultimately also intended to improve population health. Hence, if health insurance is also assumed to improve the health status of the population, the question arises how much it actually should, or rather could contribute. Coming back to the issue of child health, the before mentioned question becomes even more interesting when contrasting the potential outcomes of health insurance to the more targeted interventions. Whereby the different measures should not necessarily be seen as directly competing options but rather be evaluated from an overall cost-effectiveness perspective. Concentrating on the health insurance question for now, there is, so far, still very little empirical evidence on the contribution of insurance coverage towards the amelioration of child health and the limited, robust evidence that is there actually draws a rather mixed picture particularly when it comes to measuring improvements in the child's health status. Thus, the question of how much health insurance could contribute to improving child health still remains an open one. Reviewing the existing literature on the topic, it becomes evident that the results obtained are very much dependent on the context and the design of the insurance scheme which makes cross-country comparisons rather difficult. Nevertheless, generally it can be said that more often than not, does the success of any health insurance system hinge on the accessibility to

good quality health care and the level of trust vested in the system.[1] In light of the importance of context, this paper presents yet another case study and investigates the question to what extent health insurance contributes to the amelioration of child health in the case of Rwanda.

Rwanda, which is a small landlocked country in central eastern Africa, provides an interesting case to study for three reasons. First, it is among the few countries in Sub-Saharan Africa and the developing world that managed to reach almost universal health insurance coverage. To date, over 90 per cent of the population are enrolled in the *Mutuelles de Santé* (hereafter also referred to as *Mutuelles*) - a system that started off from a number of stand-alone community based health insurance schemes and over time evolved into a standardised social health insurance plan. Second, of its current population of an estimated 11 million, a substantial share, namely 17.5 per cent is below 5 years of age (NISR, 2009), which is also considered the generation that will be key to reap the benefits of a demographic dividend. Third, the country has made significant progress in improving child health particularly since 2005,[2] which coincides with the year when the *Mutuelles* scheme was standardized; raising the question to what extend the insurance system did manage to contribute to this. As indication, from 2005 to 2010, the infant mortality rate dropped from 86 per 1000 live births to 50. Under-5 mortality was halved (from 152 per 1000 live births to 76). While in 2005, still 5 per cent of the children between 6 month and 5 years were wasted, in 2010 the rate declined to 3 per cent. In addition, stunting fell significantly between 2005 and 2010 from 51 per cent to 44 per cent (NISR, 2012). However, the high stunting prevalence does still remain an area of concern.

A rigorous evaluation of the health effects of the *Mutuelles* is challenging in many ways but a central matter is the question of identification. The underlying issue here is that the decision to join the health insurance scheme might be determined by unobserved factors which could simultaneously also affect the choice of health care practises and consequently the potential health outcomes. Any estimated effect of health insurance enrolment on health care behaviours or outcomes might hence be subject to selection or omitted variable bias. These biases could be limited in randomized assessments. However, is a randomized trial for the assessment of health insurance neither always feasible nor desirable, particularly if it concerns large scale, nationwide policy interventions as in the case of the *Mutuelles*, where it

[1] See Schneider (2005) for an exploratory study on the importance of trust in the early phase of the *Mutuelles de Santé* in Rwanda.

[2] Comparing the child health statistics over time it can be seen that it took the country about 10 years to recover from the 1994 Genocide and to get back to the pre-Genocide rates of 1992 (see RDHS of the years 1992, 2000 and 2005).

would be politically and ethically challenging to systematically exclude a part of the population over an extended period of time, which would be necessary to measure the longer-term health effects. Randomized trials have also been criticised for focusing too strongly on answering the question on what kind of interventions work, without actually attempting to investigate in more detail the underlying (theoretical) mechanisms (see e.g. Deaton, 2010). While we are not providing a fully fledged theoretical model, we are least partially also picking up on this critique and do consider a number of indicators of potential transmission mechanisms in our assessment in order to obtain at least some indication on how the effects on health outcomes could manifest themselves.

In light of the concern on attribution and the potential biases we aim for a band estimate (upper and lower bound of a potential impact) derived from using alternative estimation strategies. 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 *Mutuelles* 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 *Mutuelles* coverage rates at the sector level.[3]

While previous studies on the *Mutuelles* 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 2005 and 2010 Rwandan Demographic and Health Surveys (RDHSs) which are representative at the national level.

The results of our analysis do provide evidence of a positive contribution of the *Mutuelles* towards increasing medical treatment both when the child is sick but also concerning health check-ups as shown in the case of antenatal care visits. In addition, insurance enrolment does seem to have triggered positive behavioural responses with insured households actually more inclined to have their children sleeping under a bed net and to treat water before drinking. Despite the positive direction on treatment and prevention, the contribution of the *Mutuelles* towards improving child health remains weak. Nevertheless, the results do still suggest that the *Mutuelles* has helped to improve child health at the critical ages (below the age of two) which manifests itself in improved height-for-age z-scores for that group and reduced risk of infant mortality.

The remainder of this paper is structured as follows. Section 2 provides a brief overview on the *Mutuelles* and the findings so far. Section 3 summarizes the main empirical evidence

[3] Sectors are the 4th level of administration follwing from the national, provincial and district levels.

on the insurance, care and health outcome-nexus in less developed countries, also bringing out some of the key design features of the different schemes that might be driving the results obtained. Building on this discussion, Section 4 lays down the conceptual framework and the results chain from which the main indicators for the analysis are derived. Sections 5 and 6 present the data and empirical strategy. The results are discussed in Section 7. 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, a direct payment system was re-introduced. For the vast majority of the population,[4] this reversal meant that health care was no longer affordable and consequently utilization dropped. So, while in 1997 on average every third person went for one consultation per year, two years on in 1999 it was only every fourth (Schneider, 2005). In 1999 then, aiming to make health services more accessible again, the Government initiated a one year pilot test on pre-payment, community based insurance schemes - the *Mutuelles de Santé* - in three districts.[5] Given the positive results of the pilots,[6] also other communities adopted a scheme and the coverage expanded nationwide. The *Mutuelles*, as known in its current form, was formally launched in 2005 with the approval of the *Mutuelles* Health Insurance Policy end of 2004 (Lu et al., 2012). The policy standardised the main parameters of the *Mutuelles*, such as the benefits package, enrolment fees, organisation structure and management, and subsidisation mechanisms (Lu et al., 2012). Despite the approval of the policy end of 2004 however, there was still some variation in the scheme design across districts until 2006 when it was fully unified (Lu et al., 2012). The standardisation was also accompanied by a further expansion of enrolment into the scheme (see Figure 1). In light of the rapid growth, in 2008

[4] The poverty rate at the time was beyond 60 per cent.
[5] These districts were Kabutare (in the former Butare prefecture), Byumba (formerly Byumba prefecture) and Kabagayi (in the former Gitarama prefecture). In 2005 Rwanda went through a re-organisation of the administrative structure and the former levels 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.
[6] See Schneider and Diop (2001) for an assessment.

the Law on the Creation, Organisation and Management of the Mutual Health Insurance Scheme (law no. 65/2007) was enacted to further strengthen the system. The law does not only regulate the cross-subsidization of the *Mutuelles* with other schemes but also stipulates health insurance as being compulsory for the population – a factor to further push universal coverage.

[Figure 1 about here]

2.2 Organisational Structure

The organisational structure of the *Mutuelles* is closely aligned to the decentralised administrative structure of the country (see Figure 2). At the sector level, each health centre has a *Mutuelles* 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 *Mutuelles* scheme is coordinated and managed at the district level with each of the 30 districts in the country holding a mutual insurance fund ("*Fonds Mutuelles de Santé*"). Each *Mutuelles* office at the district level is staffed with a director, in charge of the management of the *Mutuelles* 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. In terms of funding, approximately 50 per cent of the *Mutuelles*' funding comes from annual membership premiums. The remainder is obtained via cross-subsidisation with other insurance funds (RAMA, MMI), and through transfers from NGOs, development partners and the Government (Antunes et al., 2009). Health service providers are paid by the *Mutuelles* directly either through monthly capitation rates on a fee-for-service basis or via a recently introduced performance-based payment scheme (Lu et al., 2012).

[Figure 2 about here]

2.3 Subscription and Services

In order to limit adverse selection, the *Mutuelles* uses a policy of household subscription, i.e. once the decision for enrolment is taken; all household members have to be enrolled. Before 2007, the annual premium for a household with up to seven members varied across regions, ranging from around 2,500 to 11,500 RwF (ca. 3.12 to 14.38 current EUR) (Lu et al., 2012). Since 2007 the annual premium has been standardized to 1,000 RwF (ca. 1.25 current EUR).

Newborn children are covered under the scheme free of charge in the first three months after birth.

Enrolled households are assigned to designated health centres. Following a referral from the health centre, members can obtain hospital services. To further mitigate adverse selection, a thirty day period starting from the day of enrolment applies before a member can benefit from the services covered under the *Mutuelles* (Lu et al., 2012). Before 2006 the *Mutuelles* covered all services and drugs in the health centre and limited services in the hospital. Since 2006, *Mutuelles* enrolees are entitled by law to a minimum package of activities (PMA) at the health centre upon a co-payment of RwF 200 per visit (ca. 0.25 current EUR). The PMA includes promotional services consisting of child growth monitoring, psychosocial support, home visits, information, education and communication for health; preventative activities including vaccination, prenuptial consultations, pre- and postnatal care, voluntary consultation and testing for HIV, family planning, water and sanitation, and epidemiological monitoring; and curative services including consultations, child health care, management of chronic illnesses, nutritional rehabilitation, HIV/AIDS patient treatment, curative care, normal deliveries, minor surgery, laboratory tests and the provision of drugs (Lu et al., 2012). At the district hospitals the enrolees are entitled to a complementary service package (PCA) which consists of preventative activities including preventive consultations for referred cases and prenatal consultations for at-risk pregnancies, family planning, with all methods available for those referred, including tubal ligation and vasectomy; curative services for those referred, including the management of difficult and caesarean deliveries, medical and surgical emergencies, minor and major surgery, hospital care, drug provision, laboratory analyses and medical imaging (Lu et al., 2012).[7] For the complementary package a co-payment of 10 per cent of the invoiced amount is required. Generally, the very poor are exempted from the annual fee and co-payments, with their membership being fully subsidized by Government.

