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# Does Ethnic Origin matter for Health Inequalities in Bolivia?

## An Assessment of the Effect of Ethnicity on Health Care Access and Health Outcomes

by

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**Abstract:** Good health is of utmost importance to individuals and economic growth. Nevertheless, inequalities concerning health services and conditions are observed in developed as well as developing countries. Often such disparities are related to ethnicity, with indigenous populations exhibiting lower health performance. Bolivia features a large indigenous population, which still experiences disadvantages concerning education, employment and poverty. However, there are few recent empirical assessments of the inequalities in access to health care and health performance of indigenous people compared to non-indigenous people. The few studies that do exist tend to focus on maternal and child health. The present study utilizes data from the Bolivian household survey from 2013 to 2019 to research ethnicity-related patterns in health performance. Several indicators regarding overall population health are scrutinized using binary logistic regressions. These are health insurance affiliation, prevalence of chronic and recent tropical diseases and the prevalence of diarrhea, which serves as a proxy for child health. This thesis focuses on ethnicity-related disparities regarding these health aspects. The study reveals considerable health inequalities between indigenous and non-indigenous populations concerning all examined indicators. Considering that indigenous people account for almost 50% of the population, these findings imply considerable shortcomings in Bolivia's health care provision. Moreover, indigenous heterogeneity, referring to disparities between different indigenous groups, is examined. Significant differences are discovered between the ethnic groups of Aymara, Quechua, other indigenous people and Afro-Bolivians. Consequently, future health interventions to decrease the health gap should not only focus on the group of "indigenous" but consider the heterogeneity within that group to achieve effective improvements in indigenous health status.

**Key words:** Health inequalities, ethnicity, Bolivia, health outcomes, indigenousness

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# List of Acronyms

ANDA – Asociación Nacional de Anunciantes de Bolivia
DHS – Demographic and Health Survey
EU – European Union
ILO – International Labour Organization
INE – Instituto Nacional de Estadística
LAC – Latin American and Caribbean
OECD – Organisation for Economic Co-operation and Development
PPS – Probability proportional to size (sampling)
SAFCI – Salud Familiar Comunitaria Intercultural
SUMI – Seguro Universal Materno Infantil
SUS – Sistema Único de Salud
UN – United Nations
US – United States
WHO – World Health Organization

# 1 Introduction

Health and economic development are intrinsically linked meaning that wealthier countries usually have healthier inhabitants (Bloom & Canning, 2008). Being one of the poorest countries in Latin America in terms of GDP per capita (Arnade & McFarren, 2021), Bolivia long exhibited disastrous health outcomes. In recent decades, Bolivia has experienced improvements in health status and equity (World Bank, 2004, p. 9). The life expectancy increased from 56 years in 1990 to 71 years in 2020 (World Bank, n.d.c). In 1994, the government introduced several new health policies, such as the introduction of public health insurance for maternal and child interventions, a greater focus on health outcomes and an expansion of the health workforce (World Bank, 2004, p. 9). These measures were primarily aimed at reducing maternal and infant mortality and curbing the spread of communicable diseases (World Bank, 2004, p. 9). Successes were seen in the reduction of infant mortality from 84 deaths per 1000 live births in 1990, one of the highest rates in Latin America, to 20.7 deaths per 1000 live births in 2020 (World Bank, n.d.d). Nevertheless, there are still measurable differences in health performance, referred to as health inequalities, between different income groups, the urban and rural and the non-indigenous and the indigenous population (World Bank, 2004, pp. 15-16).

Being home to more than 36 indigenous groups who account for about 48% of the population, Bolivia features the third-largest indigenous population in the world (Gigler, 2009; Buchholz, 2020). Despite constituting a considerable part of the population, indigenous people are still subject to discrimination and social exclusion (World Bank, 2004, p. 71). Differences between the indigenous and the non-indigenous inhabitants remain in terms of employment, education, housing, income and also health (Gigler, 2015, pp. 103-108). Indigenous people have poorer access to health care and poorer health outcomes, are more likely to contract diseases such as tuberculosis or Chagas and have higher mortality rates (Gigler, 2015, p. 105; Montenegro & Stephens, 2006, Pozo et al. 2006, pp. 62-63). Despite attempts from the government and the implementation of initiatives to reduce health inequalities, the ethnic health gap seems to remain. To improve the effectiveness of tailor-made health policies in the future, a deeper understanding of the role of ethnicity in health outcomes and health care access in Bolivia is required. Consequently, this study focuses on ethnicity-related health inequalities.

## 1.1 Research Problem

While the existence of health inequalities cannot be denied, a large body of research has elaborated on this aspect in the context of Western and more prosperous countries. Fewer studies have focused on developing countries (Braveman & Tarimo, 2002). Additionally, previous analyses focusing on health gaps in Bolivia tended to investigate infant, child or maternal health. In doing so, most studies rely on data from the latest Demographic and Health Survey (DHS) from 2008, which mainly provides data on women's reproductive health and child health. Few studies examine the recent overall health performance of the population as a whole including children, females and males. Moreover, despite representing a wide variety of ethnic groups, previous research has treated the indigenous in Bolivia as a homogenous group, and the aspect of indigenous heterogeneity has mostly been disregarded. To fill this gap, the present thesis scrutinizes the role of ethnicity and also indigenous heterogeneity on access to health care and various health outcomes using national household survey data. Hence, complementing previous research regarding health inequalities in Bolivia.

The relevance of the present study lies in the requirement for a new health policy that benefits the entire Bolivian population and thus eliminates the health inequalities of the different indigenous groups. Failure to address a health gap can potentially decrease the health performance of the population and thus, serve as an obstacle to further economic development in Bolivia.

## 1.2 Aim and Scope

The presented research aims to deepen the knowledge about the role that ethnicity plays when it comes to deviations in health outcomes and health access in Bolivia. Here, the disparities in access to health care and health performance of the overall population rather than just certain population groups are examined to complement previous research that points to health inequalities. Consequently, the paper aims to answer the following research question:

***Is ethnicity related to inequalities in terms of health care access and outcomes in Bolivia?***

The paper applies a quantitative approach to studying health insurance access and health outcomes for different ethnic groups in Bolivia using the Household Surveys (*Encuesta de Hogares*) covering 2013 to 2019 conducted by the Instituto Nacional de Estadística (INE). The scope of the study is limited to respondents of household surveys between 2013 and 2019. The impact of ethnicity is scrutinized by first considering Bolivia's indigenous population as a homogeneous group and then, in a second step, taking a more disaggregated view. Here, the study distinguishes between Aymara, Quechua, other indigenous and Afro-Bolivians. The dependent variables used in the binary logistics analyses as indicators of access to health care and health performance of the population are health insurance affiliation, the prevalence of chronic diseases, recent diseases and children suffering from diarrhea in the last two weeks.

## 1.3 Outline of the Thesis

This thesis will first provide background information regarding the country context of Bolivia and a literature review regarding relevant concepts and theories in the field of health economics and health inequalities. The next chapter will introduce the data and relevant variables. Chapter 4 will present the empirical approach applied in the analysis. Chapter 5 will provide the main results and robustness checks. Moreover, a thorough discussion of the findings and also limitations of the presented study will be given. The final chapter will provide conclusive thoughts and directions for further research.

# 2 Background

This section first elaborates on the Bolivian context, the situation of indigenous people and the health situation and health care system. The second part considers the crucial role of health in economic development and discusses the aspect of health inequality and the intersection of ethnicity and health. Lastly, previous publications and findings concerning health inequalities are presented.

## 2.1 Country Context of Bolivia

### 2.1.1 Background on Bolivia

The Plurinational State of Bolivia is located in South America and is home to a population of around 11.673 million people (World Bank, n.d.e). The country is landlocked and considered a highland country (Arnade & McFarren, 2021). However, it features three main geographic zones: the highlands (*altiplano*) are home to around 42% of the population, the valleys (*valles*) host 29% and another 29% of the population live in the plains (*llanos*) (Gigler, 2015, p. 92). Although still one of the poorest countries in South America, Bolivia has achieved considerable progress in recent decades. Between 2005 and 2016, the economy grew threefold and with a GDP per capita of around US$ 3,550 in 2019 (Beverinotti, 2018; World Bank, n.d.b), the country is now classified as a lower-middle-income country. However, the Bolivian economy is largely dependent on the extractive sector such as mining and hydrocarbon (Beverinotti, 2018). Hence, the growth spurt was probably linked to the commodity price boom and the end thereof resulted in more moderate growth (Beverinotti, 2018). The country also experienced considerable decreases in poverty (Arauz et al., 2019, pp. 14-15). The percentage of the population living under the US$3.20/day poverty line decreased from approximately 41% in 2000 to around 8% in 2019 (World Bank, n.d.f). Nevertheless, poverty alleviation still poses challenges and especially one group experiences relatively more poverty compared to other population groups – the indigenous.

### 2.1.2 The Situation of Indigenous People in Bolivia

The indigenous constitute around 48% of the Bolivian population and with 36 officially recognized peoples, Bolivia is one of the most culturally-diverse countries in the world (Buchholz, 2020; IWGIA, n.d.). Among the numerous indigenous groups, the Quechua and the Aymara, who live mainly in the Andean highlands and the central valleys, are the largest groups, accounting for about 50 % and 40 % of the indigenous population respectively (Gigler, 2009; IWGIA, 2019). In addition, the Chiquitano, Guaraní and Moxeno make up 3.6%, 2.5% and 1.4% of the indigenous population respectively (IWGIA, n.d.). These groups live mainly in the lowlands. Together, the remaining peoples constitute around 2.4% of the indigenous population (IWGIA, n.d.). Bolivia's indigenous groups are culturally very diverse and feature differences in social organizations, subsistence economy and settlement patterns (Gigler, 2015, p. 88).

For a long time, indigenous cultures and identities were disregarded and neglected. From the early 1990s, progress was made in the recognition of indigenous identities and cultures (Crabtree, 2017). This was also reflected in the increased protection of indigenous rights and increased participation of indigenous groups in policy-making (Gigler, 2015, p. 87; Crabtree, 2017). Although the 1994 amendment to the constitution actively respected the right of indigenous peoples and the country's plurinational character, Bolivia continued to feature a monocultural state model (Gigler, 2015, p. 87; Schilling-Vacaflor, 2011). A noticeable event was the election of the first indigenous president Evo Morales, an Aymara, in 2005 (Hicks et al., 2018). The new constitution passed under his presidency in 2009 improved the position of indigenous peoples in society as it officially acknowledged Bolivia as a plurinational state comprised of indigenous nations with a right to autonomy, their own cultural identity, language, education and protection of their territories (IWGIA, 2019; Crabtree, 2017). The new constitution also recognized indigenous medicines (Hammond, 2011). Additionally, Afro-Bolivians received similar rights as the indigenous groups (Crabtree, 2017).

Despite the improvements, the indigenous population is still subject to discrimination and social exclusion. The illiteracy rate equals over 40% among indigenous compared to an average illiteracy rate of 15% and indigenous peoples constitute a lower share of skilled workers (Gigler, 2015, p. 104, 107). Likewise, indigenous still experience higher poverty levels although the indigenous-non-indigenous poverty gap has decreased, especially since 2005 (Gigler, 2015, p. 97; Hicks et al., 2018). Inequalities still exist - also with regards to health.

### 2.1.3 The Health Situation and Health Care System in Bolivia

Relative to its income and education levels, Bolivia has long performed poorly in terms of health performance (World Bank, 2004, p. 10). In countries with comparable income levels, infant and maternal mortality were significantly lower (World Bank, 2004, p. 10). Bolivia exhibited lower life expectancy at birth and lower survival to age 65 than the LAC average in 2017 (OECD/World Bank, 2020, p. 24). Similarly, communicable diseases such as Chagas or malaria were above the Latin American average (World Bank, 2004, p. 11). Recently, the health situation in Bolivia has improved. This is shown by increases in life expectancy from 56 years in 1990 to 71 years in 2020 (World Bank, n.d.c). Likewise, the decrease in child mortality from 84 deaths per 1000 live births in 1990 to 20.7 deaths in 2020 presents a positive trend (World Bank, n.d.). Improvements in health care access can also be noted from the increase in institutional delivery of children (Weissstaub, Aguilar & Uauy, 2014).

Nevertheless, Bolivia continues to lag behind its regional peers and holds the "35 year-old sad record of the worst social and health indicators of Latin America" (Tejerina et al., 2014, p. 91). The country still features a high disease burden with infectious diseases and non-communicable diseases accounting for most deaths (Ledo & Soria, 2011). The achieved improvements mask large differences in health outcomes within the country. As such, regional differences and disparities between the indigenous and the non-indigenous population are reported (World Bank, 2004, pp. 15-16). For example, the tuberculosis prevalence of the Guaraní is five to eight times higher than the national average (Montenegro & Stephens, 2006). Likewise, the tropical and chronic disease Chagas is more common among indigenous communities (Salm & Gertsch, 2019). Indigenous peoples also experience higher infant and child mortality rates and have a higher probability to have recently suffered from sicknesses (Gigler, 2015, p. 105). Gigler (2015, p. 105) partly attributes these differences to a lack of access to health care for indigenous people. The health care system will be scrutinized in the next paragraph.

The Bolivian constitutions of 1961, 1971 and the most recent constitution of 2009 recognize health as a right (Alvarez et al., 2016; World Bank, 2020, p. 24). Here, the state pledges to provide access to health for the entirety of the population in a non-discriminatory manner (World Bank, 2020, p. 24). However, the Bolivian health care system faces certain challenges. The government allocates only 9.5% of its governmental expenditures to health services, social security and public insurance (Abbott et al., 2018). Although the government previously increased its healthcare spending by 5.8%, this is still lower than the global average of spending

15% of governmental expenditure on health services (Abbott et al., 2018). In its current form, the Bolivian health system is decentralised and comprises four levels: national, departmental, municipal and the local level, which ensures the participation of the population in health services (Alvarez et al., 2016). Next to the public sector, Bolivia's health system also features a private sector with insurance and health service providers (Ledo & Soria, 2011).

Since the start of the era of primary health care in 1994, the Bolivian health care system has experienced several reforms. Public health insurance was first introduced in 1996 in the form of the "National Insurance Scheme for Maternity and Childhood" aiming to improve maternal and child health care (World Bank, 2004, p. 24; Pooley, Ramirez & de Hilari, 2008). In the following years, several expansions were introduced to increase the number of health services covered and expand the provision of coverage to larger parts of the population such as the elderly (Alvarez et al., 2016; Pooley, Ramirez & de Hilari, 2008). Additionally, basic health insurance for indigenous and native peoples (*Seguro Básico de Salud)* was introduced in 2001 (Vandebroek et al., 2008). Since 2002, the Universal Mother and Child Insurance Scheme (*Seguro Universal Materno Infantil (SUMI)*) provided free health care services for numerous health issues (Alvarez et al., 2016). A further step was the introduction of the Unified Family, Community and Intercultural Health System (*Salud Familiar Communitaria Intercultural (SAFCI)*) in 2008. The SAFCI combined the principles of community participation, intersectorality, interculturality and integrality and aimed to increasingly consider indigenous health practices (Alvarez et al., 2016). Nevertheless, there are still problems in intercultural health care, also at the interface between western and traditional medicine, due to the lack of communication and language barriers between indigenous inhabitants and non-indigenous medical personnel (Torri & Hollenberg, 2013).

Bolivians working in formal employment often receive health insurance and consequently access to health care through their employers (Booth, 2020). However, Bolivia features one of the largest informal sectors in the world. Subsequently, a large proportion of the working population does not receive social benefits or social security and is not covered by health insurance (Abbott et al., 2018; Booth, 2020). This affects many indigenous because large parts of the native population work in the informal sector (Gigler, 2009). Consequently, healthcare expenses have to be paid out of their own pockets, limiting access to health care (Booth, 2020). Since 2014, the government has taken steps toward universal health coverage to decrease such access barriers. In 2018, the Single Health System model (*Sistema Único de Salud (SUS)*) was

created (World Bank, 2020, p. 28). The SUS aims to provide free health care coverage to people without coverage from social security which is around 50% of the population (WHO, n.d.). However, due to the lack and uncertainty of the required government funding, the practical implementation of the SUS has proven difficult (Booth, 2020).

Overall, Bolivia improved its economic situation and experienced positive developments in poverty. Furthermore, indigenous peoples receive more institutional recognition, which is reflected in an improvement in their situation. In this vein, reforms in the health care system aimed to provide increased health insurance coverage to vulnerable groups such as the indigenous. Nevertheless, persistent exclusion and discrimination put indigenous people at a disadvantage.

## 2.2 Theoretical Approach

### 2.2.1 The Special Role of Health

Health constitutes a crucial aspect of human development (Bloom & Canning, 2008). The pivotal role we assign to health is reflected in health even being considered a human right in the 1964 WHO Constitution and the 1948 UN General Assembly Universal Declaration of Human Rights (WHO, 2017; UN, n.d.). Hence, achieving good health can be considered a goal of its own right not requiring further justification (Bloom & Canning, 2008). Nevertheless, health also has economic relevance.

Theoretically, health can be considered an economic good since it turns into a form of capital – more specifically human capital. In general, human capital constitutes an accumulation of productive skills of a person that can be applied to produce income in the labour market and increase a household's consumption options (Weiss, 2015). In his theory of human capital, Becker (1964, p. 1) classifies health as a form of human capital similar to education. He further argues that investments can increase human capital. Such investments refer to ”activities that influence future monetary and psychic income by increasing the resources in people” (Becker, 1964: 1)” among which he classifies schooling but also medical care. Building on that, Grossman (1972) created his model of health demand for the commodity of ”health”. Although he argues that not only health is of interest but that people demand ”good health”. In his model, ”health capital” is regarded as a form of capital stock that contributes to the output of ”healthy

time". Individuals receive a stock of health capital which depreciates with increasing age. This depreciation can be countered by making investments in health. A unique feature of "health capital" according to Grossman (1972) is that it is a consumption good entering a consumer's preference function but similar to Mushkin (1962), he also views it as an investment good. The reason is that health capital influences a person's duration of life and consequently the available time to engage in market and nonmarket activities. Thus, health is also valued for its production capabilities since it contributes to earnings (Galama & van Kippersluis, 2013). Education also receives a special role in the model since it is hypothesized that more educated individuals consume and produce health care more efficiently (Galama & van Kippersluis, 2013).

Additionally, health plays a crucial role in economic growth and development. Cross-country comparisons show a correlation between health and GDP, with countries with better health exhibiting higher levels of income (Bloom, Kuhn & Prettner, 2018). The concept known as the "Preston curve" describes this positive relationship between real GDP per capita and life expectancy (Preston, 1975). Figure 1 below depicts the Preston Curve for 1960 and 2015 for all countries with the available data (Bloom, Kuhn & Prettner, 2018). Health may be seen as an "economic engine" and as a prerequisite for economic development (Mirvis, Chang & Cosby, 2008).

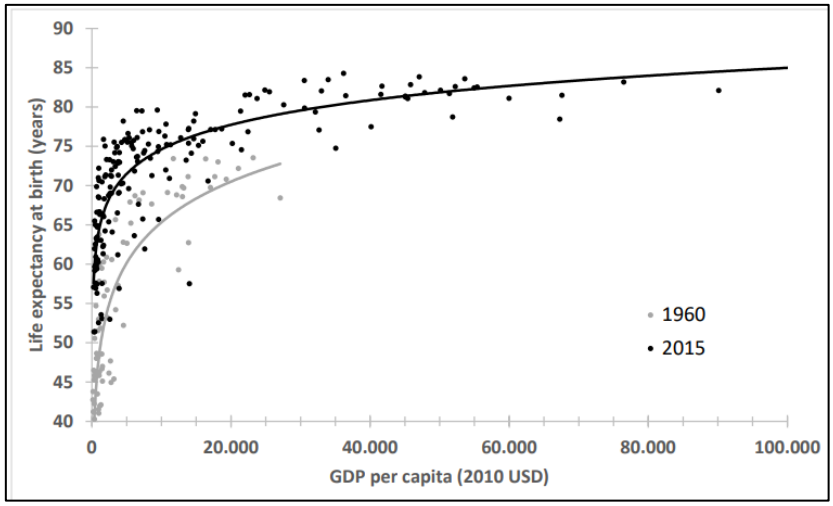


*Figure 1: Preston Curves for 1960 and 2015*
*Source: Bloom, Kuhn and Prettner (2013), Data obtained from the World Bank*

Several channels run from health to income. First, ill health reduces income because the sick individual cannot work (Bleakley, 2013). Similarly, health directly affects the productivity of workers since healthier workers enjoy higher returns to labour (Bloom & Canning, 2003; Finlay, 2007). Consequently, health influences the productive capacity of an economy. Health is further indirectly linked to income and economic growth via its effect on education which is

crucial for economic development. A healthier person with a longer life expectancy has a larger incentive to invest in education since the rewards from higher educational attainment can be reaped over a longer period (Finlay, 2007). Improved health can also increase education productivity, as shown by Lucas (2010), who finds that malaria eradication resulted in increased educational attainment in Sri Lanka and Paraguay.

Despite the correlation, the relationship between health and income is not undisputed as the direction of causality remains unanswered. It could also be that higher income leads to better health based on better nutrition and increased investments in health care (Pritchett & Summers, 1996). Hence, while health improvements contribute to economic growth, economic growth can also contribute to health improvements (Bloom & Canning, 2003). On the contrary, the interaction between economic development and health can lead to a vicious circle in which ill health hinders economic development and contributes to loss of income, which in turn leads to deteriorating health (Bloom & Canning, 2003). This is referred to as the health-poverty trap. The health poverty trap constitutes a major challenge because reducing poverty requires the reduction of health issues of the poor and health issues will remain if poverty is not reduced (Sala-i-Martín, 2005, p. 95). Therefore, it is difficult to break the vicious cycle and escape the trap.