In the past the flat premium payment structure has been criticized, for aggravating inequality and benefiting the rich more than the poor (see e.g. Schmidt et al., 2006). In light of these concerns and also to ensure the financial sustainability of the scheme the annual premium schedule was amended as of July 2011 and the flat-fee replaced by stratified contributions based on the *Ubudehe* categories.[8] Under the new policy, individuals from the

[7] The services covered under the *Mutuelles*, are similar to the services covered by alternative insurance schemes operated in Rwanda (like RAMA or MMI).

[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*

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

A factor which is considered key to the functioning of the system is the mandatory, household-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 of the scheme with the enrolment conducted at the community i.e. the sector level, within a close social network and the presence of a community health worker who facilitates monitoring and access also.

2.4 Previous Assessments

A number of studies have already been conducted on the *Mutuelles*. While there is quite some variation in the methodological rigour, these earlier studies concentrate almost exclusively on the assessment of the *Mutuelles* in improving access to health care and in providing financial risk protection. This focus is not surprising given that these are usually also the two primary objectives of any health insurance scheme, whereas a third more long-term aspect, namely the final health implications, has so far been rather neglected. Concerning the access to health care, the existing studies do document an overall positive effect (see e.g. Schneider and Hanson, 2006; Shimeles, 2010; Saksena et al., 2011; Dhillon et al., 2011; Lu et al., 2012). Saksena et al. (2011) illustrates, for example, that insured individuals use almost twice as many services as their uninsured counterparts. A similar magnitude is also found by Lu et al. (2012), which show that the odds of using medical care is increased by 2 for *Mutuelles* enrolees. In a more concentrated study in the Mayange sector Dhillon et al. (2011) show that the reduction in financial barriers through the enrolment in the *Mutuelle*s paired with an elimination of co-payments increases annual per capita visits for curative care by 0.6. The same study also shows that the financial barriers outweigh quality considerations in this context as an increase in nursing staff in this sector did not lead to a significant increase in

nyakujya), the very poor (*umutindi*), to the poor (*umukene*), the resourceful poor (*umukene wifashije*), the food rich (*umukungu*) and finally the money rich (*umukire*).

[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.

utilisation rates. Despite the overall positive evidence of the *Mutuelles* on access to health care, the picture is somewhat more diversified when the results are disaggregated by income group. While Saksena et al. (2011) and Sekabaraga et al. (2011) present a stronger effect for the lower income quintiles and thus argue for a narrowing of the utilization gap between the rich and the poor, Shimeles (2010) and Lu et al. (2012) actually find lower utilization rates among the poor. Hence, the evidence on this aspect remains inconclusive. However, the studies of Shimeles (2010) and Lu et al. (2012) are methodologically stronger than the works by Saksena et al. (2011) and Sekabaraga et al. (2011) and thus seem more credible.

Concerning the financial risk protection capacity of the *Mutuelles*, similar evidence is found. Overall the *Mutuelles* seems to prove quite efficient in reducing catastrophic health spending. However, here again there are limitations. Saksena et al. (2011) shows, for example, that over 40 per cent of those insured did not use health services when ill and 20 per cent of the insured households under study still experienced a high financial burden when seeking treatment. The precise reasons from these observations are however not further investigated. Shimeles (2010) and Lu et al. (2012) also show a higher rate of catastrophic health spending among the poor again.

While the before mentioned studies were primarily concerned with the demand side, for any health insurance system to work, the supply side, i.e. the quality of the health infrastructure does also play an important role. In order to improve the supply side, Rwanda has since 2005 also expanded on a pay-for-performance scheme for health care providers. The impact of this intervention is also of interest here as first empirical evidence shows that the incentives introduced through the scheme improved provider efficiency and also had a significant effect on improving the weight-for-age z-scores of children from 0-11 months and the height-for-age z-score of children from 24-49 months (Gertler and Vermeersch, 2012). The authors do attribute these latter findings to an increase in the use and quality of pre- and postnatal care – a point we will come back to in Section 4.

3 A Review of the Literature

In the following we will not present an exhaustive review of the literature on the health insurance, -care and outcome nexus. We exclusively only consider studies from less

developed country contexts.[10] The number is further limited to studies which assess the impact of health insurance on child health outcomes in methodologically sound ways which allow deducing a causal relationship between the two. For more exhaustive and systematic reviews on the health insurance, care and outcome-nexus see Haldey (2003) or Levy and Meltzer (2008). Overall, the majority of the evidence (largely from developed countries) does point towards a positive influence of health insurance on various outcome measures of health. However, Levy and Meltzer (2008) also explicitly mention that most studies, so far, have not been able to disentangle the complex relationships between health insurance, -utilization and final health outcomes and to establish causal relations, particularly between the first and the latter link of the chain. A more recent review by Giedion and Diaz (2011) summarizes the existing evidence from 49 studies on health insurance schemes in low- and middle income countries. About half of the studies reviewed do provide reasonably robust evidence showing that in most cases health insurance also in these contexts meets the intended goals of expanding financial protection and access to care, however, on the impact on the health status the results remain inconclusive. Giedion and Diaz (2011) also point out that there is so far still little detailed understanding on how health insurance changes health seeking behaviour with respect to the quantity, quality, type and composition of services demanded. Furthermore, the authors also level criticism on the lack of comparability between studies and the outcome variables chosen. They argue that particularly weight-for-age and height-for-age z-scores, which are common indicators on the child health status, are only marginally dependent on better access to care but strongly influenced by other variables. They therefore advocate to use outcome variables which are closer related to the precise services covered by the insurance scheme; these are however often marginal aspects which are not covered by standard household surveys. In light of the underlying data source used and the limitations that are thus applied to the potential outcome variables under consideration, the present study is also subject to the criticism by Giedion and Diaz (2011).

Concentrating on the financial risk protection aspect of health insurance, Ansah et al. (2008) assessed the effect of removing direct health care payments on utilization and child health outcomes in Ghana. For the study 2,194 households with 2,592 children under the age of five in the Dangme West District in southern Ghana were randomly assigned to either, a pre-payment scheme providing free primary care and drugs, or to normal practise needing to

[10] We are thus not considering the work form the RAND Health Insurance Experiment conducted in California in the 1970s which has for long served as landmark study and is still one of the few randomized control trials (RCTs) conduced in this area (see e.g. Brook et al, 1983).

pay user fees for health care. While the introduction of the pre-payment scheme has clearly altered the health seeking behaviour of the households with the enrolees using more formal care and less informal care than the control group, the authors are not able to identify measurable differences in health outcomes meaning that one year after the intervention, mortality, the mean haemoglobin concentration, severe anaemia, parasite prevalence and anthropometrics remained similar in both treatment and control group. The results of the study do suggest two things. First, an increase in health care utilization might not directly result in improvements in the health status and hence utilization might not be safe proxy for increased health. However, health effects might also take time to manifest themselves and thus might not be measureable immediately. This applies particularly to anthropometric improvements but should not be the case for the anaemia indicators which were considered the primary outcome in the study. Second, removing the direct financial barriers to health might be a necessary but not sufficient condition for improving health. Improvements of the standard of care and the availability of transport to get to the health centre, for example, may need to parallel with free health care in order for it to have an effect on health outcomes.

Wagstaff and Pradhan (2005) were among the first authors to go beyond the questions of access and financial protection in evaluating health insurance in a low income setting and did for the case of Vietnam's Health Insurance (VHI) programme also investigate child health outcomes. Using a matched double-difference approach on panel data collected before and after the introduction of the insurance programme in 1993, the authors find that for children under the age of five, health insurance enrolment improves the height-for-age z-scores by 0.456 and the weight-for-age z-scores by 0.332. This represents an annualized average increase in height of 0.47 cm and weight of 0.15 kg of the youngest cohort between 1992/93 to 1997/98. For elder children however, no significant improvement was identified. The authors argue that the improvements in young children's health are driven by a substitution away from using non-prescribed medicine and pharmacists' advice to actually seeking more primary care at the community health centre. The substitution seems to be driven by two factors, a reduction in the financial burden and a sufficient standard in the quality of care. The (compulsory) insurance scheme did have a very generous initial coverage, covering all drugs, impatient and outpatient care. In addition, also no co-payments were required prior to 1998. Moreover, an assessment of the World Health Organisation (WHO) in 1998 did attribute a good score to the primary care providers in Vietnam in diagnosing and treating common childhood illnesses (Wagstaff and Pradhan, 2005).

Further evidence on improvements of health insurance for child health is provided by Quimbo et al. (2011), who assess the effect on the basis of data from the Quality Improvement Demonstration Study (QIDS) in the Philippines, a randomized policy experiment. The intervention under consideration in this study does provide access to PhilHealth, the social health insurance programme in the Philippines, by providing fully subsidized premiums with zero co-payments to indigent households. Using a difference-in-difference regression model, the authors find robust evidence, that for poor children in this context health insurance coverage leads to a 9-12 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. The beneficial health effects however were not measurable at the time of discharge from the hospital but only became apparent 4 to 10 weeks later (Quimbo et al., 2011). The authors argue that insured children are set on a better trajectory for full recovery as they are better protected from reduced consumption, particularly of food items resulting from catastrophic health spending - an argument that is also supported by results obtained by Wagstaff and Pradhan (2005) in Vietnam who equally show that VHI enrolment increases non-medical consumption including food.