Although the nature of the relationship between health and economic development and the interaction effects remains difficult to discern, the crucial role of health cannot be denied. The resulting economic importance of health is a good reason to ensure that a population is healthy.

### 2.2.2 Health Inequality

Despite the individual and economic importance of good health performance, significant differences in health can be found between as well as within countries. While the healthy life expectancy of men in Haiti is equal to 27.8 years, Japanese men have a healthy life expectancy of 70.6 years (Arcaya, Arcaya & Subramanian, 2015). Similarly, within-country differences exist. Measurable differences in health aspects between groups or individuals are referred to as *health inequalities* or *health disparities* (Arcaya, Arcaya, Subramanian, 2015). Such inequalities can be observed along with a variety of dimensions, for example, age, income, social class, geography or ethnicity (McCartney, Collins & Mackenzie, 2013). While the term ”inequality” has a negative connotation, not all health inequalities reflect a social gradient. Health inequalities between a 20-year-old and a 60-year-old would most likely not be

considered unfair or immoral since health generally deteriorates with age. In contrast, disparities between different ethnic groups or different income groups would be regarded as unfair (Arcaya, Arcaya & Subramanian, 2015). Nevertheless, since health inequalities often reflect an unequal distribution of underlying social determinants of health, most health inequalities are regarded as unjust (Kawachi, Subramanian & Almeida-Filho, 2002).

In general, it is assumed that health inequalities arise for three reasons: genetics, the physical and social environment and lifestyle (Olsen, 2011, p. 817). Following the theory regarding genetics as a determinant, biological variations are a cause of health inequalities (Olsen, 2011, p. 817). As will be explained below, this explanation has largely been rejected by now. Lifestyle or health behaviour as the cause of health inequalities is related to differences between groups in terms of behaviours such as smoking, alcohol consumption, diet and physical activity (McCartney, Collins & Mackenzie, 2013). However, this view disregards how and why health behaviour differences exist between groups. Additionally, the individuals or groups which have the most resources are generally the healthiest in a society, regardless of their health behaviours (McCartney, Collins & Mackenzie, 2013; Cutler, Lleras-Muney & Vogl, 2011). Hence, the physical and social environment and socio-economic circumstances are generally regarded as major drivers of health inequalities in developed and developing countries (Cutler, Lleras-Muney & Vogl, 2011). In this vein, Galama and van Kippersluis (2013), present the stylized fact that a strong link exists between health and socio-economic status. The authors report that education plays a particularly important role among the socio-economic dimensions, confirming the previously reported importance of education for good health. However, disentangling the different causes and contributors remains difficult (McCartney, Collins & Mackenzie, 2013; Bhopal, 2007, p. 153).

The motivation to reduce health inequalities lies in several aspects. Inequalities can be perceived as unjust and reflect societal inadequacies, providing a moral argument for their reduction (Woodward & Kawachi, 2000). But there are also economic arguments: These relate increased health equity to greater long-term economic capacity and higher productivity in the economy (Braveman & Tarimo, 2002). Since health is important for economic development, health inequalities cause the loss of life and economic activity and as such have economic costs. Quantifying these costs is a difficult endeavour but for example, Mackenbach et al. (2011) estimate the inequality-related losses for the EU-25 in the year 2004 to be 1.4% of GDP. While this seems low in relative terms, in absolute terms it was 141 billion euros (Mackenbach et al.,

2011). Consequently, increasing health equality bears economic gains and will pay off in the long run.

Based on the moral and economic arguments against health inequalities, action is needed to achieve a more equal distribution of health. Here the question arises: Is all that is needed to treat everyone the same? In this context, the distinction between horizontal and vertical inequity should be elaborated upon. The concept of horizontal equity constitutes a similar treatment of similar individuals (Culyer, 2001). However, since different population groups exhibit different health needs, the similar treatment of all population groups can be considered unfair (Starfield, 2011). In contrast, vertical equity refers to " treating differently those who are different in relevant aspects such as having different health needs" (Giuffrida et al., 2007, p. 12). This might be relevant in the context of ethnicity-related inequalities. The concept of vertical equity is also linked to the concept of positive discrimination referring to policies that provide minorities with greater opportunities. Since previous interventions have not been sufficiently successful, Giuffrida et al. (2007, p. 12) argue that positive discrimination might be necessary to reduce health gaps between ethnic groups in LAC.

### 2.2.3 Ethnicity and Health

Since this thesis focuses on ethnicity-related inequalities, the intersection of ethnicity and health should be discussed. First, it is important to distinguish the concepts of *race* and *ethnicity*. Both concepts have been created by society and influence people's lives (Baciu et al., 2017, p. 58). The concept of race applies biological factors such as skin colour to identify individuals (Bhopal, 2007, p. 10). In contrast, the concept of ethnicity distinguishes people according to cultural and social factors such as language, values, literature and music (Bhopal, 2007, p. 10; Williams, 1997). Ethnicity can be considered a more imprecise and fluid concept than race and thus might be harder to measure (Bhopal, 2007, p. 13). Although these terms are often used simultaneously and interchangeably, they are distinct. The present study focuses on ethnicity rather than race because it considers the self-identification of the individual and the spoken language.

The theory of genetics as a determinant was long considered especially relevant in the context of ethnic health disparities. This is because this biological model attributes ethnic differences in health status to biological and genetic differences (Giuffrida et al., 2007, p. 7). According to this model, social structures and policies were not responsible for health inequalities, which

relieved governments of any responsibility for implementing policies to address the problem (Giuffrida et al., 2007, p. 7). Certain genetic predispositions might reflect in health inequalities and the interaction of genetics and environmental factors can be an underlying factor (Bhopal, 2007, p. 155). However, this model has proven to be invalid in the grand scheme. Since greater genetic variation can be found within races than between races, biological differences are not accurately captured by racial or ethnic categories (Giuffrida et al., 2007, p. 6; Williams, 1997).

As mentioned previously, socio-economic factors and circumstances are often considered crucial drivers of health outcomes. Likewise, differences in terms of socio-economic position are often related to ethnicity (Giuffrida et al., 2007, p. 11). Looking at the intersection of ethnicity and health inequalities, ethnic inequalities in socio-economic position could potentially translate into health inequalities (Egede, 2006). For example, Bernal and Cárdenas (2005) find that health differences between indigenous and non-indigenous in Colombia do not remain when controlling for socio-economic status. This implies that the effect of ethnicity on health differences works through the channel of socio-economic factors or that the health gap is due to socio-economic differences rather than ethnicity (Egede, 2006). In this context, the aspect of racism should be noted. Although the direct role of racism in health inequalities is very complex, racism can manifest itself in socio-economic differences which then translate into health disparities (Bhopal, 2007, p. 179). Consequently, it is crucial to account for socio-economic factors when researching ethnic differences in health.

### 2.2.4 Previous Research on Health Inequalities

The existence of health inequalities has long been known, and ethnicity-related health disparities have been researched in a variety of contexts. The Maori in New Zealand as well as the Aborigines in Australia or the native groups in Canada generally exhibit a health deficit (Bhopal, 2007, p. 156; Wilson & Cardwell, 2011; Adelson, 2005; Gracey & King, 2009). Watkinson, Sutton and Turner (2021) report on ethnic health inequalities in terms of long-term health conditions among older adults in the United Kingdom. In the United States (US), racial and ethnic minorities face health disparities that translate into, among other things, higher rates of chronic diseases (Baciu et al., 2017, p. 59). Wang et al. (2020) report ethnicity-related health inequalities in China. Hotez (2014) reports that indigenous populations suffer disproportionately more from neglected tropical diseases.

The prevalence of health inequalities between indigenous and non-indigenous populations has also been found in Latin America. As such, indigenous populations show higher levels of mortality and morbidity (Montenegro & Stephens, 2006). More specifically, the present paper is not the first to research the role of ethnicity in health outcomes in Bolivia. For example, Pozo et al. (2006, pp. 62-63) provide evidence for health gaps between the indigenous and non-indigenous populations. Montenegro and Stephens (2006) report that the indigenous groups of Guaraní exhibit a much higher prevalence of tuberculosis compared to national averages. Heaton et al. (2014) find disparities concerning child mortality and child nutritional status. However, the majority of the studies regarding health inequalities in Bolivia focus on maternal and infant health. Armenta-Paulino et al. (2020) report that indigenous women experience lower health care coverage levels before, during and after pregnancy and during childbirth. Likewise, Mesenburg et al. (2018) find significantly lower contraceptive usage, antenatal care and skilled birth attendance for indigenous women in Bolivia even after adjusting for socio-economic indicators such as wealth or education.

Mena-Meléndez (2020) researches ethnoracial child health inequalities in Bolivia, Colombia, Guatemala and Peru. Controlling for a range of other factors such as geography, socio-economic status, reproductive and nutritional variables, the author finds that inequalities can be detected in terms of the health outcomes of stunting and wasting in Bolivia (Mena-Meléndez, 2020). Mayer-Foulkes and Larrera (2005) research racial and ethnic health inequalities jointly in Bolivia, Brazil, Guatemala and Peru and report lower per capita health assets and access to health services for indigenous and black people. Ziegler's (2014, p. 97) study applying a multivariate regression approach focuses on differences in child health in terms of childhood diseases and vaccinations between indigenous and non-indigenous children. She finds that indigenous origin is positively associated with childhood diseases. Moreover, she finds different effects for different indigenous groups, for example, Quechua children have a higher likelihood to suffer from a bad health status compared to children belonging to the Aymara (Ziegler, 2014, p. 111). Hence, the author highlights the relevance of considering indigenous heterogeneity and going beyond an indigenous/non-indigenous categorization (Ziegler, 2014, p. 112).

Overall, previous literature finds that Bolivia features a health gap between indigenous and non-indigenous on various (mostly maternal and child health-related) health indicators.

### 2.2.5 Hypotheses

The Bolivian government has attempted to ensure health care access for its indigenous population by providing health insurance coverage for this vulnerable group. However, as previous reports still talk about a lack of access to health care (Gigler, 2015, p. 105; Pozo et al., 2006, pp. 62-63), this study hypothesises that indigenous people have a lower health insurance affiliation than their non-indigenous peers. Likewise, earlier studies report health inequalities among indigenous populations. In Bolivia, maternal and child health studies report significant differences according to ethnicity (Ziegler, 2014, p. 111; Mena-Melendez, 2020). Based on previous findings, a link is therefore suspected between indigenous origin and poorer health performance. Regarding the studied health outcomes, which are explained in the next section, the hypothesised relationship represents a higher likelihood for indigenous people to have a chronic disease, recent disease or diarrheal disease in children. The heterogeneity regarding culture or settlement patterns is further hypothesized to translate into health disparities within the indigenous group.

This theoretical section discussed the relation between health and economic development and established that health has economic relevance. If the good of health is not evenly distributed, health inequalities exist. Besides the moral arguments against health inequalities, they also cause economic losses. Health gaps between indigenous and non-indigenous peoples in terms of maternal and child health have been recorded in Bolivia. However, few of the previous studies have scrutinized recent health outcomes and few have considered the health performance of the entire population while also distinguishing between different indigenous groups. Hence, the present study explores ethnic health disparities in Bolivia.

# 3 Data

The following section elaborates on the applied data source and introduces the relevant variables and presents their descriptive statistics. An overview of all variables and measurements can be found in Table 11 in Appendix A.

## 3.1 Data Source

The quantitative data applied in the presented analysis is sourced from the Bolivian Household surveys (*Encuesta de Hogares*) which are conducted by the INE (ANDA, n.d.a-g). The WHO Handbook on Monitoring Health Inequalities considers household surveys to be well suited for health inequality studies, as they provide health-related information, but also information on socio-economic indicators (WHO, 2013, p. 20-21). Furthermore, general-purpose household surveys are frequently applied in the literature to study health inequalities in Latin America and the Caribbean (Norberto & Dachs, 2002). The INE conducts these household surveys annually since 2005 (ANDA, n.d.a-g). The survey collects information on socio-economic and demographic variables concerning the Bolivian population. The survey's focus is to assess the living conditions of Bolivian households and subsequently formulate, evaluate, monitor and develop policies and social programmes (ANDA, n.d.a-g). To obtain the required information, trained personnel conduct interviews with the members of the chosen households on topics such as housing, socio-demographic characteristics, migration, health, educational characteristics and occupational characteristics (ANDA, n.d.a-g). Hence, the survey is deemed to provide suitable and valid data for the analysis at hand. Nevertheless, it should be kept in mind that the information relies on self-reported data, thus potentially giving rise to reporting errors and compromising the reliability of the data. Similarly, non-sampling errors can arise but are assumed to be only of minor importance due to the large number of observations.

For the analysis, I create a dataset by first merging the *personas* file with the variables of interest of the *housing* part of the survey of the respective year. The *housing* file contains information about the state of the dwelling the household resides in, for example, the sanitary situation while

the *personas* file provides information regarding individual, socio-demographic, health and educational characteristics. Afterwards, I construct the final dataset by appending the merged datasets for the different waves of the survey from 2013 to 2019 (INE, n.d.). Survey waves conducted before 2013 do not include information about the scrutinized health outcomes and 2019 is the latest freely available survey wave which justifies the choice of time frame used for the analysis. Since the identification of households differs across the survey waves it is not possible to construct a panel dataset. Therefore, the data from the different survey waves are combined into a pooled dataset and controlled for the survey year. Although the survey waves contain similar questions, the coding of the respective variables differs from survey wave to survey wave, so that extensive recoding and adjustment measures are necessary to create a coherent and consistent data set.

The geographic coverage of the survey includes all nine Bolivian departments and hence, includes urban and rural areas (ANDA., n.d.a-g). The sampling of included dwellings consisted of two stages: first, the sampling of primary sampling units was done systematically using Probability Proportional to Size (PPS) sampling of dwellings (ANDA, n.d.a-g). With this sampling method, the size of the population units is known before sampling and the probability of selection is then proportional to its size (Skinner, 2016). Afterwards, the dwellings were chosen using a random start (ANDA, n.d.a-g) meaning that the first element in the systematic sampling procedures is randomly selected, hence preventing sampling errors (Lavrakas, 2008, p. 686). In 2019, 11, 853 households were questioned out of a total sample of 11, 976 households which equals a response rate of 99% (ANDA, n.d.a-g). After appending the different survey waves, the final sample has a total sample size of 263 547 observations.

## 3.2 Variables and Descriptive Statistics

### 3.2.1 Dependent Variables

The presented analysis researches the access to health care and scrutinizes several health indicators, meaning the analysis contains several outcome variables. The choice of dependent variables is based on previous research and data availability. A separate binary logistics model is applied for each dependent variable. Chapter 4 provides a more detailed description of the empirical approach and the models.

*Health insurance*

Previous discussions of human development in Bolivia point to the lack of access to health care for the indigenous population (Gigler, 2015, p. 105). Hence, the dependent variable applied in the first analysis explores whether ethnicity is still associated with differences in health care access and a regression with the outcome variable *health insurance* is conducted. This analysis also has the purpose to justify the inclusion of the *health insurance* variable in the following analyses since previous literature establishes a positive association between health insurance coverage and various health outcomes such as chronic diseases (Institute of Medicine, 2002, p. 47; Barker & Li, 2020 ). The binary variable receives the value of 0 if the respondent is not affiliated with any health insurance and a 1 if the respondent is affiliated with one or more public or private health insurance. This includes affiliation with the SUS in the 2019 wave of the survey.

*Chronic Diseases*

The dependent variable regarding the prevalence of a *chronic disease* functions as a proxy for the health performance of Bolivia's population. It is one of the European Core Health Indicators (European Commission, n.d.) and is widely applied in research on health inequalities (Albert-Ballestar & García-Altés, 2021; Abbott et al., 2018). The variable is binary coded, assigning a 1 if the respondent suffers from one or more chronic diseases and a 0 if no chronic disease is reported. According to the Bolivian household surveys (ANDA, n.d.), a chronic disease is a disease with a long duration whose cure or end cannot be foreseen or is unlikely to occur. While a consensus about the time frame after which a disease turns chronic is missing, generally, a disease that lasts longer than 6 months is regarded as chronic (ANDA, n.d.). Chronic diseases considered in the survey are diabetes, cancer, kidney disease, heart disease, tuberculosis, Chagas disease, rheumatism, arthritis, osteoarthritis, osteoporosis, liver disease, chronic gastritis and hypertension.

*Recent Disease*

This dependent variable assesses whether the respondent experienced a disease in the last 12 months. Hereby, tropical diseases and neglected tropical diseases are considered. The survey asks about the following diseases: Chikungunya, Dengue, Flu A(H1N1), Zika, Leishmaniasis and Malaria. The number of people requiring interventions for neglected tropical diseases such as Dengue, Leishmaniasis and the malaria incidence rate are core health indicators put forward by the WHO justifying the inclusion in the analysis (WHO, 2018). Again, the dependent

variable is dichotomously coded with the value 1 signalling that the person suffered from one or several of the diseases in the past 12 months while a 0 means no experience of one of the named sicknesses in that period.

*Diarrhea*

Since the previous two dependent variables mainly concern adult health, the dependent variable *diarrhea* concerns child health. In Bolivia, still 16% of child deaths are attributable to diarrhea (Burke et al., 2014), showing that it is an important health concern. The prevalence of diarrhea is a relevant indicator of child health and has been applied in previous research (Ziegler, 2014, p. 98). The Bolivian household surveys include a question concerning the incidence of diarrhea in the last 2 weeks for children aged four or younger. The variable is binary coded with 1 indicating the occurrence of diarrhea in the past two weeks and 0 indicating the opposite.

Table 1 below shows the descriptive statistics of the dependent variables for the entire sample. Table 12 in Appendix A displays the descriptive statistics for the indigenous and the non-indigenous parts of the sample separately. It reveals that the share of indigenous having health insurance or a recent disease is lower than for non-indigenous. In contrast, the share of indigenous having a chronic disease or diarrhea is higher.

*Table 1: Descriptive statistics of dependent variables*

| | **Obs.** | **Mean** | **S.D** | **Min.** | **Max.** |
|---|---|---|---|---|---|
| **Health Insurance Affiliation** | 263,547 | .423 | .494 | 0 | 1 |
| **Chronic Disease** | 263,544 | .096 | .295 | 0 | 1 |
| **Recent Disease** | 263,534 | .0480 | .214 | 0 | 1 |
| **Diarrhea in the last 2 weeks** | 26,799 | .219 | .413 | 0 | 1 |

Notes: Author's own elaborations based on data from the Bolivian Household Survey (ANDA, n.d.a-g)

### 3.2.2 Independent and Control Variables

*Ethnicity*

Since the relationship between ethnicity and health outcomes is the main focus of the analysis, ethnicity constitutes the most relevant independent variable. First, the variable will be binary coded with 0 meaning that the respondent is not indigenous while 1 identifies the person as indigenous. However, since Ziegler (2014, pp. 107-108) finds differences in health outcomes between different indigenous groups, this aspect will be scrutinized in an additional step. Hence, different indigenous populations and Afro-Bolivians will be differentiated by coding a

categorical variable for further analysis. Here, the variable distinguishes between non-indigenous, the two most prominent indigenous groups Quechua and Aymara, other indigenous groups and Afro-Bolivians. Both ethnicity variables are based on people's self-identification in the survey. This is in line with the International Labour Organization (ILO) convention which determines self-identification as the main criterion for identifying indigenous groups and similarly, the UN Declaration of indigenous rights stresses the right to self-identification (ILO, 1989; UN, n.d.). In the sample, 68,556 individuals self-identify as indigenous which equals 26% of the sample.

Although the self-identification measure bears many advantages, it can also be viewed critically. Negative biases against indigenous people might prevent individuals from self-identifying as indigenous in surveys and can result in underestimation (Armenta-Paulino, Vázquez & Bolúmar, 2019; Montenegro & Stephens, 2006). Moreover, one's perception of ethnicity can be subject to recreation and redefinition over time and consequently, self-identification might change (Yoshioka, 2010). Likewise, whether the person is recognized by others as indigenous can influence self-identification (Armenta-Paulino, Vázquez & Bolúmar, 2019).

The spoken language is another often-used proxy for ethnicity (see Mena-Melendez, 2020; Ziegler, 2014, p. 100). Language is a crucial aspect of defining own identity and is closely linked to the culture of indigenous groups. Hence, it can be assumed that a person who claims to be able to speak an indigenous language belongs to an indigenous group (Montenegro & Stephens, 2006; Yoshioka, 2010). Yoshioka (2010) regards indigenous language as one of the most relevant measures of indigeneity. Likewise, Montenegro and Stephens (2006) argue that language is less dependent on people's view of themselves compared to self-identification and thus might not change over time. Regarding health, language is a relevant determinant for access to health care and services (Armenta-Paulino, Vázquez & Bolúmar, 2019). Hence, the robustness of the results will be tested by using the language spoken in childhood as a measure of ethnicity. Based on the language spoken during childhood, 52,880 individuals or 21% of the sample where language information is available are considered indigenous. A disadvantage of using this proxy lies in the decreasing usage of indigenous languages, especially in younger or urban populations. Note that people who self-identify as indigenous do not necessarily speak an indigenous language in their childhood and vice versa. Therefore, another robustness check

includes the variable *all indigenous* which only receives the value of 1 if the respondent self-identifies as indigenous AND grew up speaking an indigenous language.

*Survey wave*

Since the observations are pooled together from different survey waves, the survey year is controlled for using a categorical variable.

*Age*

Health generally deteriorates with age. As such, the prevalence of chronic diseases usually increases with age due to long exposure to an unhealthy lifestyle (Prasad, Sung & Aggarwal, 2012). For example, Prasad, Sung and Aggarwal (2012) report that over 80% of the population over 65 suffers from a chronic disease in the US. Similarly, Abbott et al. (2018) find that in La Paz the incidence of having several chronic diseases is higher for Bolivians of higher ages. Thus, it can be expected that age is negatively associated with health outcomes. Similarly, the national insurance schemes in Bolivia specifically aimed to provide coverage to the elderly (see section 2.1.3.) which might reflect in increased health insurance affiliation as age increases. The control variable *age* is continuous. To account for the possibility that the effect of the control variable *age* is not linear, the analysis also includes the quadratic term $age^2$.

*Gender*

In the presented analysis gender is a relevant control. First, gender is possibly related to health insurance affiliation because initiatives like the SUMI (see section 2.1.3) provided free health care coverage to mothers which might increase the likelihood of being insured for women. Second, gender gaps in health outcomes such as life expectancy, morbidity and mortality have not only been recorded globally but also in the Bolivian context (World Bank, 2018). For example, cardiovascular or respiratory diseases are more commonly found among men (World Bank, 2018). Hence, the control variable *female* takes the value 1 if the respondent is female and 0 if the respondent is male.

*Education*

The relationship between education and health outcomes has been established in the literature. In their study of 26 OECD countries from the years of 1995-to 2015, Raghupathi and Raghupathi (2010) find that higher educated adults enjoy better health and longer lifespans. Likewise, Cutler and Lleras-Muney (2006) point to the association between educational attainment and health outcomes. The authors report, for example, that the likelihood of suffering

from chronic diseases such as heart disease or diabetes decreases with additional years of education. Education also seems to be relevant in the context of tropical diseases with less educated people having a higher likelihood of suffering from neglected tropical diseases (Houweling et al., 2016). Thus, a variable regarding the *years of education* achieved by the respondent is added to the analysis. The models concerning the health outcome of diarrhea cannot utilize the variable *years of education.* The reason is that these models only include individuals aged four or younger who have received zero years of education. Nevertheless, education is still a relevant predictor since previous literature shows a relationship between maternal educational attainment and diarrhea among young children in Nigeria (Desmennu et al., 2017). The data structure of the present database does not permit controlling for maternal education due to lack of information, hence, the *years of education of the household head* will be used as a proxy instead.

*Income*

The variable *income* controls for the financial situation of the individual. Previous literature such as Case, Lubotsky and Paxson (2002) present a relationship between income and health. Likewise, it is widely established that especially lower income is related to poorer health outcomes (Benzeval & Judge, 2001). Since relatively more indigenous people suffer from poverty compared to non-indigenous (Velasquez, 2007, p. 1), the differential effect of income should be accounted for, hence justifying the inclusion in the analysis. The *income* variable is continuous and measures the household income per capita in Bolivianos. The household income equals the quotient of the total household income weighted by the number of people living in the household excluding domestic employees (ANDA, n.d.a-g). The per capita household income is adjusted for the Bolivian consumer price index (CPI) obtained from the World Bank (n.d.a) to account for inflation and to ensure comparability of income figures from different survey waves. The CPI is adjusted for 2013 to be the base year. Hence, all income figures are given in 2013 Bolivianos. Since the distribution of the variable is highly skewed, the natural logarithm of the variable is taken.

*Geographic controls*

Bolivia is a geographically very diverse country. The country features very rugged territory, different climates and isolated populations in rural areas (Perry & Gesler, 2000). This could potentially affect health outcomes. Pooley, Ramirez and de Hilari (2008) report disparities between regions in terms of health care access. Therefore, the study will control for differences between departments by including the categorical control variable *department*. Moreover, there are considerable differences between rural and urban areas, for example, urban areas feature better infrastructure and better provision of public goods. This can materialize in advantages in terms of access to health facilities and services (Ziegler, 2014, p. 92). The urban-rural divide can also indirectly influence health outcomes for example through the possibly higher water and sanitation quality in urban areas (Heaton & Forste, 2003). More specifically, Heaton and Forste (2003) confirm rural-urban differences with their finding of higher child mortality and higher incidences of child stunting in rural areas in Bolivia. Since rural areas still feature a larger population of indigenous people compared to non-indigenous (Gigler, 2015, p. 89) it is important to control for this factor. The *rurality* variable is binary coded and takes the value 1 if the person lives in a rural area. The survey considers population centres with less than 2000 inhabitants as rural (ANDA, n.d.).

*Sanitary facilities*

Research shows that sanitary facilities can potentially influence health outcomes. Indigenous households tend to exhibit lower levels of sanitation in Bolivia which justifies the inclusion of this aspect in the analysis (Liberato, Pomeroy & Fennell, 2006). This factor is controlled for by using two variables. First, *toilet type* describes the type of toilet facility present in the household. Sanitary improvements of latrines can positively affect health outcomes, for example in the form of decreases in diarrhea, morbidity and mortality (World Bank, 2003). Since Gundry, Wright and Conroy (2004) find an association between health outcomes and the quality of household water in developing countries, the variable *water source* controls for the source of drinking water for the household. While many papers have established associations between insufficient sanitation and neglected tropical diseases or communicable diseases, Mishra et al. (2017) also report a link between sanitation and certain chronic diseases. Hence, the sanitary facility variables are assumed to not only be relevant for the health outcomes of recent disease and diarrhea but also chronic diseases.

*Household size*

Based on findings from the literature, the analysis also includes a control variable for the size of the household. Wagner, Schubert and Schubert (1985) found that large family sizes influence parental health. For example, mothers with more children are more likely to develop diabetes. Moreover, Dunga (2018) found a positive relationship between household size and morbidity in South Africa. Larger households are more likely to suffer from congestion where individuals share rooms and thus more easily spread diseases to other family members. Similarly, Ntshebe, Channon and Hosegood (2019) report that household size is a determinant of diarrhea prevalence among children in Botswana.

Table 2 displays the descriptive statistics of the independent and control variables for the entire sample while Table 13 in Appendix A presents the descriptive statistics disaggregated by ethnicity. It reveals that compared to the non-indigenous, a higher share of the indigenous lives in rural areas and does not have piped water or a flush toilet. Moreover, indigenous exhibit lower mean years of education and lower mean incomes.

*Table 2: Descriptive statistics of independent and control variables*

| | **Obs.** | **Mean** | **S.D** | **Min.** | **Max.** |
|---|---|---|---|---|---|
| **Indigenous** | 263,546 | 0.260 | 0.439 | 0 | 1 |
| **Ethnic category** | 226,928 | 0.417 | 0.779 | 0 | 4 |
| **Survey year** | 263,547 | 3.055 | 2.00 | 0 | 6 |
| **Rural** | 263,547 | 0.226 | 0.418 | 0 | 1 |
| **Department** | 263,547 | 3.151 | 2.632 | 0 | 8 |
| **Household size** | 263,547 | 4.522 | 2.002 | 1 | 17 |
| **Water source** | 263,547 | 0.297 | 0.457 | 0 | 1 |
| **Toilet type** | 263,547 | 0.345 | 0.476 | 0 | 1 |
| **Age** | 263,547 | 28.905 | 20.748 | 0 | 98 |
| **Age$^2$** | 263,547 | 1,265.939 | 1,546.484 | 0 | 9,604 |
| **Female** | 263,547 | 0.509 | 0.500 | 0 | 1 |
| **Years of education** | 241,680 | 8.321 | 5.652 | 0 | 27 |
| **Household head Years of education** | 26,590 | 10.008 | 4.984 | 0 | 27 |
| **Income** | 261,705 | 6.712 | 0.934 | 0.211 | 11.674 |
| **Health Insurance** | 263,547 | 0.423 | 0.494 | 0 | 1 |
| **Indigenous language speaker** | 252,594 | 0.209 | 0.407 | 0 | 1 |
| **All indigenous** | 219,515 | 0.164 | 0.370 | 0 | 1 |

Note: Author's own elaborations based on data from the Bolivian Household Survey (ANDA, n.d.a-g). The observation number for the variable *Household head Years of education* only refers to observations aged 4 or younger because this variable is only applied in models regarding individuals aged 4 or younger

# 4 Methodology

This section elaborates on the applied empirical strategy and the different models.

## 4.1 Empirical Strategy

Using the variables presented in the previous chapter, the study applies a quantitative approach to investigate the research question of this paper. Due to the dichotomous nature of the dependent variables, binary logistics regressions are estimated. Applying logistics regressions is common practice in health sciences (Boateng & Abaye, 2019). This approach also follows previous analyses conducted in the field of health inequalities for example Wang et al. (2020), Wattkinson, Sutton and Turner (2021) and Wilson and Cardwell (2011). The binary logistics regression aims to find the best fitting and simplest model to make inferences concerning the relationship between the independent and the dependent variables (Fritz & Berger, 2015, p. 271). Here, the logistic regression calculates the probability that an observation with certain values for the independent variables is a member of the category of interest (Boateng & Abaye, 2019). Boateng and Abaye (2019) report logistic regression to be especially appropriate for models regarding disease states which is the case in the present study. The base model applied in the present analysis is as follows:

$$Y_i = \alpha + X_i\beta + \varepsilon_i \quad (1)$$

Where $Y_i$ is the respective dichotomous dependent variable, α is the intercept, $X_i$ denotes the vector for independent and control variables, β is the coefficient and ε denotes the error term. In all cases, the subscript $i$ identifies the individual. In this base model, the different health indicators are regressed on the variable concerning ethnicity. The following models add different control vectors to this base equation. These are explained below.

## 4.2 The Models

To gain insights into the health performance of the Bolivian population, the present study scrutinizes different outcome variables and consequently applies several models. In each case, a base model including only the dependent variable of interest, the ethnicity variable and the control for survey years is estimated first. Subsequently, further models including the controls are conducted. Here, Vector $C_i$ controls for the geographical factors *department* and *rurality*. Vector $D_i$ identifies household-related controls including *household size*, *water source* and the *toilet type*. This vector of controls is included in the models concerning health outcomes and excluded from the models concerning health insurance affiliation. The control variable *household size* is an exception since it is also included in the health insurance models. The vector $E_i$ denotes a vector of individual control variables such as *age*, *age*$^2$ *gender*, *years of education* (*years of education of the household head*) and *income*.

The empirical strategy entails multiple stages: in the first stage, the effect of being indigenous on health insurance affiliation is explored. The second step attempts to deepen the analysis. Instead of including a dichotomous variable to distinguish solely between indigenous and non-indigenous, the categorical variable *ethnic categories* is introduced to explore heterogeneities among indigenous groups. Next, the effect of ethnicity on the different health outcomes is researched. Here, the variable *health insurance* will also be added to the models as part of the individual control vector $E_i$. The reason is that studies such as Barker and Li (2020) and the Institute of Medicine (2002, p. 47) report that health insurance affiliation is associated with health. Again, the models in these first steps only distinguish between indigenous and non-indigenous identification while a further step examines the differences between various indigenous groups. The analyses on ethical differences between groups exclude the survey year 2014, as for this year there is only information on whether the person is indigenous or not, but more disaggregated information on membership of a particular group is missing.

The models applied in the study are presented in the following:

**First stage: health insurance affiliation (indigenous)**

$$health\ insurance_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \varepsilon_i \quad (2)$$

$$health\ insurance_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \varepsilon_i \quad (2a)$$

$$health\ insurance_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 * household\ size + \varepsilon_i \quad (2b)$$

$$health\ insurance_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 * household\ size + \beta_5 E_i + \varepsilon_i \quad (2c)$$

**Second stage: health insurance affiliation (ethnic category)**

$$health\ insurance_i = \alpha + \beta_1 ethnic\ category_i + \beta_2 Survey\ year_i + \varepsilon_i \quad (3)$$

$$health\ insurance_i = \alpha + \beta_1 ethnic\ category_i + \beta_2 Survey\ year_i + \beta_3 C_i + \varepsilon_i \quad (3a)$$

$$health\ insurance_i = \alpha + \beta_1 ethnic\ category_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \varepsilon_i \quad (3b)$$

$$health\ insurance_i = \alpha + \beta_1 ethnic\ category_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \beta_5 E_i + \varepsilon_i \quad (3c)$$

**Third stage: health outcomes (indigenous)**

*Chronic disease*

$$chronic\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \varepsilon_i \quad (4)$$

$$chronic\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \varepsilon_i \quad (4a)$$

$$chronic\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \varepsilon_i \quad (4b)$$

$$chronic\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \beta_5 E_i + \varepsilon_i \quad (4c)$$

*Recent disease*

$$recent\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \varepsilon_i \quad (5)$$

$$recent\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \varepsilon_i \quad (5a)$$

$$recent\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \varepsilon_i \quad (5b)$$

$$recent\ disease_{\ i} = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \beta_5 E_i + \varepsilon_i \quad (5c)$$

*Diarrhea*

$$recent\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \varepsilon_i \quad (6)$$

$$recent\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \varepsilon_i \quad (6a)$$

$$recent\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \varepsilon_i \quad (6b)$$

$$recent\ disease_i = \alpha + \beta_1 Indigenous_i + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \beta_5 E_i + \varepsilon_i \quad (6c)$$

**Fourth stage: health outcomes (ethnic category)**

*Chronic disease*

$$chronic\ disease_i = \alpha + \beta_1 ethnic\ category_i + \beta_2 Survey\ year_i + \varepsilon_i \quad (7)$$

$$chronic\ disease_i = \alpha + \beta_1 ethnic\ category + \beta_2 Survey\ year_i + \beta_3 C_i + \varepsilon_i \quad (7a)$$

$$chronic\ disease_i = \alpha + \beta_1 ethnic\ category + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \varepsilon_i \quad (7b)$$

$$chronic\ disease_i = \alpha + \beta_1 ethnic\ category + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \beta_5 E_i + \varepsilon_i \quad (7c)$$

*Recent disease*

$$recent\ disease_i = \alpha + \beta_1 ethnic\ category_i + \beta_2 Survey\ year_i + \varepsilon_i \quad (8)$$

$$recent\ disease_i = \alpha + \beta_1 ethnic\ category + \beta_2 Survey\ year_i + \beta_3 C_i + \varepsilon_i \quad (8a)$$

$$recent\ disease_i = \alpha + \beta_1 ethnic\ category + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \varepsilon_i \quad (8b)$$

$$recent\ disease_i = \alpha + \beta_1 ethnic\ category + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \beta_5 E_i + \varepsilon_i \quad (8c)$$

*Diarrhea*

$$diarrhea_i = \alpha + \beta_1 ethnic\ category_i + \beta_2 Survey\ year_i + \varepsilon_i \quad (9)$$

$$diarrhea_i = \alpha + \beta_1 ethnic\ category + \beta_2 Survey\ year_i + \beta_3 C_i + \varepsilon_i \quad (9a)$$

$$diarrhea_i = \alpha + \beta_1 ethnic\ category + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \varepsilon_i \quad (9b)$$

$$diarrhea_i = \alpha + \beta_1 ethnic\ category + \beta_2 Survey\ year_i + \beta_3 C_i + \beta_4 D_i + \beta_5 E_i + \varepsilon_i \quad (9c)$$

In each analysis, average adjusted predicted probabilities and marginal effects are provided in the main text to deduct accurate conclusions from the models. These postestimations provide information about the absolute and the relative effect respectively of ethnicity on the outcome variables. The adjusted average prediction probabilities indicate the probability that the dependent variable is equal to 1. (Torres-Reyna, 2014). The change in probabilities when the independent or control variable increases by one unit, is represented by the marginal effects (Torres-Reyna, 2014). Instead of calculating the predicted probabilities and marginal effects with the independent variables being kept at their means, this analysis applies average adjusted predicted probabilities and average marginal effects. This technique uses actual observed values for the variables and hence the entire sample rather than just the means (Williams, 2012). Here, the predicted probability is calculated for each case using actual values of variables and in the end, the predicted values are averaged (Williams, 2012). Appendix B provides the tables containing odds ratios. Odds ratios compare the odds of an outcome happening given a certain factor with the odds of the outcome happening without that factor (Szumilas, 2010). All statistical figures are calculated using robust standard errors clustered at the household level.

# 5 Empirical Analysis

The conducted analyses reveal persistent differences in access to health care and health outcomes between indigenous and non-indigenous peoples. These results update previous research on the topic of health inequalities in Bolivia. Similarly, the present study explores and sheds light on the role of indigenous heterogeneity suggested by Ziegler (2014, pp. 106). The following chapter presents the results, robustness checks and analytical discussions thereof. The results are placed in the context of existing literature and findings while also discussing the analyses' caveats. The tables in the main text show the predicted probabilities and relevant marginal effects. Tables 14 to 21 in Appendix B display the odds ratios and tables of all marginal effect results are given in Appendix C.

## 5.1 Results

The first stage of the analysis reveals that being indigenous is associated with lower health insurance affiliation. Following Model 1 in Panel A of Table 3, individuals self-identifying as indigenous have a statistically significant lower predicted probability of having health insurance. Likewise, compared to their non-indigenous counterparts, the indigenous exhibit negative marginal effects (Panel B, Table 3) which confirms their lower likelihood of being insured. In Models 2-4, various geographical, household and individual controls are added. The controls do not alter the result. In Model 4, indigenous still exhibit a statistically significant lower predicted probability of being affiliated with health insurance. Regarding geographical controls, rurality has a negative marginal effect in Models 2 and 3, however, it turns positive in Model 4. Small differences between departments concerning health insurance affiliation seem to exist. In Model 3, household size statistically significantly decreases insurance affiliation. In Model 4, it has a positive but insignificant impact. Age has a significant negative effect, however, $age^2$ has a significant positive effect, indicating that health insurance affiliation increases in older age. Females seem to be significantly more frequently affiliated with health insurance. Additional years of education, and higher income exhibit positive and statistically significant marginal effects and hence, can be considered determinants of health insurance

affiliation. Note that the predicted probability for a self-identifying indigenous to be covered by health insurance increases from Model 1 to Model 4. Likewise, the magnitude of the negative marginal effects decreases. While in Model 1 the change in the probability of being insured when ethnicity changes from non-indigenous to indigenous corresponds to a decrease of 8.6 percentage points, the decrease in Model 4 is 1.2 percentage points.

*Table 3: First Stage Results - Health Insurance*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Panel A: Predicted Probabilities | | | | |
| Non-indigenous | 0.446*** | 0.433*** | 0.433*** | 0.406*** |
| | (0.00186) | (0.00172) | (0.00171) | (0.00168) |
| Indigenous | 0.359*** | 0.399*** | 0.397*** | 0.393*** |
| | (0.00267) | (0.00268) | (0.00268) | (0.00273) |
| Panel B: Marginal Effects | | | | |
| *Base category: Non-indigenous* | | | | |
| Indigenous | -0.0865*** | -0.0339*** | -0.0364*** | -0.0122*** |
| | (0.00314) | (0.00317) | (0.00316) | (0.00321) |
| Survey wave controls: | Yes | Yes | Yes | Yes |
| Geographic controls | No | Yes | Yes | Yes |
| Household controls | No | No | Yes | Yes |
| Individual controls | No | No | No | Yes |
| Observations | 263,546 | 263,546 | 263,546 | 239,972 |

Note: The table depicts the models from equation 2-2c. Table 22 in Appendix C shows all marginal effects. All models control for the survey years. Moreover, Model 2 controls for rurality and departments, Model 3 further adds the control household size and Model 4 includes individual controls: age, age$^2$, gender, education, income
Robust standard errors clustered at the household level are given in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In a further step, disparities between different indigenous groups are scrutinized. Here, a slightly different picture emerges. In Model 1, all indigenous groups display lower predicted probabilities than the non-indigenous. In Model 4, Quechua and other indigenous groups exhibit higher predicted probabilities than the non-indigenous with values of 0.42 and 0.43 respectively (see Panel A, Table 4). Aymara and Afro-Bolivians have lower predicted probabilities. All predicted probabilities are highly statistically significant.

A similar picture emerges from the marginal effects (Panel B, Table 4). While in Model 4, Quechua and the other indigenous groups exhibit positive but insignificant marginal effects, Afro-Bolivians exhibit negative and insignificant marginal effects. The group of the Aymara constitutes the only significant negative marginal effect. Here, the change in probability of having health insurance decreases by 3.7 percentage points when the respondent self-identifies as Aymaran. The controls show similar signs and significance levels as in the first stage analysis

except for household size which remains significant in Model 4 in the second stage analysis. Again, the predicted probabilities and marginal effects of most indigenous groups increase when adding the controls.

*Table 4: Second Stage Results - Health Insurance*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Panel A: Predictive Probabilities | | | | |
| Non-indigenous | 0.454*** | 0.441*** | 0.442*** | 0.416*** |
| | (0.00199) | (0.00186) | (0.00184) | (0.00181) |
| Aymara | 0.339*** | 0.387*** | 0.384*** | 0.378*** |
| | (0.00405) | (0.00439) | (0.00437) | (0.00434) |
| Quechua | 0.384*** | 0.424*** | 0.422*** | 0.423*** |
| | (0.00421) | (0.00440) | (0.00436) | (0.00441) |
| Other Indigenous | 0.452*** | 0.430*** | 0.438*** | 0.431*** |
| | (0.0109) | (0.00982) | (0.01000) | (0.00980) |
| Afro-Bolivian | 0.339*** | 0.383*** | 0.366*** | 0.384*** |
| | (0.0558) | (0.0535) | (0.0525) | (0.0552) |
| Panel B: Marginal Effects | | | | |
| *Base category: Non-indigenous* | | | | |
| Aymara | -0.115*** | -0.0550*** | -0.0587*** | -0.0379*** |
| | (0.00443) | (0.00481) | (0.00477) | (0.00475) |
| Quechua | -0.0699*** | -0.0174*** | -0.0207*** | 0.00719 |
| | (0.00456) | (0.00473) | (0.00468) | (0.00473) |
| Other Indigenous | -0.00206 | -0.0112 | -0.00458 | 0.0156 |
| | (0.0110) | (0.00995) | (0.0101) | (0.00994) |
| Afro-Bolivian | -0.116** | -0.0584 | -0.0763 | -0.0316 |
| | (0.0558) | (0.0535) | (0.0525) | (0.0552) |
| Survey wave controls: | Yes | Yes | Yes | Yes |
| Geographic controls | No | Yes | Yes | Yes |
| Household controls | No | No | Yes | Yes |
| Individual controls | No | No | No | Yes |
| Observations | 226,928 | 226,928 | 226,928 | 206,726 |

Note: The table depicts the models from equation 3-3c. Table 23 in Appendix C shows all marginal effects. The models include the same controls as in the previous table. The observations from survey wave 2014 are excluded. Robust standard errors clustered at the household level are given in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

After establishing that ethnicity is linked to health insurance affiliation, the next step scrutinizes the role of indigenousness in different health outcomes. Concerning the prevalence of chronic diseases, ethnicity is also relevant. In all four models, the indigenous group has a higher predicted probability of suffering from a chronic disease and in all models, this result is highly statistically significant (see Panel A, Table 5).