Apart from the anthropometric measures and anaemia, child mortality, even though a secondary measure, is also a commonly used indicator to document progress in improving child health. Using the case of Costa Rica, Dow and Schmeer (2003) and Dow et al. (2003) have analysed how much the expansion in the countries' national health insurance scheme in the 1970s has contributed to the reduction in child mortality and found only a very small effect; and this despite the insurance granting universal access to hospitals and widespread health facilities at zero prices with no deductibles, contrary to the large out-of-pocket prices and user fees which the uninsured were faced with. For example, based on a 100 per cent micro sample from the 1973 and 1984 Costa Rican census, Dow et al. (2003) show that the 1970s insurance expansion from a 46 to 74 per cent coverage explains only about 4 per cent of the drop in the observed reduction in child mortality between the years 1973 and 1984. In other words, all else equal except for the insurance introduction, mortality would have dropped from 53 deaths per 1,000 live births to 51.6 deaths per 1,000 live births but not to the 18 deaths per 1,000 live births actually achieved over the period. In explaining the low effect the authors speculate that it might be due to low quality, i.e. if the quality available at hospitals yields relatively low health benefits, the insurance expansions might not have a major impact on aggregate health indicators such as mortality (Dow et al., 2003).

Summing up the evidence a few points become apparent. First, there is no uniform measure of health status used throughout these studies which makes comparison rather difficult. Second, despite some variation, the majority of studies do point towards a positive relationship between health insurance coverage and child health outcomes. Third, discussing the transmission mechanisms on the insurance-outcome-nexus, the present studies seem to indicate that it is not so much the free access to care that matters but rather the financial risk reduction aspect of health insurance safeguarding consumption and thus a better trajectory of recovery for the child. Forth, the quality of care in which the health insurance scheme is operated seems to play a crucial role for improvements in the health status. This has been one point consistently mentioned and discussed in all studies reviewed aiming at explaining the results obtained.

4 The Linkages from Health Insurance Coverage to Health Outcomes

Figure 3 presents the causal linkages from health insurance coverage to final health outcomes in form of a results chain on the basis of which the underlying hypothesis to be tested in this paper will be derived. In addition, the chain of results does also allow identifying a set of performance indicators which will serve as basis for analysis. However, the choice of indicators proposed is limited to the information available in the RDHS - the underlying data source used for analysis.

In retrospective, considering the high rate of stunting reported above, the health situation of small children in Rwanda could be considered as precarious. Hence, an insurance scheme could provide a valuable contribution to improving child health. The *Mutuelles* covers all (promotional and curative) health services rendered under the PMA and PCA presented above in Section 2.3 which include, for example, treatment of all common child illnesses, child growth monitoring, nutritional rehabilitation, vaccination, pre- and postnatal care but also regular sensitisation on health issues. The sensitisation campaigns do take place at least once a year around the period for insurance renewal (June/July). Given that the *Mutuelles de Santé* is a pre-existing scheme we have already seen that there has been a gradual increase in insurance coverage of the population as a whole (see Figure 1) and because of the household level enrolment also an increasing number of children are covered by health insurance (see also descriptive statistics in Tables A1 and A2 in the Appendix which show increased insurance coverage of children over time). Thus, we can already establish that the provisioning of health insurance has led to an increasing number of children being covered by

health insurance. Following the enrolment in the *Mutuelles* children gain easier access to health care and can receive treatment when sick. This is based on the assumption that insurance coverage reduces the direct cost for consultations and thus increases the incentives to seek care. However, given that the decision for treatment is not with the child but with the parent or guardian of the child, different preference structures are coming into play here and it could be that the decision to seek care for oneself diverges from the decision taken concerning ones child. Hence, in order to assess whether the insurance has led to increased access for small children, we use the likelihood to receive modern health care, i.e. health care at a public or private health facility, when ill. Gaining access to formal health care could also reduce traditional, often more perilous treatments. Thus, the likelihood to receive traditional care gives an indication whether a substitution from traditional to formal care is taking place. As part of the PMA, pre-natal care visits are covered under the *Mutuelles*, hence, the number of antenatal visits is an alternative indicator for increased access to care. Through this we try to at least partly address the critique levied by Giedion and Diaz (2011) and do consider an indicator that is directly related to the precise services offered. If insurance induced improvements in access to care can be established, the amelioration is expected to impact on several levels. First, on the treatment side, children would receive better treatment when visiting a health facility. This is based on the assumption that a minimum quality of care is ensured at all health facilities. This is where the supply side is coming into play. One potential indicator testing for improved treatment practises, given the data limitations, is the likelihood that the child received oral rehydration when suffering from diarrhoea. Second, the access provides for consultation and sensitization. Consequently, parents are expected to have more knowledge on child health matters and are taking precautionary measures to limit infection and disease. However, in order to see an increase in preventative measures, insurance induced (ex-ante) moral hazard must be low. This means that despite easier access to care, parents do not lower precaution. Unlike with other types of insurance, concerning health insurance, moral hazard is often not considered a serious issue as people are not expected to gamble with their health or the health of their minors at least not to the extent to which they would with material assets, as a loss in health bears serious to even fatal consequences (Cutler & Zeckhauser, 2000). In order to test for an increase in information, knowledge and the precautionary measures taken, the following three indicators are proposed: first, the likelihood that the mother has received nutrition education as a basic indicator for knowledge sharing; second, the likelihood that the household uses a means to purify drinking water; and third, the likelihood that the child sleeps under a bed net. The latter

two indicators assume that knowledge is transformed into action. At a third level, interplaying with improved treatment and prevention, increased access to care can contribute to improved child health in the short term. As the studies by Quimbo et al. (2011) and Wagstaff and Pradhan (200) suggest the effects of, for example, infection induced malnutrition might be limited if (food) consumption can be safeguarded. This can be verified by assessing a change in wasting. Extrapolating from the short to the long-run then the hypothesis to be tested is as follows:

Mutuelles de Santé enrolment does lead to improvements in child health.

Improvements in child health can be assessed through several aspects. Being aware of the criticism of Giedion and Diaz (2011) but also bound to data limitations, the indicators proposed for measuring improvements in child health are threefold: First, the likelihood to suffer from illness (i.e. from diarrhoea, fever and/or anti-respiratory infection (ARI)), - this is a rather crude measure as the disease prevalence is strongly influenced by the current epidemiological environment and also subject to reporting error; second, the change in stunting; and third, the change in infant- and child mortality as more long-term measures for an overall improvement in the general health status of children.

Following the line of argument on the long-term consequences of shocks in early childhood, a reduction in the time of illness and an improved health status would then also translate into improved cognitive development and higher earnings capabilities in future. However, these latter two aspects are beyond the scope of this study as this would require further and more specific data for analysis.

[Figure 3 about here]

5 Data Sources and Descriptive Statistics

In the absence of panel data, the present analysis is based on cross-sectional data from the Rwandese Demographic and Health Surveys (RDHSs) of the years 2005 and 2010. The RDHS is a standardised and nationally representative survey that collects i.a. detailed level information on household characteristics, housing, gender aspects, family planning, health care, HIV/AIDS, malaria, and maternal- and child health. The RDHS uses a two-stage

sampling design analogue to the Integrated Living Conditions Survey (EICV), the only other nationally representative survey conducted in Rwanda. The 2005 RDHS was carried out in the period between February and July 2005 and gathered information from 10,272 households; for the 2010 RDHS 12,540 households were interviewed over seven months from September 2010 to March 2011. Out of the total sample, our analysis concentrates exclusively on children aged between zero and five years of age. We further limit the sample to only children enrolled in the *Mutuelles* or children that are not covered by any form of formal health insurance. Hence, children covered by alternative schemes such as RAMA, MMI or other private health insurance schemes are systematically excluded from the analysis.[11] The total sample of children used for analysis thus comprises of 16,594 observations – 8,210 from 2005 and 8,384 from 2010.

The descriptive statistics of the sample children split by insurance status and survey year are presented in Tables A1 and A2 in the Appendix. While in 2005 the children covered by the *Mutuelles* are not different on their basic characteristics (gender, age and breastfeeding period) to those not enrolled, the group does nevertheless exhibit noticeable differences in maternal and household characteristics. Mothers of enrolled children are on average about one year older, they are better educated (enrolled children have a lower share of uneducated and higher share of mothers achieving secondary or higher education), they are more often married (62.6 per cent) and they show a slightly higher body mass index (BMI). Concerning the household characteristics, enrolees are more often coming from male headed households with, on average, slightly more members and younger children. They live in rural but wealthier environments with a higher share coming from the richest quintile (which is defined by higher asset holdings), while non-enrolled households are more dominant in the poorest quintile (23.5 per cent vs. only 17.8 per cent of the enrolled).

Five years on in 2010, we see that the sample has somewhat shifted but on average children that are enrolled in the *Mutuelles* remain 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. Concerning the child characteristics, while also in 2010 the sample is gender balanced, we do see that children covered under the *Mutuelles* are on average 2 months younger than non-enrolled children. Partly, this can be explained by the feature that children born to insured mothers are automatically covered by the *Mutuelles* in the first three months before also a premium has to be paid for them. The age difference is

[11] This represents 2.6 per cent of all children in the sample.

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 still better educated with 82 per cent having at least primary education while for uninsured children it is only 75.9 per cent. The difference observed on the marital status of the mothers of insured and uninsured children, has almost remained the same. The educational attainment, marital status of the mothers and wealth distribution suggest that uninsured children are coming from poorer, more vulnerable backgrounds. Comparing the situation found in 2010 to the one in 2005 it thus seems that the status quo has been kept up, implying that even over time the *Mutuelles* has not managed to sufficiently include the poor and most vulnerable.

The descriptive statistics depict a clear difference between insured and uninsured children on average – point that has to be taken into account in the following analysis.

6 Methods

Given the status of the scheme it is not possible to answer the question on the extent to which the *Mutuelles de Santé* improves child health through a randomised assessment. Thus, self-selection is a major concern when analysing the impact of the *Mutuelles* on health care practices and health outcomes as it could render any estimation results subject to selection and omitted variable bias. For example, in the case of adverse selection, if households with frailer children are more likely to enrol they may also use more medical care. Hence, this may lead to an over-estimation of the impact of *Mutuelles* enrolment on health care. In light of these concerns, this study uses different statistical approaches in order to address the selection issue. The results of the different statistical approaches are used to derive a band estimate on the potential impact. The analysis presented below concentrates on the data from the 2010 RDHS and is complemented by the 2005 data for robustness checks and extensions.

To begin with, a standard multivariate regression model is used to estimate the effect of health insurance enrolment on the range of outcome indicators that we have derived in the results chain presented above. The basic estimation equation used in this case has the following functional form:

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

where Y_{ij} stands for the respective outcome variable of child i in sector j. I_{ij} represents a binary variable indicating whether the child is enrolled in health insurance or not. X^C_{ij} is a vector of child characteristics including covariates on the child's gender, age and breastfeeding history. X^M_{ij} controls for the mother characteristics, age, educational attainment, marital status, and BMI. X^H_{ij} is a vector of household characteristics including the sex of the household head, the number of household members and the number children living in the household below the age of five, the household's wealth quintile, radio ownership as important source of information, and the place of residence. District characteristics (η^D) are controlled for through district dummy variables. The error-term μ_{ij} represents a set of unobserved attributes of the child, mother or household including, for example, the level of frailty, risk aversion or initiative.

In case of binary outcome variables, probit regression models are used for estimation, otherwise ordinary least squares (OLS) estimation is used. In all estimations the standard errors are clustered at the sector level. While we do control for a range of observable characteristics in the OLS and probit estimations, the results obtained are subject to selection and unobserved variable bias.[12] In order to mitigate a potential selection bias due to observable characteristics, we use propensity score matching to construct a dataset in which the uninsured children are as similar as possible to the insured children. For the propensity score to be used for the matching we estimate a probit model of the following functional form:

$$I_{ij} = \beta_0 + \beta_1 X^C_{ij} + \beta_2 X^M_{ij} + \beta_3 X^H_{ij} + \eta^D + \mu_{ij} \qquad [2]$$

with I_{ij} representing the binary variable on whether the child is enrolled in health insurance or not, and X^C_{ij}, X^M_{ij}, X^H_{ij}, and η^D representing vectors of child-, mother-, household-, and district characteristics.[13] On the basis of the estimated propensity score ($\hat{I}_{ij}$) the data is matched using local linear matching (with tri-cube kernel) which allows for more than one uninsured unit to be matched to an insured observation in order to estimate the effect of *Mutuelles* enrolment on the respective outcome variables. The standard errors in the matching are obtained through bootstrapping with 100 repetitions. To test for the robustness of the results obtained the

[12] In order to address the selection issue we follow a similar procedure as used by Lu et al. (2012).

[13] The household characteristics controlled for do not include the wealth quintile but have been expanded to include the a range of variables on housing (e.g. access to piped water, toilet facility, electricity, roofing, wall material), asset holdings, including the ownership of radio, television, bicycle, mobile phone, watch, livestock (cattle, goat, sheep chicken, pig, rabbits), and whether the household has a bank account.

before mentioned procedure is repeated using a nearest-neighbour matching approach.[14] In addition, we also report the Rosenbaum Bounds in order to verify how big the bias needs to be in order to render the matching results invalid. Following the potential reduction in the selection bias on the basis of observable characteristics, we use an instrumental variable (IV) approach on the matched data[15] in order to further reduce the influence of a potential bias. In light of the requirements under the in- and exclusion restriction, we use the *Mutuelles* coverage rates at the sector level derived from the RDHS data as instrument. This is considered appropriate given the decentralised nature of the *Mutuelles* with mobilization for enrolment being carried out at the sector level.

The IV approach is implemented following a two-step procedure with the first step equation represented by

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

with I being the 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 are also 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. To ensure that the standard errors are correct we follow the two-stage procedure as proposed by Wooldridge (2002). Hence, the second stage regression is specified as follows.

$$Y_{ij} = \beta_0 + \beta_1 \hat{I}_{ij} + \beta_2 X^C_{ij} + \beta_3 X^M_{ij} + \beta_4 X^H_{ij} + \eta^D + \mu_{ij} \qquad [4]$$

where again Y_{ij} represents the respective outcome variables and $\hat{I}_{ij}$ the predicted value obtained from the first stage regression. Despite some outcome variables being binary the second stage regression is estimated using a linear probability model. This allows for the standard errors on the effect of interest, β_1, to be correct. However, it comes at the expense that probabilities are not restricted to lie between zero and one. Also here, the standard errors are clustered at the sector level.

We test the validity of the exclusion restriction and the strength of the instrument using the first-stage regression results (see Table A3 in the Appendix). From the first-stage regression results it can be seen that children with mothers with higher educational

[14] Results on the robustness checks on any of the outcomes can be obtained from the authors upon request.
[15] The results on the quality of the matching and the resulting dataset are provided by the authors upon request.

backgrounds are more likely to be enrolled in the *Mutuelle*. Also the marital status of the mother seems to strongly influence the likelihood of enrolment. 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 *Mutuelles* with households in sectors with higher coverage rates being more likely to be enrolled. Regressing the instrument on *Mutuelles* 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 instrument was weak the standard IV point estimate would also be weak, as well as, the ensuing hypothesis tests.[16] Depending on the sample size and thus the variation, the first-stage F-results beyond 10 (reported in Tables 1-11b, third column) do give comfort on the strengths of the instrument.

In addition to the tests based on the first stage regression results, we conduct a placebo test re-estimating the second stage equation with the instrument (2010 sector enrolment rates) on data from the 2005 RDHS. The coefficient on the instrument is not statistically significant in any specification hence, providing further assurance on the instrumental approach (see Table A4).

Furthermore, we have also examined the existence of selection bias due to unobserved factors using the two-stage residual inclusion (2SRI) method recommended by Terza et al. (2008) (see Table A5 in the Appendix) as further alternative approach in order to test the robustness of the results. Concerning all the outcome indicators chosen in this paper, the residual coefficient was not statistically significant in any of the specifications, which would suggest that there are actually no unobserved factors at play. [17]

While the analysis has thus far concentrated on a single cross-section, to further test the robustness of the results, in a final step we run sector-level fixed-effects regressions on

[16] 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 whether a set of instruments is strong is whether the concentration parameter is sufficiently large.
[17] Detailed results are available from the authors upon request.

pooled, matched data from the 2005 and 2010 RDHS.[18] The fixed-effects estimation equation is defined as follows:

$$Y_{ijk} = \beta_0 + \beta_1 I_{ijk} + \beta_2 X^C_{ijk} + \beta_3 X^M_{ijk} + \beta_4 X^H_{ijk} + \eta^D + \beta_5 T_k + \eta^S + \mu_{ijk} \quad [5]$$

with T_k presenting a binary variable indicating the survey year and η^S representing the sector effects.

As a word of caution, while we have tried to reduce the potential for bias step-by-step, following different estimation approaches, the effects that have been obtained through the various procedures are not directly comparable as they apply to different populations. As pointed out by Angrist and Imbens (1995), the parameter that is obtained via instrumentation, for example, captures a weighted average of causal responses to a unit change in treatment, for those whose treatment status is affected by the instrument. Thus, the effect is not representative of the whole population but rather represents a local average treatment effect (LATE) on a specific part of the population namely the enrolled population only (compliers). It may also imply that an increase of the IV effect relative to the OLS effect, for example, partly stems from the distribution, i.e. a stronger concentration at the upper end.

7 Results

7.1 Access to health care

Concerning access, there is vast evidence in the literature that health insurance improves access to health care (see e.g. Levy and Meltzer, 2008; and Giedion and Diaz, 2011 for summaries). Also, in the case of the *Mutuelles* several studies have already shown that the scheme overall has increased access to care (see e.g. Schneider and Hanson, 2006; Shimeles, 2010; Saksena et al., 2011; Dhillon et al., 2011; Lu et al., 2012). However, a more disaggregated analysis has not yet taken place. Concentrating on small children exclusively we do also find that this applies. The descriptive statistics (see Tables A1 and A2 in the Appendix) already point to improvements in access. In 2005, over half of the insured children (55 per cent) that suffered from diarrhoea, fever or acute respiratory infection (ARI) in the two weeks prior to the survey received medical treatment at a modern health facility whereas

[18] The matching of the 2005 data was carried out analogue to the procedure described before. Given that not all outcome variables were compiled in the 2005 dataset, the fixed effects estimations are limited to the outcomes which have been compiled in both datasets.

in the case of uninsured children only 34 per cent received formal care when sick. Similarly also in 2010 insured children do clearly appear more likely to receive medical treatment when ill, with the gap between insured and uninsured also widening slightly compared to 2005. In addition to the descriptive evidence, also the results from the different econometric approaches (presented in Table 1) show a robust, statistically significant, positive effect of *Mutuelles* coverage on seeking medical treatment for the child when sick. The estimates range suggests that children that are covered by health insurance are between 16 to 29 percentage points more likely to receive treatment at a modern health facility or from trained personnel when being sick.

The comparison of sample means in 2005 shows that uninsured children receive more often traditional treatment than their ensured counterparts. While traditional care seems to have declined over time, in 2010 still uninsured children are more frequently being treated by traditional means than enrolees (now 8 respectively 4 per cent, whereas in 2005 it was at 20 respectively 15 per cent). The more detailed analysis does also depict a negative relationship between health insurance coverage and traditional treatment (see Table 2). However, the estimated effects are less strong. The lack of statistical significance in this case however is likely to stem from the low number of observations. Nevertheless, overall the observed decrease in traditional treatment as a consequence of health insurance enrolment might actually be indicative of a substitution away from traditional treatment practises to more formal means.