In Panel B of Table 5, the indigenous also report positive and statistically significant marginal effects. In Model 2 and 3, the marginal effect of being indigenous is equal to 5 and 4.9

percentage points respectively, which is a relevant increase from 3.2 percentage points in the base model. In Model 4, the change in probability decreases to 0.4 percentage points which constitutes a rather small magnitude. In Model 4, rurality seems to not be relevant for chronic diseases since it turns statistically insignificant. Concerning household controls, the household size and the type of toilet facility display negative and significant marginal effects. Of the individual controls, educational attainment, gender and age, seem to be significant determinants of chronic diseases. The small negative marginal effect of age$^2$ implies that at a certain stage the marginal effect becomes rather stable. The results further suggest that being female and having health insurance is associated with a positive change in the probability of a chronic disease. Income is not a relevant determinant of this health outcome.

*Table 5: Third stage Results - Chronic Disease*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Panel A: Predicted Probabilites | | | | |
| Non-indigenous | 0.0876*** | 0.0842*** | 0.0846*** | 0.102*** |
| | (0.000726) | (0.000709) | (0.000701) | (0.000809) |
| Indigenous | 0.120*** | 0.135*** | 0.133*** | 0.107*** |
| | (0.00144) | (0.00172) | (0.00168) | (0.00131) |
| Panel B: Marginal Effects | | | | |
| *Base category: Non-indigenous* | | | | |
| Indigenous | 0.0327*** | 0.0508*** | 0.0486*** | 0.00477*** |
| | (0.00160) | (0.00190) | (0.00187) | (0.00163) |
| Survey wave controls: | Yes | Yes | Yes | Yes |
| Geographic controls | No | Yes | Yes | Yes |
| Household controls | No | No | Yes | Yes |
| Individual controls | No | No | No | Yes |
| Observations | 263,544 | 263,544 | 263,544 | 239,972 |

Note: The table depicts the models from equation 4-4c. Table 24 in Appendix C shows all marginal effects. All models control for the survey years. Moreover, Model 2 controls for rurality and departments, Model 3 further adds the control vector $D_i$ and Model 4 includes all individual controls from Vector $E_i$. Robust standard errors clustered at the household level are given in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Deepening the analysis by looking at the various ethnic groups, differences become apparent. Panel A in Table 6 shows that Quechua, other indigenous groups and Afro-Bolivians display larger predicted probabilities than the non-indigenous group in all models. The Aymara display a larger predicted probability than the non-indigenous in Models 1-3, but in Model 4 their predicted probability is lower. All of these predicted probabilities are statistically significant.

However, when observing the marginal effects of Model 4 in Panel B, the negative figure of the Aymara group is insignificant. Quechua and the other indigenous groups exhibit statistically significant positive marginal effects throughout all models. In Model 4, their marginal effects

are equal to 0.7 percentage points and 2.1 percentage points respectively. The Afro-Bolivian group also shows a positive marginal effect, however, statistically insignificant. Similar to the analysis regarding health insurance affiliation, predicted probabilities and marginal effects decrease when adding controls. Except for rurality and the toilet type which turn insignificant in Model 4 in this analysis, the controls display similar marginal effects in terms of sign and significance as in the preceding analysis.

*Table 6: Fourth Stage Results - Chronic Disease*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Panel A: Predicted Probabilities | | | | |
| Non-indigenous | 0.0884*** | 0.0850*** | 0.0855*** | 0.104*** |
| | (0.000782) | (0.000765) | (0.000756) | (0.000874) |
| Aymara | 0.103*** | 0.136*** | 0.131*** | 0.101*** |
| | (0.00206) | (0.00313) | (0.00292) | (0.00212) |
| Quechua | 0.144*** | 0.145*** | 0.142*** | 0.112*** |
| | (0.00255) | (0.00289) | (0.00277) | (0.00213) |
| Other Indigenous | 0.134*** | 0.118*** | 0.128*** | 0.126*** |
| | (0.00538) | (0.00502) | (0.00520) | (0.00475) |
| Afro-Bolivian | 0.126*** | 0.135*** | 0.112*** | 0.107*** |
| | (0.0469) | (0.0496) | (0.0409) | (0.0376) |
| Panel B: Marginal Effects | | | | |
| *Base category: Non-indigenous* | | | | |
| Aymara | 0.0144*** | 0.0509*** | 0.0451*** | -0.00317 |
| | (0.00220) | (0.00327) | (0.00307) | (0.00239) |
| Quechua | 0.0553*** | 0.0603*** | 0.0563*** | 0.00760*** |
| | (0.00266) | (0.00302) | (0.00291) | (0.00237) |
| Other indigenous | 0.0454*** | 0.0331*** | 0.0426*** | 0.0216*** |
| | (0.00543) | (0.00507) | (0.00525) | (0.00481) |
| Afro-Bolivian | 0.0378 | 0.0501 | 0.0261 | 0.00346 |
| | (0.0469) | (0.0496) | (0.0409) | (0.0377) |
| Survey wave controls: | Yes | Yes | Yes | Yes |
| Geographic controls | No | Yes | Yes | Yes |
| Household controls | No | No | Yes | Yes |
| Individual controls | No | No | No | Yes |
| Observations | 226,928 | 226,928 | 226,928 | 206,726 |

Note: The table depicts the models from equation 7-7c. Table 25 in Appendix C shows all marginal effects. The models include the same controls as in the previous table. The observations from survey wave 2014 are excluded. Robust standard errors clustered at the household level are given in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Generally, Bolivia is not characterized by a high prevalence of tropic diseases since both groups exhibit lower predicted probabilities than for the other health indicators. In contrast to the previous analyses, the indigenous even display a lower predicted probability of having suffered from a recent disease than the non-indigenous in Model 1. However, adding controls in Model 2 to 4 results in the indigenous experiencing higher predicted probabilities. This pattern is also reflected in the marginal effects (see Panel B, Table 7). In Model 1, the marginal effect is

negative and significant. In Model 4, the change in probability for the indigenous group is equal to 0.4 percentage points and is statistically significant. Rurality displays negative significant effects and strong regional differences can be observed. The household controls are partly significant. Household size has a negative marginal effect and toilet type has a positive effect. Age and age$^2$ display similar effects as in previous analyses. Higher education again decreases the probability of potentially experiencing one of the diseases and the marginal effect is highly statistically significant. Health insurance affiliation has a significant positive effect on recent diseases while income seems to not be a relevant determinant for this health outcome.

*Table 7: Third Stage Results - Recent Disease*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Panel A: Predicted Probabilities | | | | |
| Non-indigenous | 0.0558*** | 0.0467*** | 0.0468*** | 0.0490*** |
| | (0.000812) | (0.000653) | (0.000653) | (0.000688) |
| Indigenous | 0.0270*** | 0.0557*** | 0.0549*** | 0.0535*** |
| | (0.000843) | (0.00174) | (0.00171) | (0.00171) |
| Panel B: Marginal Effects | | | | |
| *Base category: Non-indigenous* | | | | |
| Indigenous | -0.0289*** | 0.00901*** | 0.00802*** | 0.00449** |
| | (0.00113) | (0.00188) | (0.00185) | (0.00187) |
| Survey wave controls: | Yes | Yes | Yes | Yes |
| Geographic controls | No | Yes | Yes | Yes |
| Household controls | No | No | Yes | Yes |
| Individual controls | No | No | No | Yes |
| Observations | 263,534 | 263,534 | 263,534 | 239,963 |

Note: The table depicts the models from equation 5-5c. Table 26 in Appendix C shows all marginal effects. All models control for the survey years. Model 2 controls for rurality and departments, Model 3 further adds the control vector $D_i$ and Model 4 includes all individual controls from Vector $E_i$.
Robust standard errors clustered at the household level are given in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The fourth stage results disclose disparities between the different groups. Compared to the non-indigenous, the Aymara group and the Afro-Bolivians have lower predicted probabilities in the models. The Quechua group has a lower predicted probability in Model 1 but a higher probability from Model 2 onwards and the remaining indigenous groups experience a higher predicted probability in all models (see Panel A, Table 8). All figures are statistically significant. The marginal effects presented in Panel B in Table 8 paint a similar picture, with Aymara displaying negative marginal effects in Model 1, 3 and 4 and Afro-Bolivians in all models. Quechua and other indigenous groups have positive marginal effects in Model 4. However, only the marginal effects of Quechua and other indigenous groups are statistically significant. Here, in Model 4 being Quechua is associated with a 0.7 percentage point increase

and being part of another indigenous group is associated with a 0.01 increase in the probability of having experienced a disease. The controls display similar patterns as in the third stage analysis.

*Table 8: Fourth Stage Results - Recent Disease*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Panel A: Predicted Probabilities | | | | |
| Non-indigenous | 0.0624*** | 0.0524*** | 0.0526*** | 0.0550*** |
| | (0.000923) | (0.000743) | (0.000743) | (0.000782) |
| Aymara | 0.0159*** | 0.0528*** | 0.0516*** | 0.0500*** |
| | (0.000990) | (0.00335) | (0.00329) | (0.00319) |
| Quechua | 0.0280*** | 0.0672*** | 0.0656*** | 0.0622*** |
| | (0.00133) | (0.00317) | (0.00311) | (0.00303) |
| Other Indigenous | 0.122*** | 0.0642*** | 0.0641*** | 0.0648*** |
| | (0.00642) | (0.00358) | (0.00353) | (0.00360) |
| Afro-Bolivian | 0.0602** | 0.0413** | 0.0387** | 0.0377** |
| | (0.0281) | (0.0192) | (0.0173) | (0.0166) |
| Panel B: Marginal Effects | | | | |
| *Base category: Non-indigenous* | | | | |
| Aymara | -0.0466*** | 0.000361 | -0.00102 | -0.00499 |
| | (0.00134) | (0.00345) | (0.00339) | (0.00330) |
| Quechua | -0.0344*** | 0.0148*** | 0.0130*** | 0.00726** |
| | (0.00158) | (0.00328) | (0.00322) | (0.00315) |
| Other indigenous | 0.0598*** | 0.0118*** | 0.0116*** | 0.00984*** |
| | (0.00647) | (0.00365) | (0.00361) | (0.00369) |
| Afro-Bolivian | -0.00221 | -0.0111 | -0.0139 | -0.0173 |
| | (0.0281) | (0.0192) | (0.0173) | (0.0166) |
| Survey wave controls: | Yes | Yes | Yes | Yes |
| Geographic controls | No | Yes | Yes | Yes |
| Household controls | No | No | Yes | Yes |
| Individual controls | No | No | No | Yes |
| Observations | 226,916 | 226,916 | 226,916 | 206,717 |

Note: The table depicts the models from equations 8-8c. Table 27 in Appendix C shows all marginal effects. The models include the same controls as in the previous table. The observations from survey wave 2014 are excluded. Robust standard errors clustered at the household level are given in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The last part of the analysis zooms in on child health by examining the prevalence of diarrheal diseases. Model 1 in Table 9 shows that non-indigenous children have a predicted probability of experiencing diarrhea of 0.21 while the predicted probability of indigenous children equals 0.24. The predicted probability of indigenous children remains higher than for non-indigenous children also when adding controls throughout Models 2-4, thus disclosing a connection between indigenous origin and diarrhea.

The marginal effects also show the discrepancy in health between children from different ethnic origins (see Panel B, Table 9). When including all controls, an indigenous child experiences a change in probability of having diarrhea of 1.6 percentage points which is statistically

significant. Compared to urban areas, rurality statistically significantly increases the incidence of diarrhea. Similarly, a toilet facility other than a flush toilet appears to increase the likelihood of having diarrhea while the source of water again is not statistically relevant. Regarding statistically significant individual controls, age has a negative marginal effect and females seem to suffer less from diarrhea. The education of the household head and higher income have a significant negative marginal effect while having health insurance once again is associated with an increased likelihood of diarrhea. Similar to the pattern observed for the outcome variables health insurance and chronic disease, predicted probabilities and the magnitude of the marginal effects decrease from Model 1 to Model 4 when adding the controls.

*Table 9: Third Stage Results - Diarrhea*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Panel A: Predicted Probabilities | | | | |
| Non-indigenous | 0.215*** | 0.216*** | 0.217*** | 0.216*** |
| | (0.00288) | (0.00292) | (0.00293) | (0.00293) |
| Indigenous | 0.242*** | 0.235*** | 0.232*** | 0.233*** |
| | (0.00726) | (0.00757) | (0.00750) | (0.00755) |
| Panel B: Marginal Effects | | | | |
| *Base category: Non-indigenous* | | | | |
| Indigenous | 0.0274*** | 0.0196** | 0.0153* | 0.0166** |
| | (0.00781) | (0.00826) | (0.00822) | (0.00828) |
| Survey wave controls: | Yes | Yes | Yes | Yes |
| Geographic controls | No | Yes | Yes | Yes |
| Household controls | No | No | Yes | Yes |
| Individual controls | No | No | No | Yes |
| Observations | 26,797 | 26,797 | 26,797 | 26,416 |

Note: The table depicts the models from equation 6-6c. Table 28 in Appendix C shows all marginal effects. All models control for the survey year. Model 2 controls for rurality and departments, Model 3 further adds the controls of Vector $D_i$, and Model 4 includes the individual controls: age, gender, household head education, health insurance affiliation, income. Robust standard errors clustered at the household level are given in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The next stage again reveals differences between the various groups. All groups display higher predicted probabilities than their non-indigenous counterparts in all four models (Panel A, Table 10). However, an especially large discrepancy can be noted for the Afro-Bolivian group which exhibits a statistically significant predicted probability of 0.5 in Model 4. With regards to the marginal effects presented in Panel B, the Quechua and other indigenous groups display positive but insignificant effects. Aymara have a marginal effect equal to an increase of 3.4 percentage points while the change in probability for Afro-Bolivians is equal to 28.7 percentage points in Model 4.

*Table 10: Fourth Stage Results - Diarrhea*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| | Panel A: Predicted Probabilities | | | |
| Non-indigenous | 0.211*** | 0.212*** | 0.213*** | 0.212*** |
| | (0.00310) | (0.00313) | (0.00314) | (0.00314) |
| Aymara | 0.223*** | 0.246*** | 0.241*** | 0.247*** |
| | (0.0120) | (0.0141) | (0.0139) | (0.0142) |
| Quechua | 0.248*** | 0.231*** | 0.227*** | 0.226*** |
| | (0.0122) | (0.0126) | (0.0125) | (0.0126) |
| Other Indigenous | 0.269*** | 0.221*** | 0.219*** | 0.215*** |
| | (0.0210) | (0.0190) | (0.0189) | (0.0188) |
| Afro-Bolivian | 0.451*** | 0.462*** | 0.463*** | 0.500*** |
| | (0.156) | (0.161) | (0.163) | (0.166) |
| | Panel B: Marginal Effects | | | |
| *Base category: Non-indigenous* | | | | |
| Aymara | 0.0119 | 0.0332** | 0.0284** | 0.0345** |
| | (0.0124) | (0.0145) | (0.0144) | (0.0146) |
| Quechua | 0.0368*** | 0.0181 | 0.0139 | 0.0133 |
| | (0.0126) | (0.0131) | (0.0130) | (0.0131) |
| Other indigenous | 0.0571*** | 0.00839 | 0.00645 | 0.00315 |
| | (0.0213) | (0.0193) | (0.0192) | (0.0191) |
| Afro-Bolivian | 0.239 | 0.250 | 0.250 | 0.287* |
| | (0.156) | (0.161) | (0.163) | (0.166) |
| Survey wave controls: | Yes | Yes | Yes | Yes |
| Geographic controls | No | Yes | Yes | Yes |
| Household controls | No | No | Yes | Yes |
| Individual controls | No | No | No | Yes |
| Observations | 22,753 | 22,753 | 22,753 | 22,392 |

Note: The table depicts the models from equations 9-9c. Table 29 in Appendix C shows all marginal effects. The models include the same controls as in the previous table. The observations from survey wave 2014 are excluded. Robust standard errors clustered at the household level are given in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Overall, indigenous have lower health care access and perform worse on all health outcomes than their non-indigenous counterparts. Likewise, the analysis reveals different patterns for distinct ethnic groups. Compared to the non-indigenous group, Aymara are less likely to have health insurance, suffer from chronic diseases or experience a tropical disease recently. Still, Aymara children are more likely to suffer from diarrhea. In contrast, Quechua and other indigenous groups are more likely to have health insurance, have a chronic disease or a tropical disease but less likely to experience diarrhea. Afro-Bolivians have a lower likelihood of having health insurance or a recent disease but a higher likelihood of suffering from a chronic sickness and a considerably higher likelihood of diarrhea.

## 5.2 Robustness Checks

The choice of ethnic indicator in health research can potentially impact the results. Armenta-Paulino et al. (2020) report heterogeneity in terms of maternal health outcomes in Bolivia when using self-identification, spoken language, or having an indigenous household head as the ethnicity indicator. Consequently, the robustness of the results was tested by using different ethnicity measures. For both alternative measures, only the distinction between indigenous and non-indigenous can be drawn, but the heterogeneity between different ethnic groups cannot be explored due to a lack of data.

The first robustness check uses the language spoken during childhood as the ethnicity measure. Tables 30 to 37 in Appendix D showcase the results. Similar to the previous analyses, speaking an indigenous language during childhood is linked to lower health insurance affiliation. Here, the predicted probability is even lower than using the self-identification measure. Likewise, the robustness check also confirms the previous results for the outcome variables of chronic disease, recent disease and diarrhea. Indigenous exhibit significant lower performances for all indicators. Consequently, the results can be considered robust when using this alternative measure of ethnicity.

The two presented measures of indigeneity partially classify different respondents as indigenous. Therefore, another robustness check uses the independent variable *all indigenous* that considers the combination of self-identification and the language spoken in childhood and requires that both conditions are met. Using this definition, around 16% or 35,917 observations from the sample are indigenous. Tables 38 to 45 in Appendix D disclose the results. The findings of the analyses concerning the health indicators of health insurance and diarrhea are similar to the main results. For the outcomes, chronic disease and recent sickness the predicted probabilities confirm previous results and are statistically significant. However, in both cases, the marginal effects of the indigenous measure turn insignificant in Model 4 when adding the individual controls. Hence, implying that differences in terms of socio-economic factors account for the entirety of the difference between indigenous and non-indigenous.

The final robustness check accounts for fixed effects at the household level. These analyses can also be conducted using the *ethnic category* variable. The findings are presented in Tables 46-53 in Appendix D. The results concerning health insurance affiliation are confirmed. Similarly,

the indigenous exhibit a higher likelihood of a chronic disease. Looking at ethnic group disparities, all groups except for the Afro-Bolivian group have a statistically significant higher likelihood. Likewise, seen as a homogenous group, the indigenous display a statistically significant higher likelihood of a recent disease. The subsequent step reveals that only the higher odds ratios of Quechua and other indigenous groups are significant for this outcome variable. While these results are in line with the main analyses, the outcome variable diarrhea displays a different pattern. In both robustness checks, regarding the indigenous variable and the ethnic categories variable, the groups display a higher likelihood of diarrhea than the non-indigenous, however, all odds ratios are insignificant.

## 5.3 Discussion

Concluding from the above, the results of the conducted logistic regressions reveal that ethnicity does matter for health care access and health outcomes in Bolivia. More specifically, the indigenous populations in Bolivia are subject to inequalities in terms of health insurance affiliation, the prevalence of chronic diseases or tropical diseases and diarrhea. Hence, the good of health seems not to be equally distributed. In the following, these results will be discussed in more detail.

Regarding the outcome variable of health insurance affiliation, the study's results are in line with previous conclusions reporting a difference between indigenous and non-indigenous in Bolivia (World Bank, 2004, p. 16). The findings further suggest that geographic controls are relevant in the context of health insurance affiliation since the predicted probabilities and the marginal effects decrease when adding the controls. As such, disparities between the departments can be observed in line with previous results of Pooley, Ramirez and de Hilari (2008) regarding regional differences in health care access. Note that the departments with very high likelihoods of health insurance affiliation, Tarija and Pando, also feature lower shares of indigenous people (Gigler, 2009). Consequently, controlling for this aspect accounts for some differences between indigenous and non-indigenous. Based on the theoretical framework previously presented, socio-economic factors are major drivers of health inequalities. In this vein, part of the effect of ethnicity on health insurance affiliation seems to be running through socio-economic channels. The positive association between age and female gender with health insurance affiliation could be explained by the Bolivian government's interventions to provide

health insurance to women and the elderly to ensure health care access for these vulnerable groups (see section 2.1.3). Likewise, the relationship between education and health insurance and income and health insurance seems intuitive. Previous to the introduction of universal and free health coverage in 2019, insurance coverage was mainly linked to formal employment, which is linked to educational attainment (World Bank, 2009). The indigenous people display lower educational attainment in the sample of the present study, as shown in Figure 2 in Appendix A. In the same vein, formal employment is associated with higher income. Large shares of the indigenous population work in informal employment (World Bank, 2009), which could contribute to lower health insurance coverage.