In order to at least partially address the criticism by Giedion and Diaz (2011) we have considered the effect of *Mutuelles* coverage on the number of antenatal visits, as this is one of the specific services covered under the PMA offered by the *Mutuelles*. The results obtained, indicate that *Mutuelles* coverage has increased the number of antenatal visits by around 0.12 to 0.28 on average (see Table 3). However, as can be seen from the descriptive statistics (see Table A2), despite the positive contribution, with on average 3.1 visits passed in 2010 the recommended number of 4 visits is still not reached.

[Tables 1-3 about here]

7.2 Treatment

With the increase in health care utilization, we also observe improvements in treatment. Considering the case of treatment with oral rehydration supplements when the child is suffering from diarrhoea, as an example, the results of the estimations suggest that children

that are covered by the *Mutuelles* are about 5 to 8 percentage points more likely to receive the treatment than their uninsured counterparts. However, the results obtained are less robust, which is partly due to the low number of observations in this case but more so due to the fact that we are here comparing insured and uninsured children that are both receiving treatment at a medical health centre. Hence, the uninsured in this case have already taken the access barrier and assuming non-discrimination we do not expect any difference in treatment standards between insured and non-insured children.

[Table 4 about here]

7.3 Knowledge and Prevention

The results of the different indicators on knowledge and prevention are presented in Tables 5 to 7 below. While we find a positive indication for mothers of insured children being more likely to have received any form of education or sensitization on nutrition aspects, the effects are not statistically significant. Nevertheless, anecdotal evidence from a brief qualitative field survey suggests that women from insured households are more knowledgeable on treatment of certain diseases than their uninsured counterparts.[19]

Concerning preventative measures, the descriptive statistics show a considerable increase in the use of bed nets over time. While (conditional on the household owning a bed net) in 2005 only 19.5 per cent of enrolled children slept under a bed net, in 2010 it increased to 74 per cent.[20] For non-enrolees however the figures are significantly lower with only 65 per cent sleeping under a net. The same scenario is observed for water treatment which is distinctively more common among insured households. Also the econometric analysis does confirm this tendency with insured households being clearly more likely to purify water before drinking. The estimates suggest a range in the likelihood between 8 to 22 percentage points. In addition, conditional on the household actually owning a bed net, insured children are also more likely to have slept under a mosquito net for protection. Here, the range is between about 3 to 11 percentage points.

[19] Vignettes with pictures on accidents or diseases were shown to a group of 20 randomly selected mothers (insured and uninsured) in Kimironko (Kigali city) in July 2012. The respondents were asked to describe what they would do in these situations pictured. Women from insured households responded more often with potential treatment options and showed a higher readiness to go to a health centre then uninsured women which in 6 out of 10 cases answered that they did not know what to do.

[20] Note that the level of bednet usage overall has increased significantly over the five year period from around 15 per cent to over 60 per cent. In September 2009 the Ministry of Health launced a nation wide mass distribution of bed nets (see Otten et al., 2009).

More generally the empirical literature on moral hazard in health insurance draws a rather mixed picture. Taking prevention in form of bed net usage as example, in a case-control study on four mutual health insurance schemes in Mali, Miller Franco et al. (2008) do not find evidence of moral hazard as enrolled members are two times more likely to have their children (under 5) sleeping under an insecticide treated bed net than their non-insured counterparts. Contrary however, Yilma et al. (2012) find evidence for the presence of 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. The positive results on the preventative behaviour found here, do actually suggest a low level of moral hazard being present in the Rwandese case. The strong social ties and the presence of community health workers are likely to be contributing factor for this situation, unlike in other contexts.

[Tables 5-7 about here]

7.4 Short-term health effects

Following the findings from Quimbo et al. (2011) and Wagstaff and Pradhan (2005), health insurance can safeguard consumption, due to a reduction in catastrophic health spending, thus providing a more conducive environment for full recovery particularly if food consumption is kept up. Existing studies on the *Mutuelles* (see Shimeles, 2010; Saksena et al., 2011; Lu et al., 2012) attest that the scheme is efficient in reducing catastrophic health spending. In light of the positive effects on health care utilization and prevention and with the *Mutuelles* safeguarding consumption, it could thus be assumed that these effects would directly manifest themselves in improvements in the child's health status, at least in the short-term. We are measuring short-term improvements in child health through changes in the weight-for-height z-scores (WHZ) of children (see Tables 8a-c).[21] While overall the results are indicative of a positive change thus, an improvement in the WHZ, we cannot identify a statistically significant difference between the insured and uninsured children. For comparison purposes to the findings from Quimbo et al. (2011) who found a 9-12 percentage points reduction in the likelihood of wasting due to insurance in the Philippines, our results

[21] The weight-for-age z-score is a commonly used indicator for wasting, i.e. the rapid loss of weight caused either by a low intake of energy, nutrient loss due to infection (e.g. caused by diarhoea) or a combination of the two. Wasting is also reffered to as acute malnutrition.

represent a reduction in the likelihood of wasting of 1.2 to 2.5 percentage points only.[22] However, this has to be seen in light of the already low prevalence of wasting (3 per cent). As already mentioned, Quimbo et al. (2011) did not identify any immediate improvements after discharge but the reduction in the likelihood in wasting only manifested itself 4-10 weeks after discharge. In our case, we do not have sufficient information on the disease history of the children but we also do not find any significant difference in wasting immediately if we limit our sample to the children that have been reported ill in the two weeks prior to the survey.

[Tables 8a-8c about here]

7.5 Long-term health effects

The overall hypothesis to be tested in the paper is that *Mutuelle*s coverage leads to long-term improvements in child health. For this we are considering different indicators - the prevalence of disease, stunting and mortality.

While the infections environment is influenced by a multitude of factors that we are not able to control for, the results of our various estimations do suggest that enrolled children are slightly less likely to be sick (see Table 9). However, the estimates are only weakly significant and are also not significant in all cases.

Considering improvements in stunting which is still a major problem in Rwanda, the descriptive statistics show that insured children have a slightly better anthropometric status in 2005 already. In 2010 we do note further improvements in the height-for-age z-scores[23] with insured children doing clearly better. The results obtained for our analysis also provides some indication on a positive effect (see Tables 10a-c). However, her again the effects are not very strong and also not consistently statistically significant in all estimations. However, disaggregating the effects by age group, we do find higher magnitudes of improvement in the 6 to 24 months category, which is also considered the crucial period for long-term development. The lower bound estimate of an improvement of 0.135 in the height-for-age z-score (HAZ) represents a gain in the height for the cohort 6 to 24 months of 0.42 cm. This is similar in magnitude to the estimates obtained by Wagstaff and Pradhan (2005) in Vietnam.

While overall child mortality has dropped from 2005 to 2010 there is however no significant difference in mortality between the insured and uninsured when comparing the sample means. On the basis of more extensive analysis (see Tables 11a-b) we do also not find

[22] Results not reported but tables can be obtained from the authors upon request.
[23] 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.

a significant improvement in child mortality. Nevertheless, we do observe a stronger effect at younger ages again and find quite robust evidence that the *Mutuelles* has actually contributed to reducing infant mortality. Hence, insured children are between 3 to 14 percentage points less likely to die at the ages between zero and one.[24] The increasing number of ante-natal check-ups, covered under the insurance scheme might be a contributing factor here.[25]

[Tables 9-11b about here]

8 Conclusion

In light of the assumed long-term implications of health shocks during early childhood, this study attempted to assess to what extent a health insurance scheme could limit negative consequences and actually contribute to improvements in child health. We have done so using Rwanda as case study as the country has implemented a nation-wide health insurance scheme, the *Mutuelles de Santé*, in recent years, which could potentially serve as best-practise case for other countries in the region.

Concerning the research question posed in this paper, a major challenge for a rigorous assessment of the contribution of the *Mutuelle* towards improvements in child health is the potential presence of selection or omitted variable bias. In order to address the selection problem, we apply a number of different methodological approaches on the basis of which we derive a band estimate (upper and lower bound of a potential impact).

The results obtained do provide evidence of a positive contribution of the *Mutuelles* towards increasing medical treatment both when the child is sick but also concerning health check-ups as shown in the case of antenatal care visits. In addition, insurance enrolment does seem to have triggered positive behavioural responses with insured households actually more inclined to have their children sleeping under a bed net and to treat water before drinking. Despite the positive contribution of insurance towards access to care and prevention, the contribution of the *Mutuelles* towards improving child health remains weak. Nevertheless, the results do still suggest that the *Mutuelles* has helped to improve child health at the critical ages (below the age of two) which manifests itself in improved height-for-age z-scores for that age group and reduced risk of infant mortality.

[24] Given the sample size, we are only able to detect effects in case of more than 19,000 deaths occuring.
[25] Due to data quality we cannot test for the contributio no post-natal visits however.

The present study is not without shortcomings as we are, for example, not able to sufficiently control for the quality of care, nor for the duration of insurance coverage at the individual level which is actually expected to play a crucial role particular when it comes to the impact of insurance on health outcomes. Furthermore, given the limitations of the data we are not able to fully follow through a potential causal chain and thus, can also not test to what extent the insurance induced reduction in health spending contributes to a better trajectory for recovery in the case of Rwanda as suggested by the studies on Vietnam and the Philippines.

On the policy side, the descriptive analysis does point to a lack of enrolment among the poorest most vulnerable members. Hence, the question arises why they scheme has failed to systematically include the poor and what needs to be done in order to overcome this barrier also in light of the amended fee schedule, which might actually have risen the barriers again. While the results of the assessment do point to a positive effect of the *Mutuelles* on stunting and mortality, the results are insufficient to explain the drop between 2005 and 2010. These might actually rather be due to the overall socioeconomic progress of the country (the GDP growth averaged 8 per cent per annum in the period). To bring the stunting prevalence down to the MDG target of 24.5 percent more concentrated efforts and interventions will thus be necessary.