Taking a more disaggregated view of the indigenous group, it becomes apparent that all groups have a lower likelihood of health insurance affiliation before adding the individual controls. After controlling for individual factors, only the Aymara group still features a lower likelihood. Consequently, socio-economic aspects play a crucial role in health insurance affiliation for Quechua, other indigenous and Afro-Bolivians. It should be noted that the survey wave of 2019 is associated with considerable increases in the likelihood of health insurance affiliation which could be due to the previously mentioned introduction of Universal and free health care with the SUS. Consequently, it can probably be expected that the share of people being covered by health insurance will increase in the future, also among indigenous. This could potentially decrease the observed disparities in health insurance access and should be reassessed in the future.

The analysis further reveals that the indigenous population displays lower health performance. Similar to the reports by Salm and Gertsch (2019), the results suggest that the indigenous have a higher probability of suffering from chronic diseases. While this finding remains significant, the effect of ethnicity decreases when adding the controls again. Accounting for geographic and household controls only shows a minor change in predicted probabilities. Hence, the present study does not confirm the findings of previous literature concerning the relationship between sanitary facilities and health outcomes (Gundry, Wright & Conroy, 2004; Mishra et al. (2017). In the prevalence of chronic diseases, sanitation facilities do not appear as a relevant determinant. However, a significant decrease in the marginal effect can be observed when accounting for socio-economic factors. This supports the link between health and socio-economic status (Galama & van Kippersluis, 2013) and McCartney, Collins and Mackenzie'S (2013) theoretical suggestion that health inequalities are often greatly linked to socio-economic

differences. It further highlights the relevance of socio-economic differences in ethnicity-related health gaps (Egede, 2006). In line with previous findings of Abbott et al. (2018), age is positively associated with the likelihood of chronic diseases. As already stressed in the Grossman model of health demand, this study finds that education is related to the good of health. Additional years of education are linked to lower incidences of chronic diseases, as suggested by Cutler and Lleras-Muney (2006). Again, the lower educational attainment of indigenous might reflect higher chronic disease prevalence. In accordance with the stylized fact put forward by Galama and van Kippersluis (2013), the analysis reveals that education is of crucial importance for health inequalities out of the socio-economic factors. Consequently, investing in and increasing the educational attainment of the indigenous population could potentially provide an opportunity to decrease the prevalence of chronic diseases among indigenous and decrease the health gap.

The disclosed positive link between health insurance affiliation and the prevalence of chronic or other diseases might seem counterintuitive at first. However, having health insurance possibly facilitates doctor visits and as such the discovery and diagnosis of chronic diseases. In this vein, Christopher et al. (2016) report an association between Medicaid insurance and the awareness and treatment of chronic diseases in the US. Nevertheless, since indigenous have a higher probability of suffering from a chronic disease or tropical disease while also having a lower probability of having health insurance, this result still raises questions. Here, it should be considered that the indigenous variable combines the patterns of the various groups and hence masks diverging trends. Taking a more disaggregated view, Quechua have a higher likelihood of experiencing a chronic disease but also a higher likelihood of health insurance than non-indigenous while the opposite is found for Aymara.

Although the gap between indigenous and non-indigenous decreases markedly when adding the controls, a significant difference remains. Thus, implying that the controls cannot account for the entire difference between the ethnic groups. Although the difference in predicted probabilities is equal to only 0.47 percentage points in Model 4 (see Panel B, Table 5), which might seem to be of negligible magnitude, the context of the study should be considered. With an indigenous population of around 50%, even small disparities affect a large part of the population and can materialize in large absolute differences.

Recent disease's outcome variable exhibits a different pattern compared to the other two outcome variables. In Model 1 in Table 7, the indigenous group exhibits a lower predicted

probability than the non-indigenous group. However, in Model 4, being indigenous is associated with a higher predicted probability. This finding aligns with Hotez (2014), who proposed that Aboriginal populations suffer more from tropical diseases. However, in contrast to the previous analyses, adding the controls does not decrease the effect of ethnicity on the outcome variable but increases it. Consequently, the results are in line with the proposed negative effect of ethnicity on the outcome variable, however, socio-economic factors do not seem as important for this specific health outcome as for previous health indicators. Potentially, other confounding factors that are not included in the analysis are relevant. For example, lifestyle and health behaviour are also often linked to health outcomes (McCartney, Collins & Mackenzie, 2013), however, due to data constraints, the study could not control for this.

It is noteworthy that a considerable increase can be observed between Model 1 and Model 2 when adding the geographical controls. This could potentially imply that the geographical controls influence the relationship between ethnicity and tropical disease prevalence in a positive way meaning that being indigenous has a differential effect in certain departments. It is important to note that this outcome variable exhibits large regional variations with individuals living in the departments of Santa Cruz, Pando and Beni having much larger likelihoods of tropical disease. Since these departments are located in the Eastern Lowlands which feature rainforests, the finding of a higher likelihood of a tropical disease does not seem counterintuitive and potentially for this health outcome, geographic factors are more relevant than ethnicity. The intersection of ethnicity and geography offers promising pathways for future research, however, exceeds the scope of the present study.

When zooming in on the indigenous variable and considering differences between the ethnic groups, one can see that the increase in predicted probabilities when adding the controls is observed only for the Aymara and the Quechua group. Likewise, the marginal effects of both groups increase throughout the models. Hence, the pattern of these two large indigenous groups probably drives the diverging trend exhibited by the indigenous variable while accounting for geographical, household and individual controls decrease the effect of ethnicity for the other indigenous group and the Afro-Bolivian group.

The analysis discloses a connection between indigenous origin and diarrhea concerning child health. These results are in line with previous research on ethnicity and child health (Ziegler, 2014, p. 111). Again, the effect of being indigenous on the incidence of diarrhea diminishes when controlling for geographical components, household controls and especially socio-

economic factors. This implies that ethnicity partly impacts the outcome variable through the channels of geographical, household and socio-economic control variables. Hereby, sanitation is a determinant of diarrhea. Consequently, improvements in sanitation could decrease the incidence of diarrhea. In terms of socio-economic factors, in line with previous research such as Case, Lubotzky and Paxson (2002) or Benzeval and Judge (2001), income is positively associated with this health outcome. Likewise, the education of the household head negatively impacts the prevalence of diarrhea, which is in line with the findings of Desmennu et al. (2017). Accordingly, interventions aiming to improve the socio-economic situation of indigenous populations in Bolivia could positively impact the prevalence of diarrhea.

It should be noted that the health outcome of diarrhea exhibited the largest disparities which render interventions decreasing the health gap especially necessary. Afro-Bolivians are seemingly especially disadvantaged. However, it should also be kept in mind that the share of Afro-Bolivians in the sample is rather small, hence, even a low number of cases translates into a high probability and high likelihood. Moreover, Afro-Bolivians and Aymara display a pattern with increasing predicted probabilities and marginal effects when adding controls, implying that the effect of ethnicity on the prevalence of diarrhea does not work through the effect of geographical household or socio-economic controls. Hence, in the context of these two groups, the proposed importance of socio-economic factors and circumstances for health outcomes (McCartney, Collins & Mackenzie, 2013; Cutler, Lleras-Muney & Vogl, 2011)) is not confirmed.

Overall, this study supported the proposed hypotheses that indigenous people have less access to health insurance and display lower performances for the examined health indicators. The results of the study are consistent with the hypothesis that the indigenous population in Bolivia is exposed to health inequalities and that ethnicity matters for health performance. However, these findings should also be viewed in a more differentiated way. This research has also investigated indigenous heterogeneity and elaborated on disparities within the indigenous community. Hereby, an interesting revelation of the conducted analyses is the different patterns exhibited by Aymara and Quechua. The study discovers that Aymara seem to perform better in terms of the examined health outcomes, despite having lower health insurance affiliation rates. In contrast, the other large indigenous population of Quechua have a higher likelihood of having health insurance even than their non-indigenous counterparts, however, still tend to suffer more from chronic and other diseases. Both groups feature rather large sizes and tend to reside in

similar geographical regions, namely the Andean Highlands and the Central Valleys (Gigler, 2015, p. 88), implying that geographical variations might not be able to account for the differences. Although, the different groups display distinctions in terms of language, culture and settlement patterns, the determinants of the observed differences are not clear.

In conclusion, the study reveals a health gap between indigenous and non-indigenous concerning the examined health indicators. Zooming in on heterogeneity among the indigenous group it becomes apparent that the different groups display different health performances. Despite showing different patterns, each ethnic group is subject to a significant inequality on at least one of the scrutinized health indicators. Although socio-economic factors seem to capture part of the effect of ethnicity on health outcomes, they cannot fully account for the differences brought to light. A significant gap remains implying that ethnicity is still a relevant determinant of health inequalities affecting health performance.

## 5.4 Limitations

The present study carries out in-depth analyses regarding the role of ethnicity in health inequalities in Bolivia and aims to be as accurate as possible. Nevertheless, the study suffers from caveats.

First, the data situation did not allow for the tracking of individuals throughout the different survey waves and hence the construction of a panel dataset. Consequently, the analysis does not control for individual-level fixed effects and additionally, the study does not explore any time trends. The pooled sample structure does not allow for researching how identifying as indigenous influences health performance over time. Future analyses should aim to incorporate a time dimension to make inferences about changes in health inequalities. It should further be noted that the analysis is rather specific to the context of Bolivia and the ethnic make-up of the country which might impact the external validity of the findings for other Latin American countries and contexts.

With regards to the ethnicity measure, this study applies several measures of indigeneity and hence addresses the limitations of previous studies in the field (Mena-Meléndez, 2020). However, the used measures could still be criticized. Ideally, an ethnicity measure would combine language, self-identification and geographical location and possibly also consider

interviewer ascription when constructing the ethnicity measure (Armenta-Paulino, Vázquez & Bolúmar, 2019; Mena-Meléndez, 2020). Moreover, this thesis goes beyond the scope of previous studies by not only differentiating between non-indigenous and indigenous respondents but also investigating distinctions between different indigenous groups. However, the variations found between ethnic groups might also capture other underlying differences and hence record the effects of other variables (Ziegler, 2014). Consequently, omitted variable bias might be a concern in the present study.

The presented analysis applies data from household studies. Although general purpose household studies are commonly applied in health inequalities research, they have certain limitations. A major limitation is that the data relies on self-reporting. Thus giving rise to response or reporting errors since the information provided by the respondents might be inaccurate (Wolff, 2015). Moreover, the WHO Handbook on Health Inequality Monitoring (2013, p. 21) raises the issue of insufficient sample sizes for population subgroups. This could potentially also be a problem with the present data. The sample includes only very few Afro-Bolivians which might not reflect a sufficient sample size for the subgroup. Similarly, the share of indigenous respondents in the sample is equal to 26% while the overall share of indigenous in the Bolivian population is estimated to be close to 50%. Consequently, the data might be subject to sampling errors which could affect the study's results.

# 6 Conclusion

The research at hand aims to investigate the topic of health inequalities. Although greatly researched in the context of developed economies, studies regarding health inequalities in developing countries, more specifically Bolivia, are rather scarce. A particularly vulnerable group in Bolivia are the indigenous. Previous literature has called attention to the precarious situation of indigenous populations in Latin America, highlighting higher poverty rates or lower educational attainment. At the same time, the growing field of research on health inequalities has shed light on the differences in health performances related to ethnicity. Consequently, the present study aimes to research whether health disparities can be observed between indigenous and non-indigenous individuals in Bolivia. Hence, contributing to the literature on health disparities in Latin America, more specifically Bolivia. The findings of the present study complement and extend previous research that focused mainly on maternal and child health by presenting a detailed assessment of the overall health performance of the Bolivian population using several relevant health indicators. Utilizing data from the general purpose household study, this thesis has provided a thorough assessment of the posed research question which was as follows:

***Is ethnicity related to inequalities in terms of health care access and outcomes in Bolivia?***

By scrutinizing the outcome variables of *health insurance access, chronic diseases, recent disease* and *diarrhea*, the study addressed health measures that provide information regarding the health performance of the entire population including females, males and child health. Moreover, indigenous heterogeneity has often been disregarded and has not received much attention in previous research. Therefore, the present study also explored the role of within-ethnicity differences in terms of health performance in a further step. The analysis reveals significant inequalities between the non-indigenous and indigenous populations, with the latter group performing worse on all health indicators. Additionally, the study shows that relevant differences exist between indigenous groups. For example, the two largest indigenous groups, Aymara and Quechua exhibit rather different patterns regarding health care access and health performance. Hence, this study sheds light on the relevance of indigenous heterogeneity for

health performance. In this context, the role of the interaction of ethnicity and other factors is noteworthy. The findings show that the underperformance of indigenous in terms of socio-economic factors accounts for parts of the observed health gap. Disadvantages experienced by indigenous Bolivians in other dimensions are partly reflected in the health disparities. However, even after controlling for these differences, a statistically significant gap remains. Consequently, in the context of this study, ethnicity is found to be related to health care access and the scrutinized health outcomes in Bolivia.

## 6.1 Practical Implications and Future Research

The obtained findings are not only of theoretical relevance but also constitute certain practical implications. First of all, the Bolivian context of the study should be stressed again. Despite the seemingly small magnitude of the observed disparities, many inhabitants of Bolivia are affected by health inequalities because the indigenous population makes up such a large proportion of the population. Consequently, the discovered health inequalities represent obstacles to future economic growth in Bolivia. Here, the economic burden of the health gap is twofold. First, it can impact labour productivity. Since the indigenous populations constitute around 50% of the Bolivian population, a lower health performance translates into unexploited potential of a large part of the Bolivian labour force. Second, health inequalities are reflected in economic costs. Hence, the health gap potentially hampers economic growth and causes additional costs. Consequently, decreasing the health gap by improving the health performance of the indigenous populations could facilitate future economic growth. Failure to address the health gap could materialize in an increasing diverging trend, negatively impacting the Bolivian labour force and economy. Consequently, it is of utmost importance to take corrective action and that health interventions are implemented to address the observed health gaps.

While the Bolivian government aims to improve health care access by the introduction of universal and free health care, which seems to have translated into higher health insurance affiliation, further health interventions and potentially positive discrimination as suggested by Giuffrida et al. (2007) might be required to reach a status closer to health equality. Indigenous should not only be treated equally but since they constitute a vulnerable group, they might require additional interventions focusing explicitly on improving indigenous health. Similarly, another practical implication is that interventions cannot solely target ”the indigenous” as a

homogenous group since the different groups face varying health struggles. Consequently, the heterogeneity of indigenous peoples needs to be institutionally recognised and translated into tailor-made measures that address the respective needs of the different groups. Moreover, while regional, household and socio-economic factors cannot account in their entirety for the health gaps, they still decrease the disparity associated with ethnicity. Especially, the socio-economic factors appear as determinants of health inequalities. Therefore, interventions could also focus on improving the socio-economic status of indigenous, for example, increasing educational attainment or income.

This study uncovered relevant differences between ethnic groups, for example, the Aymara display very different health patterns than the Quechua. However, the determinants of these differences are not investigated since it exceeds the scope of the research. The ethnic differences could potentially also be related to other variables. Consequently, future research should address the drivers of differences between the various ethnic groups in Bolivia to implement even better-fitting policies and interventions. In this vein, the situation of Afro-Bolivians also deserves more attention. Although addressed in this study, this research featured the main focus on the indigenous populations of Bolivia. Hence, future research should focus specifically on the health situation of Afro-Bolivians and the determinants thereof that may differ from the situation of indigenous people. Lastly, the interaction of ethnicity and other relevant variables such as geography could provide exciting opportunities for future research.

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# Appendix A – Description of Variables and Descriptive Statistics

*Table 11: Description of variables*

| Category | Variable name | Measurement |
|---|---|---|
| **Dependent variables** | Health Insurance | 0 = no health insurance<br>1 = health insurance |
| | Chronic Disease | 0 = no chronic disease<br>1 = at least one chronic disease |
| | Recent Disease | 0 = no sickness in the last 12 months<br>1 = at least one sickness in the last 12 months |
| | Diarrhea | 0 = no diarrhea in the last 2 weeks<br>1 = diarrhea in the last 2 weeks |
| **Independent variables** | Indigenous | 0 = does not identify as indigenous or Afro-Bolivian<br>1 = does identify as indigenous or Afro-Bolivian |
| | Ethnic Category | 0 = white<br>1 = Aymara<br>2 = Quechua<br>3 = other indigenous groups<br>4 = Afro-Bolivian |
| **Survey wave control** | Survey wave | 0 = 2013<br>1 = 2014<br>2 = 2015<br>3 = 2016<br>4 = 2017<br>5 = 2018<br>6 = 2019 |
| **Geographical controls** | Rurality | 0 = urban area<br>1 = rural area |
| | Department | 0 = La Paz<br>1 = Chiquisaca<br>2 = Cochamba<br>3 = Oruro<br>4 = Potosí<br>5 = Tarija<br>6 = Santa Cruz<br>7 = Beni<br>8 = Pando |

| | | |
|---|---|---|
| **Household controls** | Household size | continuous |
| | Water Source | 0 = piped<br>1 = other (for example: welled, spring, river, rainwater, bottled) |
| | Toilet Type | 0 = flush<br>1 = other (pit, ecological toilet, none) |
| **Individual controls** | Age | Continuous |
| | $Age^2$ | Continuous |
| | Female | 0 = male<br>1 = female |
| | Years of education | continuous |
| | Household Head education | continuous |
| | Income | Continuous (natural logarithm of CPI adjusted household income per capita in Bolivianos) |
| | Health insurance affiliation | 0 = no health insurance<br>1 = health insurance |
| **Robustness check** | Indigenous_langauge | 0 = the person grew up speaking a non-indigenous language<br>1 = the person grew up speaking an indigenous language |
| | All indigenous | 0 = the person does not identify as indigenous and/or did not grow up speaking an indigenous language during childhood<br>1 = the person self-identifies as indigenous AND grew up speaking an indigenous language during childhood |

*Table 12: Descriptive statistics of dependent variables by ethnicity*

| | **Obs.** | | **Mean** | | **S.D** | | **Min.** | **Max.** |
|---|---|---|---|---|---|---|---|---|
| | Ind. | Non-ind. | Ind. | Non-ind. | Ind. | Non-ind | | |
| **Health Insurance Affiliation** | 68,556 | 194,990 | 0.355 | 0.447 | 0.479 | 0.497 | 0 | 1 |
| **Chronic Disease** | 68,554 | 194,990 | 0.120 | 0.088 | 0.325 | 0.283 | 0 | 1 |
| **Recent Disease** | 68,554 | 194,980 | 0.028 | 0.055 | 0.166 | 0.227 | 0 | 1 |
| **Diarrhea in the last 2 weeks** | 4,004 | 22,795 | 0.242 | 0.215 | 0.428 | 0.411 | 0 | 1 |

Notes: Author's own elaborations based on data from the Bolivian Household Survey (ANDA, n.d.a-g)

*Table 13: Descriptive statistics of independent and control variables by ethnicity*

| | **Obs.** | | **Mean** | | **S.D.** | | **Min.** | | **Max.** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ind. | Non-ind. | Ind. | Non-ind. | Ind. | Non-ind. | Ind. | Non-ind. | Ind. | Non-ind. |
| **Survey year** | 68,556 | 194,990 | 3.033 | 3.062 | 1.927 | 2.019 | 0 | 0 | 6 | 6 |
| **Rural** | 68,556 | 194,990 | 0.375 | 0.173 | 0.484 | 0.378 | 0 | 0 | 1 | 1 |
| **Department** | 68,556 | 194,990 | 1.909 | 3.588 | 2.176 | 2.638 | 0 | 0 | 8 | 8 |
| **Household size** | 68,556 | 194,990 | 4.448 | 4.548 | 2.148 | 1.947 | 1 | 1 | 16 | 17 |
| **Water source** | 68,556 | 194,990 | 0.412 | 0.257 | 0.492 | 0.437 | 0 | 0 | 1 | 1 |
| **Toilet type** | 68,556 | 194,990 | 0.513 | 0.287 | 0.500 | 0.452 | 0 | 0 | 1 | 1 |
| **Age** | 68,556 | 194,990 | 35.219 | 26.685 | 21.811 | 19.890 | 0 | 0 | 98 | 98 |
| **Age$^2$** | 68,556 | 194,990 | 1,716 | 1,107 | 1,716 | 1,430 | 0 | 0 | 9,604 | 9,604 |
| **Female** | 68,556 | 194,990 | 0.514 | 0.507 | 0.500 | 0.500 | 0 | 0 | 1 | 1 |
| **Years of education** | 65,215 | 176,465 | 7.165 | 8.748 | 5.281 | 5.724 | 0 | 0 | 27 | 27 |
| **Household head Years of education** | 3,964 | 22,625 | 8.456 | 10.279 | 4.846 | 4.958 | 0 | 0 | 25 | 27 |
| **Income** | 68,186 | 193,518 | 6.444 | 6.806 | 1.046 | 0.871 | 0.211 | 0.392 | 10.386 | 11.674 |
| **Health Insurance** | 68,556 | 194,990 | 0.355 | 0.447 | 0.479 | 0.497 | 0 | 1 | 0 | 1 |

Notes: Author's own elaborations based on data from the Bolivian Household Survey (ANDA, n.d.a-g)

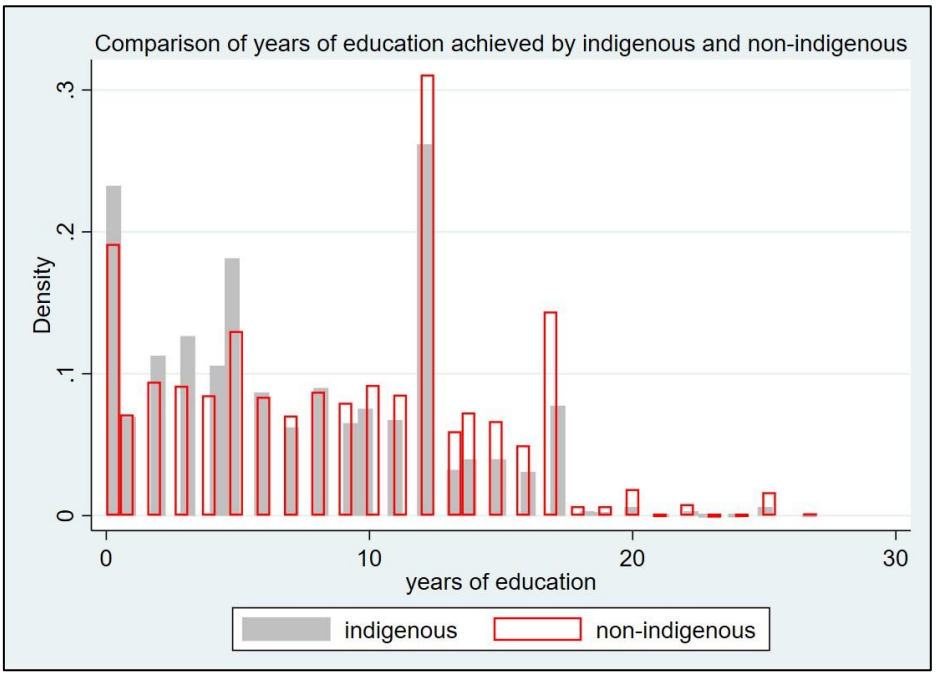


*Figure 2: Years of education achieved by ethnicity*

# Appendix B – Odds Ratios

## Outcome variable: Health Insurance

*Table 14: First stage Health Insurance - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | 0.684*** | 0.850*** | 0.838*** | 0.936*** |
| | (0.00964) | (0.0130) | (0.0129) | (0.0164) |
| *Base category: 2013* | | | | |
| 2014 | 0.860*** | 0.849*** | 0.848*** | 0.888*** |
| | (0.0232) | (0.0228) | (0.0228) | (0.0266) |
| 2015 | 0.788*** | 0.754*** | 0.750*** | 0.812*** |
| | (0.0208) | (0.0200) | (0.0198) | (0.0239) |
| 2016 | 0.907*** | 0.852*** | 0.832*** | 0.923*** |
| | (0.0234) | (0.0221) | (0.0216) | (0.0265) |
| 2017 | 0.847*** | 0.813*** | 0.790*** | 0.888*** |
| | (0.0220) | (0.0216) | (0.0210) | (0.0261) |
| 2018 | 0.934*** | 0.904*** | 0.868*** | 0.973 |
| | (0.0240) | (0.0237) | (0.0228) | (0.0281) |
| 2019 | 3.183*** | 3.356*** | 3.247*** | 4.295*** |
| | (0.0854) | (0.0921) | (0.0898) | (0.132) |
| Rural | | 0.786*** | 0.799*** | 1.077*** |
| | | (0.0136) | (0.0138) | (0.0226) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 1.607*** | 1.619*** | 1.877*** |
| | | (0.0477) | (0.0479) | (0.0624) |
| Cochamba | | 0.800*** | 0.801*** | 0.785*** |
| | | (0.0167) | (0.0167) | (0.0181) |
| Oruro | | 1.111*** | 1.104*** | 1.088** |
| | | (0.0350) | (0.0347) | (0.0382) |
| Potosi | | 1.461*** | 1.487*** | 1.697*** |
| | | (0.0469) | (0.0479) | (0.0612) |
| Tarija | | 10.26*** | 10.14*** | 13.59*** |
| | | (0.361) | (0.358) | (0.525) |
| Santa Cruz | | 0.817*** | 0.822*** | 0.795*** |
| | | (0.0176) | (0.0177) | (0.0191) |
| Beni | | 3.138*** | 3.318*** | 4.110*** |
| | | (0.110) | (0.117) | (0.159) |
| Pando | | 1.160*** | 1.199*** | 1.193*** |
| | | (0.0392) | (0.0406) | (0.0457) |
| Household_size | | | 0.917*** | 1.005 |
| | | | (0.00352) | (0.00450) |
| Age | | | | 0.923*** |
| | | | | (0.00119) |
| $Age^2$ | | | | 1.001*** |
| | | | | (1.79e-05) |
| Female | | | | 1.263*** |
| | | | | (0.0106) |
| Years of education | | | | 1.066*** |
| | | | | (0.00139) |
| Income | | | | 1.504*** |
| | | | | (0.0160) |
| Constant | 0.752*** | 0.614*** | 0.920*** | 0.0313*** |
| | (0.0146) | (0.0143) | (0.0258) | (0.00267) |
| Observations | 263,546 | 263,546 | 263,546 | 239,972 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 15: Second stage Health Insurance - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 0.598*** | 0.767*** | 0.752*** | 0.812*** |
| | (0.0123) | (0.0181) | (0.0177) | (0.0214) |
| Quechua | 0.737*** | 0.921*** | 0.906*** | 1.039 |
| | (0.0150) | (0.0208) | (0.0204) | (0.0263) |
| Other indigenous | 0.991 | 0.948 | 0.978 | 1.087 |
| | (0.0467) | (0.0448) | (0.0471) | (0.0573) |
| Afro-Bolivian | 0.597* | 0.754 | 0.688 | 0.841 |
| | (0.158) | (0.201) | (0.184) | (0.258) |
| *Base category: 2013* | | | | |
| 2015 | 0.784*** | 0.755*** | 0.750*** | 0.815*** |
| | (0.0207) | (0.0199) | (0.0198) | (0.0239) |
| 2016 | 0.902*** | 0.851*** | 0.831*** | 0.926*** |
| | (0.0233) | (0.0220) | (0.0215) | (0.0265) |
| 2017 | 0.843*** | 0.812*** | 0.788*** | 0.892*** |
| | (0.0219) | (0.0215) | (0.0209) | (0.0261) |
| 2018 | 0.931*** | 0.904*** | 0.867*** | 0.977 |
| | (0.0239) | (0.0236) | (0.0226) | (0.0281) |
| 2019 | 3.169*** | 3.335*** | 3.224*** | 4.283*** |
| | (0.0851) | (0.0913) | (0.0889) | (0.131) |
| Rural | | 0.805*** | 0.816*** | 1.121*** |
| | | (0.0150) | (0.0151) | (0.0252) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 1.565*** | 1.581*** | 1.810*** |
| | | (0.0524) | (0.0528) | (0.0678) |
| Cochamba | | 0.774*** | 0.773*** | 0.752*** |
| | | (0.0190) | (0.0190) | (0.0204) |
| Oruro | | 1.071** | 1.062* | 1.058 |
| | | (0.0361) | (0.0357) | (0.0397) |
| Potosi | | 1.410*** | 1.431*** | 1.612*** |
| | | (0.0517) | (0.0526) | (0.0659) |
| Tarija | | 9.206*** | 9.034*** | 11.96*** |
| | | (0.351) | (0.345) | (0.499) |
| Santa Cruz | | 0.808*** | 0.808*** | 0.772*** |
| | | (0.0198) | (0.0198) | (0.0211) |
| Beni | | 2.878*** | 3.006*** | 3.665*** |
| | | (0.110) | (0.115) | (0.154) |
| Pando | | 1.141*** | 1.172*** | 1.138*** |
| | | (0.0419) | (0.0432) | (0.0471) |
| Household_size | | | 0.917*** | 1.010** |
| | | | (0.00382) | (0.00492) |
| Age | | | | 0.922*** |
| | | | | (0.00131) |
| $Age^2$ | | | | 1.001*** |
| | | | | (1.96e-05) |
| Female | | | | 1.263*** |
| | | | | (0.0114) |
| Years of education | | | | 1.069*** |
| | | | | (0.00156) |
| Income | | | | 1.525*** |
| | | | | (0.0175) |
| Constant | 0.755*** | 0.628*** | 0.946* | 0.0286*** |
| | (0.0147) | (0.0157) | (0.0286) | (0.00264) |
| Observations | 226,928 | 226,928 | 226,928 | 206,726 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

## Outcome variable: Chronic Disease

*Table 16: Third stage Chronic Disease - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | 1.425*** | 1.709*** | 1.688*** | 1.062*** |
| | (0.0232) | (0.0310) | (0.0309) | (0.0218) |
| *Base category: 2013* | | | | |
| 2014 | 1.140*** | 1.152*** | 1.164*** | 1.267*** |
| | (0.0371) | (0.0374) | (0.0379) | (0.0447) |
| 2015 | 1.189*** | 1.181*** | 1.184*** | 1.291*** |
| | (0.0376) | (0.0372) | (0.0373) | (0.0441) |
| 2016 | 1.325*** | 1.318*** | 1.262*** | 1.467*** |
| | (0.0407) | (0.0406) | (0.0389) | (0.0489) |
| 2017 | 1.335*** | 1.346*** | 1.267*** | 1.433*** |
| | (0.0409) | (0.0414) | (0.0387) | (0.0474) |
| 2018 | 1.502*** | 1.526*** | 1.401*** | 1.529*** |
| | (0.0456) | (0.0465) | (0.0426) | (0.0505) |
| 2019 | 1.339*** | 1.347*** | 1.235*** | 1.238*** |
| | (0.0407) | (0.0410) | (0.0375) | (0.0407) |
| Rurality | | 1.123*** | 1.261*** | 1.003 |
| | | (0.0216) | (0.0295) | (0.0280) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 2.017*** | 2.062*** | 2.038*** |
| | | (0.0656) | (0.0660) | (0.0760) |
| Cochamba | | 1.349*** | 1.397*** | 1.400*** |
| | | (0.0329) | (0.0353) | (0.0378) |
| Oruro | | 0.823*** | 0.800*** | 0.692*** |
| | | (0.0338) | (0.0326) | (0.0297) |
| Potosi | | 1.070* | 1.094** | 1.032 |
| | | (0.0420) | (0.0425) | (0.0445) |
| Tarija | | 2.357*** | 2.219*** | 1.913*** |
| | | (0.0689) | (0.0651) | (0.0637) |
| Santa Cruz | | 1.848*** | 1.883*** | 2.008*** |
| | | (0.0451) | (0.0459) | (0.0526) |
| Beni | | 1.413*** | 1.637*** | 1.556*** |
| | | (0.0538) | (0.0633) | (0.0631) |
| Pando | | 1.094** | 1.248*** | 1.539*** |
| | | (0.0487) | (0.0570) | (0.0753) |
| Household_size | | | 0.791*** | 0.975*** |
| | | | (0.00414) | (0.00464) |
| Water source | | | 0.958* | 0.965 |
| | | | (0.0214) | (0.0241) |
| Toilet type | | | 0.889*** | 0.943** |
| | | | (0.0181) | (0.0225) |
| Age | | | | 1.108*** |
| | | | | (0.00194) |
| $Age^2$ | | | | 0.999*** |
| | | | | (1.85e-05) |
| Female | | | | 1.364*** |
| | | | | (0.0193) |
| Years of education | | | | 0.967*** |
| | | | | (0.00163) |
| Health insurance | | | | 1.378*** |
| | | | | (0.0246) |
| Income | | | | 1.010 |
| | | | | (0.0111) |
| Constant | 0.0760*** | 0.0500*** | 0.139*** | 0.00306*** |
| | (0.00186) | (0.00147) | (0.00496) | (0.000298) |
| Observations | 263,544 | 263,544 | 263,544 | 239,972 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 17: Fourth stage Chronic Disease - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 1.182*** | 1.704*** | 1.630*** | 0.960 |
| | (0.0287) | (0.0503) | (0.0475) | (0.0299) |
| Quechua | 1.731*** | 1.843*** | 1.798*** | 1.099*** |
| | (0.0395) | (0.0479) | (0.0468) | (0.0318) |
| Other Indigenous | 1.594*** | 1.448*** | 1.593*** | 1.292*** |
| | (0.0757) | (0.0719) | (0.0781) | (0.0694) |
| Afro-Bolivia | 1.490 | 1.692 | 1.354 | 1.045 |
| | (0.635) | (0.729) | (0.576) | (0.490) |
| *Base category: 2013* | | | | |
| 2015 | 1.184*** | 1.185*** | 1.183*** | 1.289*** |
| | (0.0375) | (0.0373) | (0.0374) | (0.0442) |
| 2016 | 1.307*** | 1.314*** | 1.255*** | 1.462*** |
| | (0.0402) | (0.0405) | (0.0387) | (0.0490) |
| 2017 | 1.321*** | 1.344*** | 1.260*** | 1.430*** |
| | (0.0406) | (0.0413) | (0.0386) | (0.0475) |
| 2018 | 1.493*** | 1.527*** | 1.395*** | 1.525*** |
| | (0.0453) | (0.0466) | (0.0425) | (0.0505) |
| 2019 | 1.322*** | 1.344*** | 1.227*** | 1.232*** |
| | (0.0402) | (0.0409) | (0.0373) | (0.0407) |
| Rurality | | 1.134*** | 1.249*** | 0.981 |
| | | (0.0232) | (0.0310) | (0.0290) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 1.950*** | 1.992*** | 1.940*** |
| | | (0.0749) | (0.0751) | (0.0836) |
| Cochamba | | 1.289*** | 1.318*** | 1.287*** |
| | | (0.0386) | (0.0404) | (0.0413) |
| Oruro | | 0.799*** | 0.767*** | 0.651*** |
| | | (0.0354) | (0.0336) | (0.0301) |
| Potosi | | 1.078* | 1.083* | 1.004 |
| | | (0.0488) | (0.0485) | (0.0500) |
| Tarija | | 2.338*** | 2.153*** | 1.824*** |
| | | (0.0775) | (0.0711) | (0.0673) |
| Santa Cruz | | 1.822*** | 1.811*** | 1.861*** |
| | | (0.0528) | (0.0520) | (0.0566) |
| Beni | | 1.469*** | 1.626*** | 1.470*** |
| | | (0.0624) | (0.0701) | (0.0664) |
| Pando | | 1.143*** | 1.260*** | 1.492*** |
| | | (0.0551) | (0.0622) | (0.0784) |
| Household_size | | | 0.787*** | 0.976*** |
| | | | (0.00445) | (0.00503) |
| Water source | | | 0.961* | 0.975 |
| | | | (0.0229) | (0.0260) |
| Toilet type | | | 0.908*** | 0.964 |
| | | | (0.0196) | (0.0244) |
| Age | | | | 1.108*** |
| | | | | (0.00208) |
| $Age^2$ | | | | 0.999*** |
| | | | | (1.99e-05) |
| Female | | | | 1.372*** |
| | | | | (0.0209) |
| Years of education | | | | 0.966*** |
| | | | | (0.00181) |
| Health insurance | | | | 1.381*** |
| | | | | (0.0264) |
| Income | | | | 1.009 |
| | | | | (0.0119) |

| | | | | |
|---|---|---|---|---|
| Constant | 0.0762*** | 0.0502*** | 0.145*** | 0.00312*** |
| | (0.00186) | (0.00163) | (0.00561) | (0.000328) |
| Observations | 226,926 | 226,926 | 226,926 | 206,726 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

## Outcome variable: Recent Disease

*Table 18: Third stage Recent Disease - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | 0.464*** | 1.229*** | 1.203*** | 1.109** |
| | (0.0163) | (0.0504) | (0.0492) | (0.0465) |
| *Base category: 2013* | | | | |
| 2014 | 0.344*** | 0.343*** | 0.338*** | 0.336*** |
| | (0.0319) | (0.0317) | (0.0313) | (0.0312) |
| 2015 | 1.266*** | 1.264*** | 1.242*** | 1.247*** |
| | (0.0796) | (0.0797) | (0.0783) | (0.0789) |
| 2016 | 3.283*** | 3.836*** | 3.765*** | 3.780*** |
| | (0.183) | (0.218) | (0.213) | (0.215) |
| 2017 | 1.769*** | 1.936*** | 1.899*** | 1.894*** |
| | (0.105) | (0.117) | (0.115) | (0.115) |
| 2018 | 1.627*** | 1.868*** | 1.818*** | 1.745*** |
| | (0.0978) | (0.115) | (0.112) | (0.108) |
| 2019 | 0.733*** | 0.812*** | 0.792*** | 0.779*** |
| | (0.0489) | (0.0549) | (0.0535) | (0.0525) |
| Rurality | | 0.924** | 0.857*** | 0.851*** |
| | | (0.0365) | (0.0384) | (0.0393) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.755** | 0.763* | 0.719** |
| | | (0.107) | (0.108) | (0.105) |
| Cochamba | | 1.406*** | 1.388*** | 1.365*** |
| | | (0.105) | (0.107) | (0.106) |
| Oruro | | 0.404*** | 0.391*** | 0.385*** |
| | | (0.0759) | (0.0739) | (0.0745) |
| Potosi | | 0.895 | 0.893 | 0.851 |
| | | (0.153) | (0.153) | (0.152) |
| Tarija | | 4.169*** | 4.174*** | 3.905*** |
| | | (0.324) | (0.327) | (0.313) |
| Santa Cruz | | 14.93*** | 15.12*** | 15.13*** |
| | | (0.887) | (0.896) | (0.905) |
| Beni | | 10.18*** | 9.993*** | 9.875*** |
| | | (0.709) | (0.725) | (0.720) |
| Pando | | 13.97*** | 13.66*** | 14.17*** |
| | | (0.986) | (1.032) | (1.086) |
| Household_size | | | 0.960*** | 0.976*** |
| | | | (0.00816) | (0.00893) |
| Water source | | | 0.984 | 0.985 |
| | | | (0.0428) | (0.0430) |
| Toilet type | | | 1.216*** | 1.216*** |
| | | | (0.0468) | (0.0484) |
| Age | | | | 1.031*** |
| | | | | (0.00238) |
| $Age^2$ | | | | 1.000*** |
| | | | | (3.08e-05) |
| Female | | | | 1.004 |
| | | | | (0.0186) |
| Years of education | | | | 0.977*** |
| | | | | (0.00256) |
| Health insurance | | | | 1.098*** |
| | | | | (0.0319) |
| Income | | | | 1.025 |
| | | | | (0.0197) |
| Constant | 0.0419*** | 0.00700*** | 0.00822*** | 0.00496*** |
| | (0.00207) | (0.000504) | (0.000654) | (0.000840) |
| Observations | 263,534 | 263,534 | 263,534 | 239,963 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 19: Fourth stage Recent Disease - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 0.239*** | 1.008 | 0.978 | 0.895 |
| | (0.0156) | (0.0764) | (0.0742) | (0.0680) |
| Quechua | 0.429*** | 1.340*** | 1.297*** | 1.158** |
| | (0.0219) | (0.0799) | (0.0774) | (0.0707) |
| Other Indigenous | 2.123*** | 1.269*** | 1.263*** | 1.216*** |
| | (0.134) | (0.0866) | (0.0855) | (0.0837) |
| Afro-Bolivia | 0.239*** | 1.008 | 0.978 | 0.895 |
| | (0.0156) | (0.0764) | (0.0742) | (0.0680) |
| *Base category: 2013* | | | | |
| 2015 | 1.241*** | 1.262*** | 1.238*** | 1.242*** |
| | (0.0781) | (0.0795) | (0.0780) | (0.0785) |
| 2016 | 3.269*** | 3.808*** | 3.735*** | 3.753*** |
| | (0.183) | (0.216) | (0.211) | (0.213) |
| 2017 | 1.764*** | 1.925*** | 1.887*** | 1.884*** |
| | (0.105) | (0.116) | (0.114) | (0.114) |
| 2018 | 1.613*** | 1.855*** | 1.803*** | 1.732*** |
| | (0.0971) | (0.114) | (0.111) | (0.107) |
| 2019 | 0.728*** | 0.806*** | 0.786*** | 0.774*** |
| | (0.0486) | (0.0544) | (0.0529) | (0.0521) |
| Rurality | | 0.917** | 0.845*** | 0.837*** |
| | | (0.0366) | (0.0384) | (0.0391) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.679*** | 0.688** | 0.652*** |
| | | (0.0993) | (0.101) | (0.0978) |
| Cochamba | | 1.277*** | 1.258*** | 1.242** |
| | | (0.105) | (0.107) | (0.106) |
| Oruro | | 0.383*** | 0.371*** | 0.366*** |
| | | (0.0726) | (0.0705) | (0.0711) |
| Potosi | | 0.797 | 0.797 | 0.767 |
| | | (0.145) | (0.146) | (0.145) |
| Tarija | | 3.850*** | 3.841*** | 3.581*** |
| | | (0.315) | (0.317) | (0.301) |
| Santa Cruz | | 12.99*** | 13.11*** | 13.03*** |
| | | (0.856) | (0.862) | (0.860) |
| Beni | | 9.494*** | 9.250*** | 9.062*** |
| | | (0.724) | (0.733) | (0.719) |
| Pando | | 13.26*** | 12.89*** | 13.28*** |
| | | (1.004) | (1.043) | (1.084) |
| Household size | | | 0.958*** | 0.975*** |
| | | | (0.00829) | (0.00902) |
| Water source | | | 0.984 | 0.986 |
| | | | (0.0430) | (0.0434) |
| Toilet type | | | 1.229*** | 1.232*** |
| | | | (0.0481) | (0.0499) |
| Age | | | | 1.030*** |
| | | | | (0.00244) |
| $Age^2$ | | | | 1.000*** |
| | | | | (3.15e-05) |
| Female | | | | 1.010 |
| | | | | (0.0191) |
| Years of education | | | | 0.977*** |
| | | | | (0.00263) |
| Health insurance | | | | 1.094*** |
| | | | | (0.0323) |
| Income | | | | 1.026 |
| | | | | (0.0201) |

| | | | | |
|---|---|---|---|---|
| Constant | 0.0421*** | 0.00781*** | 0.00926*** | 0.00558*** |
| | (0.00208) | (0.000598) | (0.000784) | (0.000966) |
| Observations | 226,916 | 226,916 | 226,916 | 206,717 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