On the institutional side, the Rwandan scheme evolved from a number of individual, community based health insurance schemes into a nationwide social health insurance scheme. A common legal framework has helped to stipulate the responsibilities across the different administrative levels. While the decentralised organisational structure might be a major advantage of the scheme concerning up-take and adherence of the insurance programme, the fragmentation of the funding pools and the management structures might actually jeopardize the efficiency. This latter point is particularly relevant given the still low capacity of local managers and the high burden on the local administrations concerning planning and management (see Antunes et al., 2009). Despite the increase in the fee schedule, the financial viability of the *Mutuelles* remains an area of concern. The Health Finance Systems Review conducted in 2008 has established that the current total average health expense per capita would be sufficient to cover an essential package of services for the total population if universal coverage is given (Antunes et al., 2009). However, even though the household contribution to the total per capita expense has increased, the majority (72 per cent) is still financed through Government and foreign resources. Currently about 11.2 per cent of the

total government budget are allocated to the health sector.[26] This share has gradually increased from 8 per cent in 2005 to over 12 per cent proposed in the 2012/13 budget. The comparatively high share of the budget allocated to the health sector is also an indicator of the strong commitment of Government to improve health and the health infrastructure. Apart from the *Mutuelles*, a number of interventions are undertaken in the sector - one that we have already pointed at is the introduction of a performance based financing (PBF) scheme for health centres and hospitals. Questions that do arise in this context are, for example, how PBF interacts with the demand side incentives created by the health insurance scheme and whether the parallel financing mechanism actually hampers universal insurance coverage. These questions are beyond the scope of the current paper but remain an issue for investigation in the future.

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[26] This includes government own resources but also budget and sector budget support. A large share of the resources allocated to the health sector, particularly by private or non-governmental organizations but also from USAID are "off budget" and thus not included in the figures stated.

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Appendix

[Tables A1 to A5 about here]

Tables and Figures

Table 1: Estimation Results for Modern Health Care Utilization

	(1) Probit (marginal effects) (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (LPM) (matched data, 2010)	(4) Sector fixed effects (LPM) (matched data, 2005 & 2010)
Mutuelles enrolment	0.195	0.161	0.288	0.182
	(0.028)***	(0.036)***	(0.136)**	(0.023)***
Other controls	Yes		Yes	Yes
N	*1,541*	*1,524*	*1,524*	*2,921*
Pseudo R^2/ R^2	*0.077*		*0.094*	*0.234*
Γ (Rosenbaum bounds)		*1.9*		
p-critical [1)]		*0.083*		
1st Stage F			*7.32*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 2: Estimation Results for Traditional Care Utilization

	(1) Probit (marginal effects) (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (LPM) (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	-0.024	-0.029	-0.076	-0.042
	(0.026)	(0.015)**	(0.085)	(0.018)***
Other controls	Yes		Yes	Yes
N	*595*	*1,064*	*1,064*	*2,221*
Pseudo R^2/ R^2	*0.176*		*0.118*	*0.308*
Γ (Rosenbaum bounds)		*1*		
p-critical [1)]		*0*		
1st Stage F			*6.25*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 3: Estimation Results for Number of Antenatal Visits

	(1) OLS (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	0.165	0.122	0.280	0.135
	(0.033)***	(0.034)***	(0.152)*	(0.025)***
Other controls	Yes		Yes	Yes
N	*5,755*	*5,716*	*5,716*	*10,293*
R^2	*0.075*		*0.072*	*0.199*
Γ (Rosenbaum bounds)		*1.5*		
p-critical [1)]		*0.457*		
1st Stage F			*26.50*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 4: Estimation Results for Oral Rehydration Treatment

	(1) Probit (marginal effects) (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (LPM) (matched data, 2010)	(4) Sector fixed effects (LPM) (matched data, 2005 & 2010)
Mutuelles enrolment	0.075	0.057	0.081	0.052
	(0.032)**	(0.036)	(0.146)	(0.022)**
Other controls	Yes		Yes	Yes
N	*1,053*	*1,045*	*1,045*	*2,071*
Pseudo R^2/ R^2	*0.069*			*0.258*
Γ (Rosenbaum bounds)		*1*		
p-critical [1)]		*0.125*		
1st Stage F			*6.18*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 5: Estimation Results for Nutrition Education

	(1) Probit (marginal effects) (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (LPM) (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	0.021	0.017	0.062	---
	(0.016)	(0.019)	(0.076)	---
Other controls	Yes		Yes	---
N	*4,255*	*4,226*	*4,226*	---
Pseudo R^2/ R^2	*0.063*		*0.081*	---
Γ (Rosenbaum bounds)		*1*		
p-critical [1)]		*1*		
1st Stage F			*20.15*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 6: Estimation Results for Water Treatment

	(1) Probit (marginal effects) (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (LPM) (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	0.081	0.087	0.223	---
	(0.014)***	(0.017)***	(0.070)***	---
Other controls	Yes		Yes	---
N	*5,822*	*5,783*	*5,783*	---
Pseudo R^2/ R^2	*0.132*		*0.153*	---
Γ (Rosenbaum bounds)		*2*		
p-critical [1)]		*0*		
1st Stage F			*26.54*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 7: Estimation Results for Bed Net Use

	(1) Probit (marginal effects) (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (LPM) (matched data, 2010)	(4) Sector fixed effects (LPM) (matched data, 2005 & 2010)
Mutuelles enrolment	0.043	0.032	0.114	0.040
	(0.012)***	(0.015)**	(0.053)**	(0.012)***
Other controls	Yes		Yes	Yes
N	*7,408*	*7,353*	*7,353*	*9,014*
Pseudo R^2/ R^2	*0.066*		*0.064*	*0.142*
Γ (Rosenbaum bounds)		*1.5*		
p-critical [1)]		*0.194*		
1st Stage F			*34.28*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 8a: Estimation Results for Wasting (Weight-for-Height Z-Score SD)

	(1) OLS (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	0.038	0.078	0.091	0.035
	(0.042)	(0.047)*	(0.166)	(0.030)
Other controls	Yes		Yes	Yes
N	*3,881*	*3,865*	*3,846*	*7,166*
R^2	*0.094*		*0.094*	*0.132*
Γ (Rosenbaum bounds)		*1.1*		
p-critical [1)]		*0.111*		
1st Stage F			*17.78*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 8b: Estimation Results for Wasting (Weight-for-Height Z-Score SD), 6-24m

	(1) OLS (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	0.042	0.099	0.778	0.025
	(0.089)	(0.091)	(0.321)**	(0.067)
Other controls	Yes		Yes	Yes
N	*1,206*	*1,198*	*1,194*	*2,320*
R^2	*0.112*		*0.049*	*0.220*
Γ (Rosenbaum bounds)		*1.1*		
p-critical [1)]		*0.341*		
1st Stage F			*6.35*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 8c: Estimation Results for Wasting (Weight-for-Height Z-Score SD), 24-60m

	(1) OLS (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	0.011	0.026	-0.192	0.007
	(0.043)	(0.049)	(0.184)	(0.034)
Other controls	Yes		Yes	Yes
N	*2,354*	*2,345*	*2,332*	*4,176*
R^2	*0.133*		*0.122*	*0.217*
Γ (Rosenbaum bounds)		*1*		
p-critical [1)]		*0.115*		
1st Stage F			*10.67*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 9: Estimation Results for Illness in 2 Weeks Prior to Survey

	(1) Probit (marginal effects) (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (LPM) (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	-0.023	-0.017	-0.070	-0.018
	(0.013)*	(0.013)	(0.054)	(0.010)*
Other controls	Yes		Yes	Yes
N	*7,887*	*7,829*	*7,829*	*14,749*
Pseudo R^2/ R^2	*0.073*		*0.084*	*0.111*
Γ (Rosenbaum bounds)		*1*		
p-critical [1)]		*0.995*		
1st Stage F			*38.22*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 10a: Estimation Results for Stunting (Height-for-Age Z-Score SD)

	(1) OLS (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	0.126	0.056	0.053	0.112
	(0.051)**	(0.050)	(0.191)	(0.056)**
Other controls	Yes		Yes	Yes
N	*3,839*	*3,865*	*3,805*	*7,095*
R^2	*0.212*		*0.213*	*0.228*
Γ (Rosenbaum bounds)		*1*		
p-critical [1)]		*0.054*		
1st Stage F			*17.11*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 10b: Estimation Results for Stunting (Height-for-Age Z-Score SD), 6-24m

	(1) OLS (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	0.208	0.195	0.191	0.135
	(0.116)**	(0.101)*	(0.303)	(0.091)
Other controls	Yes		Yes	Yes
N	*1,196*	*1,143*	*1,184*	*2,297*
R^2	*0.284*		*0.287*	*0.337*
Γ (Rosenbaum bounds)		*1.2*		
p-critical [1)]		*0.069*		
1st Stage F			*6.29*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 10c: Estimation Results for Stunting (Height-for-Age Z-Score SD), 24-60m

	(1) OLS (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (matched data, 2010)	(4) Sector fixed effects (matched data, 2005 & 2010)
Mutuelles enrolment	0.029	-0.031	0.097	0.097
	(0.059)	(0.066)	(0.248)	(0.050)*
Other controls	Yes		Yes	Yes
N	*2,328*	*2,345*	*2,307*	4135
R^2	*0.177*		*0.177*	0.215
Γ (Rosenbaum bounds)		*1*		
p-critical [1)]		*0.182*		
1st Stage F			*10.29*	

Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 11a: Estimation Results for Child Mortality

	(1) Probit (marginal effects) (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (LPM) (matched data, 2010)	(4) Sector fixed effects (LPM) (matched data, 2005 & 2010)
Mutuelles enrolment	-0.007	-0.024	-0.023	-0.003
	(0.005)	(0.009)***	(0.023)	(0.004)
Other controls	Yes		Yes	Yes
N	*8,383*	*8,324*	*8,324*	*16,112*
Pseudo R^2/ R^2	*0.4748*		*0.237*	*0.247*
Γ (Rosenbaum bounds)		*1*		
p-critical [1)]		*0*		
1st Stage F			*39.14*	