## Outcome variable: Diarrhea

*Table 20: Third stage Diarrhea - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | 1.169*** | 1.120** | 1.093* | 1.104** |
| | (0.0506) | (0.0523) | (0.0514) | (0.0533) |
| *Base category: 2013* | | | | |
| 2014 | 1.267*** | 1.285*** | 1.255*** | 1.258*** |
| | (0.0765) | (0.0779) | (0.0764) | (0.0779) |
| 2015 | 1.165** | 1.172*** | 1.136** | 1.116* |
| | (0.0705) | (0.0711) | (0.0692) | (0.0702) |
| 2016 | 1.015 | 1.032 | 1.007 | 0.999 |
| | (0.0627) | (0.0641) | (0.0629) | (0.0635) |
| 2017 | 1.280*** | 1.308*** | 1.276*** | 1.275*** |
| | (0.0779) | (0.0799) | (0.0783) | (0.0798) |
| 2018 | 1.427*** | 1.445*** | 1.418*** | 1.426*** |
| | (0.0869) | (0.0885) | (0.0874) | (0.0893) |
| 2019 | 0.935 | 0.951 | 0.933 | 0.941 |
| | (0.0596) | (0.0608) | (0.0601) | (0.0616) |
| Rurality | | 1.332*** | 1.179*** | 1.098* |
| | | (0.0517) | (0.0545) | (0.0535) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.979 | 0.997 | 0.894 |
| | | (0.0765) | (0.0781) | (0.0727) |
| Cochamba | | 1.150*** | 1.111** | 1.085 |
| | | (0.0580) | (0.0592) | (0.0595) |
| Oruro | | 1.035 | 1.004 | 1.022 |
| | | (0.0801) | (0.0779) | (0.0814) |
| Potosi | | 1.160** | 1.162** | 1.085 |
| | | (0.0861) | (0.0869) | (0.0839) |
| Tarija | | 0.890* | 0.912 | 0.857** |
| | | (0.0614) | (0.0630) | (0.0607) |
| Santa Cruz | | 1.243*** | 1.265*** | 1.238*** |
| | | (0.0615) | (0.0629) | (0.0631) |
| Beni | | 1.365*** | 1.298*** | 1.281*** |
| | | (0.0926) | (0.0915) | (0.0921) |
| Pando | | 1.279*** | 1.212*** | 1.221*** |
| | | (0.0900) | (0.0890) | (0.0923) |
| Household size | | | 0.980** | 0.965*** |
| | | | (0.00889) | (0.00932) |
| Water source | | | 1.008 | 0.988 |
| | | | (0.0449) | (0.0450) |
| Toilet type | | | 1.285*** | 1.206*** |
| | | | (0.0510) | (0.0500) |
| Age | | | | 0.802*** |
| | | | | (0.00830) |
| Female | | | | 0.911*** |
| | | | | (0.0278) |
| Household head | | | | 0.973*** |
| Years of education | | | | |
| | | | | (0.00363) |
| Health insurance | | | | 1.167*** |
| | | | | (0.0419) |
| Income | | | | 0.958** |
| | | | | (0.0195) |
| Constant | 0.238*** | 0.196*** | 0.208*** | 0.608*** |
| | (0.0109) | (0.0111) | (0.0147) | (0.101) |
| Observations | 26,797 | 26,797 | 26,797 | 26,416 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 21: Fourth stage Diarrhea - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 1.072 | 1.210** | 1.178** | 1.223** |
| | (0.0772) | (0.0965) | (0.0943) | (0.100) |
| Quechua | 1.233*** | 1.112 | 1.085 | 1.084 |
| | (0.0840) | (0.0830) | (0.0815) | (0.0842) |
| Other Indigenous | 1.371*** | 1.051 | 1.039 | 1.019 |
| | (0.150) | (0.119) | (0.118) | (0.119) |
| Afro-Bolivian | 3.078* | 3.236* | 3.247* | 3.907** |
| | (1.950) | (2.126) | (2.161) | (2.708) |
| *Base category: 2013* | | | | |
| 2015 | 1.163** | 1.177*** | 1.142** | 1.122* |
| | (0.0705) | (0.0715) | (0.0698) | (0.0708) |
| 2016 | 1.012 | 1.032 | 1.010 | 1.001 |
| | (0.0626) | (0.0643) | (0.0633) | (0.0637) |
| 2017 | 1.279*** | 1.311*** | 1.281*** | 1.277*** |
| | (0.0779) | (0.0802) | (0.0789) | (0.0801) |
| 2018 | 1.426*** | 1.447*** | 1.424*** | 1.432*** |
| | (0.0869) | (0.0888) | (0.0880) | (0.0898) |
| 2019 | 0.933 | 0.952 | 0.936 | 0.947 |
| | (0.0595) | (0.0610) | (0.0605) | (0.0621) |
| Rurality | | 1.329*** | 1.187*** | 1.106* |
| | | (0.0556) | (0.0593) | (0.0582) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 1.036 | 1.062 | 0.952 |
| | | (0.0907) | (0.0932) | (0.0870) |
| Cochamba | | 1.201*** | 1.169** | 1.147** |
| | | (0.0710) | (0.0726) | (0.0735) |
| Oruro | | 1.010 | 0.984 | 0.998 |
| | | (0.0868) | (0.0848) | (0.0881) |
| Potosi | | 1.269*** | 1.279*** | 1.195** |
| | | (0.107) | (0.109) | (0.106) |
| Tarija | | 0.964 | 0.992 | 0.945 |
| | | (0.0729) | (0.0753) | (0.0735) |
| Santa Cruz | | 1.236*** | 1.258*** | 1.231*** |
| | | (0.0711) | (0.0727) | (0.0732) |
| Beni | | 1.487*** | 1.428*** | 1.418*** |
| | | (0.114) | (0.113) | (0.115) |
| Pando | | 1.356*** | 1.302*** | 1.320*** |
| | | (0.108) | (0.108) | (0.112) |
| Household size | | | 0.981* | 0.964*** |
| | | | (0.00982) | (0.0104) |
| Water source | | | 0.983 | 0.962 |
| | | | (0.0475) | (0.0476) |
| Toilet type | | | 1.290*** | 1.199*** |
| | | | (0.0555) | (0.0540) |
| Age | | | | 0.808*** |
| | | | | (0.00912) |
| Female | | | | 0.915*** |
| | | | | (0.0305) |
| Household head | | | | 0.971*** |
| Years of Education | | | | |
| | | | | (0.00417) |
| Health insurance | | | | 1.138*** |
| | | | | (0.0447) |
| Income | | | | 0.953** |
| | | | | (0.0211) |
| Constant | 0.237*** | 0.189*** | 0.199*** | 0.624*** |

| | | | | |
|---|---|---|---|---|
| | (0.0110) | (0.0116) | (0.0154) | (0.113) |
| Observations | 22,753 | 22,753 | 22,753 | 22,392 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

# Appendix C – Full Marginal Effects

## Outcome variable: Health Insurance

*Table 22: First stage Health Insurance – Full Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | -0.0865*** | -0.0339*** | -0.0364*** | -0.0122*** |
| | (0.00314) | (0.00317) | (0.00316) | (0.00321) |
| *Base category: 2013* | | | | |
| 2014 | -0.0355*** | -0.0351*** | -0.0351*** | -0.0219*** |
| | (0.00636) | (0.00573) | (0.00572) | (0.00553) |
| 2015 | -0.0555*** | -0.0593*** | -0.0604*** | -0.0379*** |
| | (0.00615) | (0.00557) | (0.00556) | (0.00538) |
| 2016 | -0.0231*** | -0.0342*** | -0.0390*** | -0.0149*** |
| | (0.00613) | (0.00555) | (0.00552) | (0.00534) |
| 2017 | -0.0392*** | -0.0440*** | -0.0500*** | -0.0219*** |
| | (0.00611) | (0.00566) | (0.00563) | (0.00544) |
| 2018 | -0.0161*** | -0.0216*** | -0.0304*** | -0.00506 |
| | (0.00612) | (0.00564) | (0.00561) | (0.00539) |
| 2019 | 0.277*** | 0.271*** | 0.262*** | 0.296*** |
| | (0.00611) | (0.00581) | (0.00585) | (0.00583) |
| Rural | | -0.0502*** | -0.0467*** | 0.0136*** |
| | | (0.00361) | (0.00358) | (0.00385) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.109*** | 0.110*** | 0.128*** |
| | | (0.00688) | (0.00681) | (0.00693) |
| Cochamba | | -0.0473*** | -0.0468*** | -0.0447*** |
| | | (0.00442) | (0.00439) | (0.00423) |
| Oruro | | 0.0233*** | 0.0217*** | 0.0163** |
| | | (0.00704) | (0.00697) | (0.00682) |
| Potosi | | 0.0863*** | 0.0898*** | 0.107*** |
| | | (0.00742) | (0.00739) | (0.00748) |
| Tarija | | 0.474*** | 0.471*** | 0.493*** |
| | | (0.00513) | (0.00518) | (0.00526) |
| Santa Cruz | | -0.0431*** | -0.0416*** | -0.0424*** |
| | | (0.00456) | (0.00453) | (0.00441) |
| Beni | | 0.264*** | 0.274*** | 0.294*** |
| | | (0.00774) | (0.00769) | (0.00776) |
| Pando | | 0.0331*** | 0.0402*** | 0.0345*** |
| | | (0.00760) | (0.00761) | (0.00758) |
| Household_size | | | -0.0180*** | 0.000863 |
| | | | (0.000786) | (0.000823) |
| Age | | | | -0.0148*** |
| | | | | (0.000229) |
| $Age^2$ | | | | 0.000228*** |
| | | | | (3.12e-06) |
| Female | | | | 0.0429*** |
| | | | | (0.00153) |
| Years of education | | | | 0.0118*** |
| | | | | (0.000234) |
| Income | | | | 0.0750*** |
| | | | -0.0180*** | (0.00190) |
| Observations | 263,546 | 263,546 | 263,546 | 239,972 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

*Table 23: Second stage Health Insurance – Full Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | -0.115*** | -0.0550*** | -0.0587*** | -0.0379*** |
| | (0.00443) | (0.00481) | (0.00477) | (0.00475) |
| Quechua | -0.0699*** | -0.0174*** | -0.0207*** | 0.00719 |
| | (0.00456) | (0.00473) | (0.00468) | (0.00473) |
| Other indigenous | -0.00206 | -0.0112 | -0.00458 | 0.0156 |
| | (0.0110) | (0.00995) | (0.0101) | (0.00994) |
| Afro-Bolivian | -0.116** | -0.0584 | -0.0763 | -0.0316 |
| | (0.0558) | (0.0535) | (0.0525) | (0.0552) |
| *Base category: 2013* | | | | |
| 2015 | -0.0567*** | -0.0594*** | -0.0607*** | -0.0375*** |
| | (0.00615) | (0.00558) | (0.00557) | (0.00539) |
| 2016 | -0.0246*** | -0.0348*** | -0.0397*** | -0.0144*** |
| | (0.00614) | (0.00556) | (0.00554) | (0.00535) |
| 2017 | -0.0402*** | -0.0444*** | -0.0505*** | -0.0213*** |
| | (0.00612) | (0.00566) | (0.00564) | (0.00545) |
| 2018 | -0.0171*** | -0.0218*** | -0.0307*** | -0.00430 |
| | (0.00612) | (0.00565) | (0.00562) | (0.00540) |
| 2019 | 0.276*** | 0.270*** | 0.261*** | 0.295*** |
| | (0.00611) | (0.00581) | (0.00585) | (0.00583) |
| Rural | | -0.0455*** | -0.0424*** | 0.0212*** |
| | | (0.00389) | (0.00386) | (0.00415) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.103*** | 0.104*** | 0.121*** |
| | | (0.00774) | (0.00767) | (0.00776) |
| Cochamba | | -0.0549*** | -0.0547*** | -0.0531*** |
| | | (0.00523) | (0.00520) | (0.00503) |
| Oruro | | 0.0152** | 0.0133* | 0.0110 |
| | | (0.00754) | (0.00746) | (0.00733) |
| Potosi | | 0.0782*** | 0.0811*** | 0.0967*** |
| | | (0.00844) | (0.00841) | (0.00843) |
| Tarija | | 0.453*** | 0.448*** | 0.469*** |
| | | (0.00583) | (0.00588) | (0.00594) |
| Santa Cruz | | -0.0460*** | -0.0456*** | -0.0484*** |
| | | (0.00526) | (0.00522) | (0.00508) |
| Beni | | 0.243*** | 0.251*** | 0.269*** |
| | | (0.00845) | (0.00836) | (0.00845) |
| Pando | | 0.0296*** | 0.0353*** | 0.0253*** |
| | | (0.00828) | (0.00827) | (0.00818) |
| Household_size | | | -0.0182*** | 0.00188** |
| | | | (0.000858) | (0.000902) |
| Age | | | | -0.0151*** |
| | | | | (0.000253) |
| $Age^2$ | | | | 0.000233*** |
| | | | | (3.44e-06) |
| Female | | | | 0.0432*** |
| | | | | (0.00165) |
| Years of education | | | | 0.0123*** |
| | | | | (0.000264) |
| Income | | | | 0.0780*** |
| | | | | (0.00207) |
| Observations | 226,928 | 226,928 | 226,928 | 206,726 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

## Outcome variable: Chronic Disease

*Table 24: Third stage Chronic Disease – Full Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | 0.0327*** | 0.0508*** | 0.0486*** | 0.00477*** |
| | (0.00160) | (0.00190) | (0.00187) | (0.00163) |
| *Base category: 2013* | | | | |
| 2014 | 0.00992*** | 0.0106*** | 0.0117*** | 0.0169*** |
| | (0.00245) | (0.00244) | (0.00250) | (0.00252) |
| 2015 | 0.0133*** | 0.0126*** | 0.0131*** | 0.0184*** |
| | (0.00242) | (0.00238) | (0.00242) | (0.00244) |
| 2016 | 0.0227*** | 0.0219*** | 0.0185*** | 0.0286*** |
| | (0.00244) | (0.00241) | (0.00241) | (0.00246) |
| 2017 | 0.0233*** | 0.0239*** | 0.0188*** | 0.0267*** |
| | (0.00244) | (0.00243) | (0.00240) | (0.00241) |
| 2018 | 0.0345*** | 0.0357*** | 0.0279*** | 0.0322*** |
| | (0.00252) | (0.00253) | (0.00247) | (0.00245) |
| 2019 | 0.0236*** | 0.0239*** | 0.0166*** | 0.0152*** |
| | (0.00242) | (0.00240) | (0.00235) | (0.00230) |
| Rurality | | 0.00992*** | 0.0195*** | 0.000246 |
| | | (0.00165) | (0.00198) | (0.00218) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.0623*** | 0.0627*** | 0.0568*** |
| | | (0.00336) | (0.00322) | (0.00335) |
| Cochamba | | 0.0224*** | 0.0247*** | 0.0240*** |
| | | (0.00186) | (0.00191) | (0.00196) |
| Oruro | | -0.0118*** | -0.0131*** | -0.0209*** |
| | | (0.00237) | (0.00226) | (0.00226) |
| Potosi | | 0.00458* | 0.00598** | 0.00206 |
| | | (0.00272) | (0.00265) | (0.00281) |
| Tarija | | 0.0812*** | 0.0710*** | 0.0508*** |
| | | (0.00317) | (0.00297) | (0.00283) |
| Santa Cruz | | 0.0525*** | 0.0528*** | 0.0554*** |
| | | (0.00216) | (0.00212) | (0.00214) |
| Beni | | 0.0264*** | 0.0388*** | 0.0326*** |
| | | (0.00318) | (0.00344) | (0.00322) |
| Pando | | 0.00617** | 0.0156*** | 0.0317*** |
| | | (0.00313) | (0.00343) | (0.00392) |
| Household_size | | | -0.0198*** | -0.00199*** |
| | | | (0.000432) | (0.000372) |
| Water source | | | -0.00363* | -0.00274 |
| | | | (0.00186) | (0.00193) |
| Toilet type | | | -0.00978*** | -0.00453** |
| | | | (0.00168) | (0.00185) |
| Age | | | | 0.00800*** |
| | | | | (0.000138) |
| $Age^2$ | | | | -4.23e-05*** |
| | | | | (1.46e-06) |
| Female | | | | 0.0243*** |
| | | | | (0.00110) |
| Years of education | | | | -0.00266*** |
| | | | | (0.000132) |
| Health insurance | | | | 0.0251*** |
| | | | | (0.00139) |
| Income | | | | 0.000771 |
| | | | | (0.000859) |
| Observations | 263,544 | 263,544 | 263,544 | 239,972 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 25: Fourth stage Chronic Disease – Full Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 0.0144*** | 0.0509*** | 0.0451*** | -0.00317 |
| | (0.00220) | (0.00327) | (0.00307) | (0.00239) |
| Quechua | 0.0553*** | 0.0603*** | 0.0563*** | 0.00760*** |
| | (0.00266) | (0.00302) | (0.00291) | (0.00237) |
| Other indigenous | 0.0454*** | 0.0331*** | 0.0426*** | 0.0216*** |
| | (0.00543) | (0.00507) | (0.00525) | (0.00481) |
| Afro-Bolivian | 0.0378 | 0.0501 | 0.0261 | 0.00346 |
| | (0.0469) | (0.0496) | (0.0409) | (0.0377) |
| *Base category: 2013* | | | | |
| 2015 | 0.0131*** | 0.0129*** | 0.0131*** | 0.0183*** |
| | (0.00243) | (0.00238) | (0.00245) | (0.00246) |
| 2016 | 0.0215*** | 0.0217*** | 0.0181*** | 0.0285*** |
| | (0.00244) | (0.00241) | (0.00243) | (0.00248) |
| 2017 | 0.0225*** | 0.0237*** | 0.0185*** | 0.0267*** |
| | (0.00245) | (0.00243) | (0.00242) | (0.00244) |
| 2018 | 0.0341*** | 0.0358*** | 0.0278*** | 0.0321*** |
| | (0.00253) | (0.00253) | (0.00249) | (0.00247) |
| 2019 | 0.0226*** | 0.0237*** | 0.0162*** | 0.0149*** |
| | (0.00241) | (0.00240) | (0.00237) | (0.00233) |
| Rural | | 0.0109*** | 0.0189*** | -0.00151 |
| | | (0.00178) | (0.00212) | (0.00233) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.0597*** | 0.0607*** | 0.0539*** |
| | | (0.00385) | (0.00371) | (0.00384) |
| Cochamba | | 0.0191*** | 0.0206*** | 0.0182*** |
| | | (0.00225) | (0.00229) | (0.00232) |
| Oruro | | -0.0138*** | -0.0158*** | -0.0249*** |
| | | (0.00259) | (0.00247) | (0.00248) |
| Potosi | | 0.00525 | 0.00546* | 0.000259 |
| | | (0.00320) | (0.00313) | (0.00333) |
| Tarija | | 0.0817*** | 0.0696*** | 0.0480*** |
| | | (0.00352) | (0.00327) | (0.00312) |
| Santa Cruz | | 0.0521*** | 0.0503*** | 0.0499*** |
| | | (0.00253) | (0.00246) | (0.00245) |
| Beni | | 0.0305*** | 0.0394*** | 0.0289*** |
| | | (0.00367) | (0.00388) | (0.00359) |
| Pando | | 0.00954*** | 0.0169*** | 0.0302*** |
| | | (0.00356) | (0.00383) | (0.00426) |
| household_size | | | -0.0204*** | -0.00193*** |
| | | | (0.000472) | (0.000405) |
| Water source | | | -0.00340* | -0.00202 |
| | | | (0.00201) | (0.00209) |
| Toilet type | | | -0.00818*** | -0.00290 |
| | | | (0.00180) | (0.00198) |
| Age | | | | 0.00810*** |
| | | | | (0.000150) |
| $Age^2$ | | | | -4.25e-05*** |
| | | | | (1.58e-06) |
| Female | | | | 0.0249*** |
| | | | | (0.00120) |
| Years of education | | | | -0.00269*** |
| | | | | (0.000147) |
| Health Insurance | | | | 0.0254*** |
| | | | | (0.00150) |
| Income | | | | 0.000719 |
| | | | | (0.000932) |
| Observations | 226,926 | 226,926 | 226,926 | 206,726 |