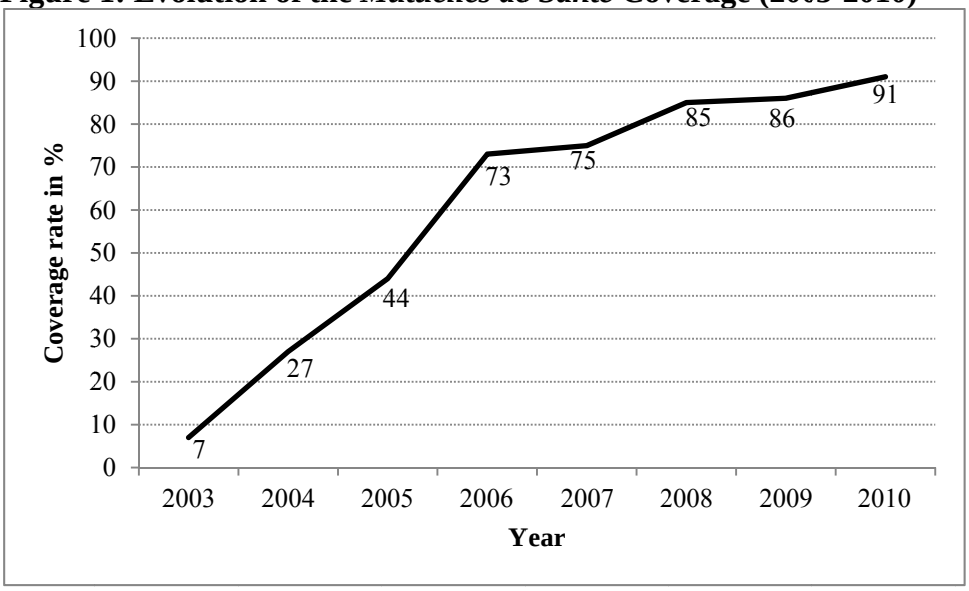
Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

Table 11b: Estimation Results for Infant Mortality

	(1) Probit (marginal effects) (unmatched data, 2010)	(2) PSM (matched data, 2010)	(3) IV (LPM) (matched data, 2010)	(4) Sector fixed effects (LPM) (matched data, 2005 & 2010)
Mutuelles enrolment	-0.063	-0.142	-0.068	-0.027
	(0.018)***	(0.033)***	(0.062)	(0.013)**
Other controls	Yes		Yes	Yes
N	*2,031*	*2,021*	*2,021*	*4,399*
Pseudo R^2/ R^2	*0.364*		*0.517*	*0.372*
Γ (Rosenbaum bounds)		*1*		
p-critical [1)]		*0*		
1st Stage F			*11.61*	

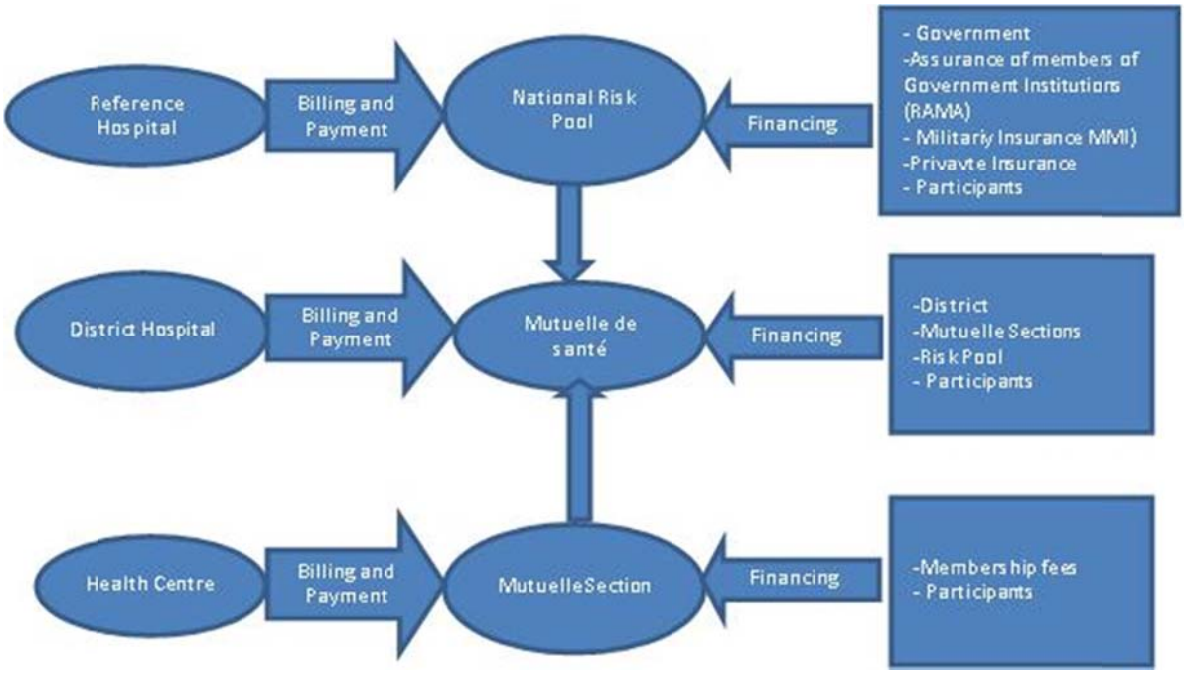
Source: RDHS 2005, 2010.
Note: * significant at 10%; ** significant at 5%; *** significant at 1%.
[1)] p-critical is p^+ or p^- if treatment effect was found to be positive of negative respectively.

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



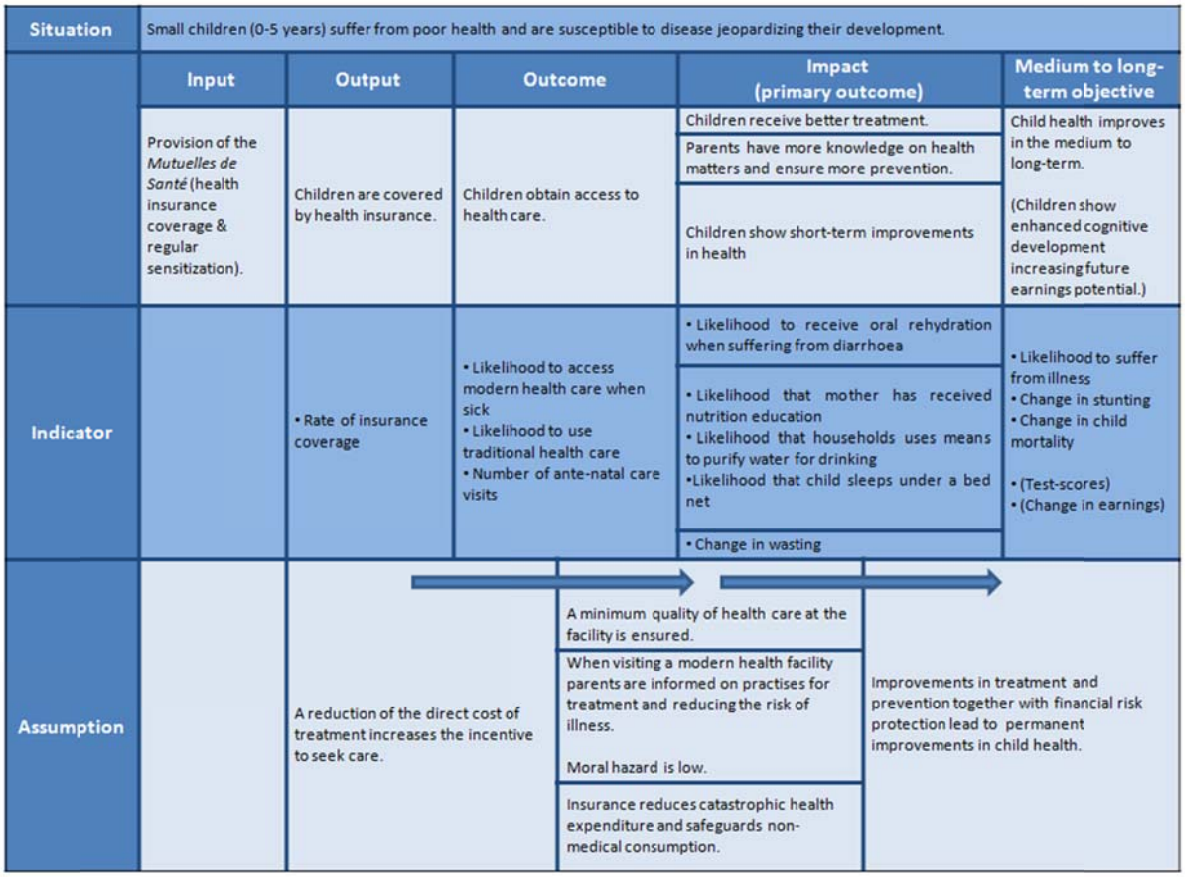
Source: The authors based on Ministry of Health (2011).
Note: The coverage rate reported here is based on the administrative records of the Ministry of Health. The discrepancy to the rates reported in the RDHS is due to timing and definition of the target population.

Figure 2: Organisational Structure



Source: The authors based on Ministry of Health (2011).

Figure 3: Results Chain



Source: Author's representation.

Table A1: Descriptive Statistics by *Mutuelle* Enrolment 2005

	2005							
	Not Enrolled			Enrolled				
Variable	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**P-value**	
Child Characteristics								
Gender (male, dummy)	4,623	0.506	0.500	3,587	0.505	0.500	0.893	
Age (in months)	4,623	25.184	17.389	3,587	25.449	17.599	0.496	
Time breastfeed (in months)	4,623	15.531	11.461	3,587	15.703	11.529	0.500	
Maternal Characteristics								
Age (in years)	4,623	30.692	6.896	3,587	31.613	6.821	0.000	***
No education (dummy)	4,623	0.304	0.460	3,587	0.255	0.436	0.000	***
Primary (dummy)	4,623	0.639	0.480	3,587	0.641	0.480	0.860	
Secondary or higher (dummy)	4,623	0.057	0.232	3,587	0.104	0.305	0.000	***
Married (dummy)	4,623	0.415	0.493	3,587	0.626	0.484	0.000	***
BMI	2,305	22.191	2.682	1,787	22.397	2.759	0.016	**
Household Characteristics								
Male head (dummy)	4,623	0.802	0.398	3,587	0.863	0.344	0.000	***
# of members	4,623	5.544	2.006	3,587	5.842	2.000	0.000	***
# of children under 5	4,623	1.862	0.802	3,587	1.900	0.802	0.030	**
Poorest	4,623	0.235	0.424	3,587	0.178	0.382	0.000	****
Poorer	4,623	0.198	0.399	3,587	0.207	0.405	0.357	
Middle	4,623	0.199	0.399	3,587	0.197	0.398	0.787	
Richer	4,623	0.202	0.401	3,587	0.216	0.412	0.115	
Richest	4,623	0.165	0.371	3,587	0.203	0.402	0.000	***
Place of residence (rural, dummy)	4,623	0.793	0.405	3,587	0.841	0.366	0.000	***
HH has radio (dummy)	4,615	0.426	0.495	3,585	0.576	0.494	0.000	***
Health Characteristics								
Medical treatment (dummy)	808	0.340	0.474	654	0.549	0.498	0.000	***
Traditional treatment (dummy)	732	0.201	0.401	463	0.156	0.363	0.049	**
# of antenatal visits	2,908	2.346	1.166	2,242	2.551	1.116	0.000	***
Oral rehydration given (dummy)	644	0.113	0.317	417	0.110	0.314	0.878	
Nutrition education (dummy)	---	---	---	---	---	---	---	
Water purification (dummy)	---	---	---	---	---	---	---	
Slept under bed net (dummy)	4,113	0.135	0.342	3,215	0.195	0.396	0.000	***
Weight-for-height z-score (SD)	1,971	-0.036	1.139	1,555	-0.034	1.051	0.964	
Sick in 2 weeks prior to survey (dummy)	4,105	0.425	0.494	3,204	0.392	0.488	0.005	**
Height-for-age z-score (SD)	1,971	-1.793	1.555	1,555	-1.701	1.468	0.076	*
Child died (dummy)	4,623	0.110	0.313	3,587	0.104	0.305	0.353	

Source: RDHS 2005.

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: Descriptive Statistics by *Mutuelle* Enrolment 2010

	2010							
	Not Enrolled			Enrolled				
Variable	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**P-value**	
Child Characteristics								
Gender (male, dummy)	2,307	0.521	0.500	6,077	0.508	0.500	0.259	
Age (in months)	2,307	30.127	17.011	6,077	28.194	17.919	0.000	***
Time breastfeed (in months)	2,307	9.964	13.056	6,077	8.109	11.960	0.000	***
Maternal Characteristics								
Age (in years)	2,307	30.969	6.902	6,077	30.620	6.585	0.033	**
No education (dummy)	2,307	0.241	0.428	6,077	0.181	0.385	0.000	***
Primary (dummy)	2,307	0.703	0.457	6,077	0.743	0.437	0.000	***
Secondary or higher (dummy)	2,307	0.056	0.231	6,077	0.077	0.266	0.001	***
Married (dummy)	2,307	0.445	0.497	6,077	0.638	0.481	0.000	***
BMI	1,182	22.422	2.851	3,049	22.711	3.031	0.005	***
Household Characteristics								
Male head (dummy)	2,307	0.755	0.430	6,077	0.833	0.373	0.000	***
# of members	2,307	5.378	1.888	6,077	5.460	1.952	0.084	*
# of children under 5	2,307	1.756	0.749	6,077	1.730	0.724	0.137	
Poorest	2,307	0.318	0.466	6,077	0.210	0.408	0.000	***
Poorer	2,307	0.233	0.423	6,077	0.214	0.410	0.060	*
Middle	2,307	0.177	0.382	6,077	0.212	0.408	0.001	***
Richer	2,307	0.142	0.349	6,077	0.203	0.402	0.000	***
Richest	2,307	0.130	0.336	6,077	0.162	0.368	0.000	***
Place of residence (rural, dummy)	2,307	0.874	0.332	6,077	0.878	0.327	0.573	
HH has radio (dummy)	2,307	0.512	0.500	6,076	0.660	0.474	0.000	***
Health Characteristics								
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	***
# of antenatal visits	1,653	2.901	1.082	4,291	3.151	0.943	0.000	***
Oral rehydration given (dummy)	338	0.216	0.412	715	0.316	0.465	0.001	***
Nutrition education (dummy)	1,793	0.606	0.489	4,724	0.651	0.477	0.001	***
Water purification (dummy)	2,306	0.392	0.488	6,074	0.515	0.500	0.000	***
Slept under bed net (dummy)	2,178	0.646	0.478	5,711	0.739	0.439	0.000	***
Weight-for-height z-score (SD)	1,092	0.007	1.072	2,808	0.091	1.048	0.009	**
Sick in 2 weeks prior to survey (dummy)	2,178	0.325	0.469	5,710	0.307	0.461	0.118	
Height-for-age z-score (SD)	1,092	-1.750	1.327	2,808	-1.537	1.281	0.000	***
Child died (dummy)	2,307	0.056	0.230	6,077	0.060	0.238	0.455	

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 A3: Results of 1st Stage Probit Estimation

	Probit (1)	Marginal Effects (2)
Sector coverage rate	1.945	0.539
	(0.122)***	(0.032)***
Child is male	-0.027	-0.008
	(0.033)	(0.009)
Child age	-0.007	-0.003
	(0.001)***	(0.000)***
Time breastfeed	-0.010	-0.003
	(0.001)***	(0.000)***
Mother's age	-0.009	-0.002
	(0.004)**	(0.001)**
No education	*Ref.*	*Ref.*
Primary	0.063	0.017
	(0.054)	(0.015)
Secondary or higher	0.122	0.034
	(0.100)	(0.028)
Married	0.422	0.117
	(0.048)***	(0.013)***
Male head	0.024	0.007
	(0.053)	(0.015)
# of members	0.003	0.000
	(0.014)	(0.004)
# of children under 5	-0.101	-0.028
	(0.035)***	(0.010)***
Poorest	*Ref.*	*Ref.*
Poorer	0.163	0.045
	(0.060)***	(0.016)***
Middle	0.315	0.087
	(0.065)***	(0.018)***
Richer	0.441	0.122
	(0.076)***	(0.021)**
Richest	0.632	0.175
	(0.088)***	(0.025)***
Rural	-0.002	-0.001
	(0.089)	(0.025)
Radio	0.168	0.047
	(0.048)***	(0.013)***
Constant	-1.016	
	(0.189)***	
District Controls	Yes	Yes
N	*7,830*	
Pseudo R^2	*0.164*	

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

Table A4: Results of Placebo test (Outcome Medical Treatment)

	1st Stage Probit	2nd Stage Probit
	(1)	(2)
Sector coverage rate	0.126	
	(0.237)	
Mutuelles		-1.551
		(2.156)
Child is male	-0.040	-0.004
	(0.032)	(0.062)
Child age	0.000	0.001
	(0.001)	(0.003)
Time breastfeed	-0.003	-0.007
	(0.002)	(0.007
Mother's age	0.009	0.014
	(0.004)**	(0.017)
No education	*Ref.*	*Ref.*
Primary	0.102	0.006
	(0.052)*	(0.112)
Secondary or higher	0.490	0.313
	(0.102)***	(0.389)
Married	0.410	0.265
	(0.054)***	(0.350)
Male head	0.057	0.049
	(0.070)	(0.108)
# of members	0.001	-0.020
	(0.012)	(0.028)
# of children under 5	0.006	0.015
	(0.035)	(0.080)
Poorest	*Ref.*	*Ref.*
Poorer	-0.017	-0.070
	(0.077)	(0.116)
Middle	-0.010	0.027
	(0.081)	(0.126)
Richer	0.117	0.082
	(0.084)	(0.157)
Richest	0.292	0.095
	(0.100)***	(0.114)
Rural	0.270	0.006
	(0.105)***	(0.114)
Radio	0.221	0.305
	(0.054)***	(0.304)
Constant	-1.635	0.107
	(0.297)***	(0.584)
District Controls	Yes	Yes
N	*5,784*	*1,152*
Pseudo R^2	*0.098*	

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

Table A5: Results of 2SRI Estimation (Outcome Medical Treatment)

	2nd Stage Probit (1)
Mutuelles	0.536
	(0.083)***
Residual	-0.201
	(1.046)
Child is male	0.081
	(0.072)
Child age	-0.002
	(0.003)
Time breastfeed	0.005
	(0.004)
Mother's age	-0.011
	(0.007)
No education	*Ref.*
Primary	0.183
	(0.098)*
Secondary or higher	0.159
	(0.182)
Married	0.138
	(0.159)
Male head	-0.007
	(0.091)
# of members	-0.007
	(0.026)
# of children under 5	-0.116
	(0.068)*
Poorest	*Ref.*
Poorer	0.141
	(0.126)
Middle	0.262
	(0.156)*
Richer	0.251
	(0.193)
Richest	0.479
	(0.249)*
Rural	0.193
	(0.140)
Radio	0.129
	(0.098)
Constant	-0.497
	(0.761)
District Controls	Yes
N	*1,524*
Pseudo R^2	

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

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