## Outcome variable: Recent Disease

*Table 26: Third stage Recent Disease – Full Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | -0.0289*** | 0.00901*** | 0.00802*** | 0.00449** |
| | (0.00113) | (0.00188) | (0.00185) | (0.00187) |
| *Base category: 2013* | | | | |
| 2014 | -0.0225*** | -0.0212*** | -0.0217*** | -0.0228*** |
| | (0.00189) | (0.00178) | (0.00180) | (0.00187) |
| 2015 | 0.00881*** | 0.00796*** | 0.00741*** | 0.00784*** |
| | (0.00231) | (0.00210) | (0.00212) | (0.00222) |
| 2016 | 0.0703*** | 0.0726*** | 0.0718*** | 0.0742*** |
| | (0.00299) | (0.00271) | (0.00272) | (0.00284) |
| 2017 | 0.0250*** | 0.0269*** | 0.0262*** | 0.0271*** |
| | (0.00250) | (0.00235) | (0.00237) | (0.00248) |
| 2018 | 0.0205*** | 0.0251*** | 0.0240*** | 0.0228*** |
| | (0.00244) | (0.00238) | (0.00239) | (0.00245) |
| 2019 | -0.00901*** | -0.00585*** | -0.00656*** | -0.00731*** |
| | (0.00199) | (0.00192) | (0.00193) | (0.00200) |
| Rurality | | -0.00326** | -0.00637*** | -0.00682*** |
| | | (0.00164) | (0.00186) | (0.00196) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | -0.00277** | -0.00269** | -0.00334** |
| | | (0.00128) | (0.00129) | (0.00133) |
| Cochamba | | 0.00454*** | 0.00435*** | 0.00428*** |
| | | (0.00101) | (0.00104) | (0.00109) |
| Oruro | | -0.00677*** | -0.00694*** | -0.00733*** |
| | | (0.00103) | (0.00102) | (0.00108) |
| Potosi | | -0.00118 | -0.00121 | -0.00177 |
| | | (0.00174) | (0.00176) | (0.00183) |
| Tarija | | 0.0339*** | 0.0340*** | 0.0326*** |
| | | (0.00236) | (0.00240) | (0.00245) |
| Santa Cruz | | 0.128*** | 0.130*** | 0.135*** |
| | | (0.00267) | (0.00284) | (0.00299) |
| Beni | | 0.0900*** | 0.0886*** | 0.0908*** |
| | | (0.00377) | (0.00386) | (0.00398) |
| Pando | | 0.121*** | 0.119*** | 0.127*** |
| | | (0.00471) | (0.00508) | (0.00544) |
| Household_size | | | -0.00170*** | -0.00102*** |
| | | | (0.000346) | (0.000385) |
| Water source | | | -0.000666 | -0.000654 |
| | | | (0.00179) | (0.00184) |
| Toilet type | | | 0.00829*** | 0.00848*** |
| | | | (0.00168) | (0.00178) |
| Age | | | | 0.00128*** |
| | | | | (9.82e-05) |
| $Age^2$ | | | | -1.42e-05*** |
| | | | | (1.31e-06) |
| Female | | | | 0.000166 |
| | | | | (0.000785) |
| Years of education | | | | -0.000974*** |
| | | | | (0.000111) |
| Health insurance | | | | 0.00395*** |
| | | | | (0.00123) |
| Income | | | | 0.00104 |
| | | | | (0.000817) |
| Observations | 263,534 | 263,534 | 263,534 | 239,963 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 27: Fourth stage Recent Disease – Full Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | -0.0466*** | 0.000361 | -0.00102 | -0.00499 |
| | (0.00134) | (0.00345) | (0.00339) | (0.00330) |
| Quechua | -0.0344*** | 0.0148*** | 0.0130*** | 0.00726** |
| | (0.00158) | (0.00328) | (0.00322) | (0.00315) |
| Other indigenous | 0.0598*** | 0.0118*** | 0.0116*** | 0.00984*** |
| | (0.00647) | (0.00365) | (0.00361) | (0.00369) |
| Afro-Bolivian | -0.00221 | -0.0111 | -0.0139 | -0.0173 |
| | (0.0281) | (0.0192) | (0.0173) | (0.0166) |
| *Base category: 2013* | | | | |
| 2015 | 0.00803*** | 0.00791*** | 0.00731*** | 0.00772*** |
| | (0.00231) | (0.00210) | (0.00212) | (0.00222) |
| 2016 | 0.0700*** | 0.0723*** | 0.0715*** | 0.0740*** |
| | (0.00299) | (0.00270) | (0.00272) | (0.00284) |
| 2017 | 0.0249*** | 0.0267*** | 0.0260*** | 0.0269*** |
| | (0.00251) | (0.00235) | (0.00237) | (0.00247) |
| 2018 | 0.0201*** | 0.0248*** | 0.0237*** | 0.0225*** |
| | (0.00245) | (0.00237) | (0.00239) | (0.00245) |
| 2019 | -0.00925*** | -0.00604*** | -0.00679*** | -0.00749*** |
| | (0.00200) | (0.00192) | (0.00193) | (0.00200) |
| Rural | | -0.00403** | -0.00779*** | -0.00844*** |
| | | (0.00185) | (0.00211) | (0.00222) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | -0.00445*** | -0.00436*** | -0.00509*** |
| | | (0.00151) | (0.00154) | (0.00159) |
| Cochamba | | 0.00380*** | 0.00356*** | 0.00349** |
| | | (0.00129) | (0.00133) | (0.00138) |
| Oruro | | -0.00860*** | -0.00882*** | -0.00932*** |
| | | (0.00126) | (0.00126) | (0.00132) |
| Potosi | | -0.00281 | -0.00283 | -0.00340 |
| | | (0.00208) | (0.00211) | (0.00221) |
| Tarija | | 0.0373*** | 0.0374*** | 0.0356*** |
| | | (0.00273) | (0.00277) | (0.00282) |
| Santa Cruz | | 0.136*** | 0.138*** | 0.142*** |
| | | (0.00316) | (0.00334) | (0.00350) |
| Beni | | 0.102*** | 0.0994*** | 0.101*** |
| | | (0.00455) | (0.00464) | (0.00475) |
| Pando | | 0.139*** | 0.136*** | 0.144*** |
| | | (0.00555) | (0.00596) | (0.00636) |
| Household size | | | -0.00198*** | -0.00121*** |
| | | | (0.000394) | (0.000435) |
| Water source | | | -0.000733 | -0.000688 |
| | | | (0.00201) | (0.00207) |
| Toilet type | | | 0.00979*** | 0.0101*** |
| | | | (0.00191) | (0.00203) |
| Age | | | | 0.00141*** |
| | | | | (0.000112) |
| $Age^2$ | | | | -1.55e-05*** |
| | | | | (1.49e-06) |
| Female | | | | 0.000469 |
| | | | | (0.000894) |
| Years of education | | | | -0.00109*** |
| | | | | (0.000128) |
| Health Insurance | | | | 0.00424*** |
| | | | | (0.00140) |
| Income | | | | 0.00121 |
| | | | | (0.000926) |
| Observations | 226,916 | 226,916 | 226,916 | 206,717 |

## Outcome variable: Diarrhea

*Table 28: Third stage Diarrhea – Full Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | 0.0274*** | 0.0196** | 0.0153* | 0.0166** |
| | (0.00781) | (0.00826) | (0.00822) | (0.00828) |
| *Base category: 2013* | | | | |
| 2014 | 0.0399*** | 0.0419*** | 0.0381*** | 0.0378*** |
| | (0.0101) | (0.0101) | (0.0101) | (0.0101) |
| 2015 | 0.0252** | 0.0259*** | 0.0208** | 0.0175* |
| | (0.00992) | (0.00984) | (0.00990) | (0.01000) |
| 2016 | 0.00230 | 0.00488 | 0.00115 | -0.000132 |
| | (0.00976) | (0.00974) | (0.00983) | (0.00980) |
| 2017 | 0.0418*** | 0.0452*** | 0.0412*** | 0.0401*** |
| | (0.0102) | (0.0102) | (0.0103) | (0.0103) |
| 2018 | 0.0620*** | 0.0636*** | 0.0606*** | 0.0604*** |
| | (0.0105) | (0.0105) | (0.0106) | (0.0106) |
| 2019 | -0.0104 | -0.00765 | -0.0107 | -0.00927 |
| | (0.00984) | (0.00980) | (0.00992) | (0.00993) |
| Rurality | | 0.0486*** | 0.0279*** | 0.0155* |
| | | (0.00656) | (0.00781) | (0.00805) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | -0.00339 | -0.000446 | -0.0172 |
| | | (0.0123) | (0.0125) | (0.0123) |
| Cochamba | | 0.0232*** | 0.0173** | 0.0133 |
| | | (0.00839) | (0.00879) | (0.00891) |
| Oruro | | 0.00558 | 0.000589 | 0.00349 |
| | | (0.0125) | (0.0124) | (0.0128) |
| Potosi | | 0.0246* | 0.0250* | 0.0133 |
| | | (0.0126) | (0.0128) | (0.0127) |
| Tarija | | -0.0180* | -0.0142 | -0.0234** |
| | | (0.0104) | (0.0106) | (0.0105) |
| Santa Cruz | | 0.0368*** | 0.0402*** | 0.0359*** |
| | | (0.00839) | (0.00850) | (0.00857) |
| Beni | | 0.0542*** | 0.0448*** | 0.0420*** |
| | | (0.0123) | (0.0125) | (0.0126) |
| Pando | | 0.0420*** | 0.0325** | 0.0334** |
| | | (0.0124) | (0.0127) | (0.0130) |
| Household size | | | -0.00342** | -0.00594*** |
| | | | (0.00153) | (0.00159) |
| Water source | | | 0.00131 | -0.00199 |
| | | | (0.00754) | (0.00752) |
| Toilet type | | | 0.0430*** | 0.0313*** |
| | | | (0.00690) | (0.00700) |
| Age | | | | -0.0366*** |
| | | | | (0.00168) |
| Female | | | | -0.0154*** |
| | | | | (0.00504) |
| Household head | | | | -0.00454*** |
| Years of education | | | | |
| | | | | (0.000616) |
| Health insurance | | | | 0.0255*** |
| | | | | (0.00593) |
| Income | | | | -0.00707** |
| | | | | (0.00337) |
| Observations | 26,797 | 26,797 | 26,797 | 26,416 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 29: Fourth stage Diarrhea – Full Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 0.0119 | 0.0332** | 0.0284** | 0.0345** |
| | (0.0124) | (0.0145) | (0.0144) | (0.0146) |
| Quechua | 0.0368*** | 0.0181 | 0.0139 | 0.0133 |
| | (0.0126) | (0.0131) | (0.0130) | (0.0131) |
| Other Indigenous | 0.0571*** | 0.00839 | 0.00645 | 0.00315 |
| | (0.0213) | (0.0193) | (0.0192) | (0.0191) |
| Afro-Bolivian | 0.239 | 0.250 | 0.250 | 0.287* |
| | (0.156) | (0.161) | (0.163) | (0.166) |
| *Base category: 2013* | | | | |
| 2015 | 0.0248** | 0.0265*** | 0.0217** | 0.0183* |
| | (0.00993) | (0.00985) | (0.00991) | (0.0100) |
| 2016 | 0.00182 | 0.00492 | 0.00158 | 0.000105 |
| | (0.00978) | (0.00975) | (0.00984) | (0.00981) |
| 2017 | 0.0416*** | 0.0455*** | 0.0417*** | 0.0404*** |
| | (0.0102) | (0.0102) | (0.0103) | (0.0103) |
| 2018 | 0.0619*** | 0.0638*** | 0.0612*** | 0.0610*** |
| | (0.0106) | (0.0105) | (0.0106) | (0.0106) |
| 2019 | -0.0108 | -0.00751 | -0.0101 | -0.00818 |
| | (0.00984) | (0.00980) | (0.00993) | (0.00995) |
| Rurality | | 0.0476*** | 0.0286*** | 0.0166* |
| | | (0.00700) | (0.00835) | (0.00861) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.00557 | 0.00942 | -0.00740 |
| | | (0.0138) | (0.0139) | (0.0137) |
| Cochamba | | 0.0299*** | 0.0252** | 0.0220** |
| | | (0.00964) | (0.0101) | (0.0103) |
| Oruro | | 0.00151 | -0.00249 | -0.000379 |
| | | (0.0133) | (0.0132) | (0.0136) |
| Potosi | | 0.0395*** | 0.0409*** | 0.0288** |
| | | (0.0145) | (0.0146) | (0.0146) |
| Tarija | | -0.00558 | -0.00122 | -0.00851 |
| | | (0.0115) | (0.0117) | (0.0117) |
| Santa Cruz | | 0.0348*** | 0.0380*** | 0.0339*** |
| | | (0.00943) | (0.00953) | (0.00966) |
| Beni | | 0.0687*** | 0.0610*** | 0.0591*** |
| | | (0.0138) | (0.0141) | (0.0142) |
| Pando | | 0.0514*** | 0.0441*** | 0.0460*** |
| | | (0.0139) | (0.0143) | (0.0146) |
| Household size | | | -0.00313* | -0.00602*** |
| | | | (0.00167) | (0.00176) |
| Water source | | | -0.00278 | -0.00632 |
| | | | (0.00804) | (0.00803) |
| Toilet type | | | 0.0432*** | 0.0301*** |
| | | | (0.00741) | (0.00754) |
| Age | | | | -0.0349*** |
| | | | | (0.00182) |
| Female | | | | -0.0145*** |
| | | | | (0.00546) |
| Household head | | | | -0.00489*** |
| Years of education | | | | |
| | | | | (0.000701) |
| Health insurance | | | | 0.0211*** |
| | | | | (0.00643) |
| Income | | | | -0.00785** |
| | | | | (0.00362) |
| Observations | 22,753 | 22,753 | 22,753 | 22,392 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

# Appendix D – Robustness Checks

## Independent variable: indigenous language spoken in childhood

*Table 30: Robustness check Health insurance - Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous language speaker | -0.110*** | -0.0574*** | -0.0642*** | -0.0429*** |
| | (0.00299) | (0.00302) | (0.00299) | (0.00327) |
| *Base category: 2013* | | | | |
| 2014 | -0.0355*** | -0.0349*** | -0.0349*** | -0.0214*** |
| | (0.00644) | (0.00579) | (0.00578) | (0.00552) |
| 2015 | -0.0407*** | -0.0436*** | -0.0445*** | -0.0384*** |
| | (0.00617) | (0.00559) | (0.00557) | (0.00537) |
| 2016 | -0.0279*** | -0.0371*** | -0.0427*** | -0.0158*** |
| | (0.00620) | (0.00560) | (0.00557) | (0.00533) |
| 2017 | -0.0413*** | -0.0436*** | -0.0505*** | -0.0229*** |
| | (0.00619) | (0.00571) | (0.00567) | (0.00543) |
| 2018 | -0.0140** | -0.0208*** | -0.0307*** | -0.00568 |
| | (0.00621) | (0.00571) | (0.00567) | (0.00539) |
| 2019 | 0.289*** | 0.282*** | 0.272*** | 0.295*** |
| | (0.00621) | (0.00589) | (0.00594) | (0.00584) |
| Rural | | -0.0446*** | -0.0397*** | 0.0193*** |
| | | (0.00370) | (0.00367) | (0.00387) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.114*** | 0.116*** | 0.132*** |
| | | (0.00696) | (0.00687) | (0.00691) |
| Cochamba | | -0.0397*** | -0.0384*** | -0.0409*** |
| | | (0.00444) | (0.00440) | (0.00423) |
| Oruro | | 0.0275*** | 0.0260*** | 0.0172** |
| | | (0.00712) | (0.00704) | (0.00681) |
| Potosi | | 0.0914*** | 0.0960*** | 0.113*** |
| | | (0.00759) | (0.00756) | (0.00752) |
| Tarija | | 0.485*** | 0.481*** | 0.489*** |
| | | (0.00509) | (0.00517) | (0.00521) |
| Santa Cruz | | -0.0458*** | -0.0443*** | -0.0447*** |
| | | (0.00447) | (0.00443) | (0.00430) |
| Beni | | 0.264*** | 0.275*** | 0.287*** |
| | | (0.00783) | (0.00777) | (0.00773) |
| Pando | | 0.0197** | 0.0266*** | 0.0280*** |
| | | (0.00765) | (0.00767) | (0.00750) |
| Household size | | | -0.0207*** | 0.000751 |
| | | | (0.000795) | (0.000823) |
| Age | | | | -0.0141*** |
| | | | | (0.000233) |
| $Age^2$ | | | | 0.000223*** |
| | | | | (3.13e-06) |
| Female | | | | 0.0428*** |
| | | | | (0.00153) |
| Years of education | | | | 0.0111*** |
| | | | | (0.000240) |
| Health Insurance | | | | 0.0731*** |
| | | | | (0.00191) |
| Income | | | | -0.0141*** |
| | | | | (0.000233) |
| Observations | 252,594 | 252,594 | 252,594 | 239,495 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 31: Robustness check Health Insurance - Predicted Probabilities*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Non-indigenous language speaker | 0.434*** | 0.423*** | 0.425*** | 0.411*** |
| | (0.00182) | (0.00167) | (0.00165) | (0.00161) |
| Indigenous language speaker | 0.325*** | 0.366*** | 0.361*** | 0.368*** |
| | (0.00261) | (0.00266) | (0.00265) | (0.00289) |
| Observations | 252,594 | 252,594 | 252,594 | 239,495 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 32: Robustness check Chronic Disease - Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous language speaker | 0.0811*** | 0.107*** | 0.103*** | 0.00725*** |
| | (0.00195) | (0.00240) | (0.00238) | (0.00179) |
| *Base category: 2013* | | | | |
| 2014 | 0.00936*** | 0.00979*** | 0.0114*** | 0.0169*** |
| | (0.00254) | (0.00251) | (0.00255) | (0.00251) |
| 2015 | 0.0109*** | 0.00976*** | 0.0113*** | 0.0188*** |
| | (0.00248) | (0.00242) | (0.00246) | (0.00244) |
| 2016 | 0.0242*** | 0.0246*** | 0.0221*** | 0.0291*** |
| | (0.00254) | (0.00252) | (0.00250) | (0.00245) |
| 2017 | 0.0255*** | 0.0264*** | 0.0218*** | 0.0272*** |
| | (0.00255) | (0.00254) | (0.00249) | (0.00241) |
| 2018 | 0.0340*** | 0.0346*** | 0.0278*** | 0.0324*** |
| | (0.00261) | (0.00260) | (0.00252) | (0.00245) |
| 2019 | 0.0244*** | 0.0248*** | 0.0186*** | 0.0156*** |
| | (0.00251) | (0.00249) | (0.00243) | (0.00230) |
| Rural | | -0.00447*** | 0.0122*** | 0.000327 |
| | | (0.00173) | (0.00206) | (0.00218) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.0501*** | 0.0522*** | 0.0565*** |
| | | (0.00332) | (0.00315) | (0.00334) |
| Cochamba | | 0.0118*** | 0.0170*** | 0.0231*** |
| | | (0.00183) | (0.00188) | (0.00193) |
| Oruro | | -0.0159*** | -0.0162*** | -0.0212*** |
| | | (0.00240) | (0.00229) | (0.00224) |
| Potosi | | -0.00501* | -0.00173 | 0.00171 |
| | | (0.00266) | (0.00259) | (0.00281) |
| Tarija | | 0.0914*** | 0.0805*** | 0.0513*** |
| | | (0.00330) | (0.00307) | (0.00278) |
| Santa Cruz | | 0.0567*** | 0.0559*** | 0.0556*** |
| | | (0.00220) | (0.00214) | (0.00209) |
| Beni | | 0.0398*** | 0.0568*** | 0.0334*** |
| | | (0.00357) | (0.00390) | (0.00326) |
| Pando | | 0.0183*** | 0.0324*** | 0.0326*** |
| | | (0.00364) | (0.00407) | (0.00395) |
| Household size | | | -0.0187*** | -0.00197*** |
| | | | (0.000431) | (0.000372) |
| Water source | | | -0.00918*** | -0.00301 |
| | | | (0.00191) | (0.00194) |
| Toilet type | | | -0.0168*** | -0.00475** |
| | | | (0.00173) | (0.00185) |
| Age | | | | 0.00802*** |
| | | | | (0.000140) |
| $Age^2$ | | | | -4.25e-05*** |
| | | | | (1.47e-06) |
| Female | | | | 0.0246*** |
| | | | | (0.00110) |
| Years of education | | | | -0.00249*** |
| | | | | (0.000136) |
| Health Insurance | | | | 0.0252*** |
| | | | | (0.00139) |
| Income | | | | 0.000774 |
| | | | | (0.000860) |
| Observations | 252,591 | 252,591 | 252,591 | 239,495 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 33: Robustness check Chronic Disease - Predicted Probabilities*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Non-indigenous language speaker | 0.0826*** | 0.0797*** | 0.0801*** | 0.101*** |
| | (0.000696) | (0.000679) | (0.000673) | (0.000840) |
| Indigenous language speaker | 0.164*** | 0.186*** | 0.183*** | 0.109*** |
| | (0.00184) | (0.00226) | (0.00224) | (0.00141) |
| Observations | 252,591 | 252,591 | 252,591 | 239,495 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 34: Robustness check Recent Disease - Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous language speaker | -0.0270*** | 0.0123*** | 0.0105*** | 0.00407** |
| | (0.00112) | (0.00196) | (0.00193) | (0.00192) |
| *Base category: 2013* | | | | |
| 2014 | -0.0230*** | -0.0216*** | -0.0221*** | -0.0227*** |
| | (0.00195) | (0.00181) | (0.00183) | (0.00187) |
| 2015 | 0.00779*** | 0.00710*** | 0.00654*** | 0.00796*** |
| | (0.00235) | (0.00212) | (0.00213) | (0.00222) |
| 2016 | 0.0697*** | 0.0752*** | 0.0744*** | 0.0746*** |
| | (0.00304) | (0.00277) | (0.00278) | (0.00283) |
| 2017 | 0.0246*** | 0.0278*** | 0.0272*** | 0.0273*** |
| | (0.00255) | (0.00241) | (0.00243) | (0.00248) |
| 2018 | 0.0212*** | 0.0246*** | 0.0237*** | 0.0228*** |
| | (0.00252) | (0.00241) | (0.00242) | (0.00245) |
| 2019 | -0.00903*** | -0.00582*** | -0.00647*** | -0.00723*** |
| | (0.00205) | (0.00197) | (0.00198) | (0.00200) |
| Rural | | -0.00329** | -0.00649*** | -0.00661*** |
| | | (0.00166) | (0.00188) | (0.00195) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | -0.00358*** | -0.00344*** | -0.00374*** |
| | | (0.00123) | (0.00125) | (0.00130) |
| Cochamba | | 0.00384*** | 0.00375*** | 0.00395*** |
| | | (0.00103) | (0.00106) | (0.00109) |
| Oruro | | -0.00721*** | -0.00734*** | -0.00754*** |
| | | (0.00105) | (0.00104) | (0.00108) |
| Potosi | | -0.00190 | -0.00185 | -0.00199 |
| | | (0.00172) | (0.00174) | (0.00184) |
| Tarija | | 0.0346*** | 0.0348*** | 0.0321*** |
| | | (0.00237) | (0.00241) | (0.00238) |
| Santa Cruz | | 0.131*** | 0.132*** | 0.134*** |
| | | (0.00258) | (0.00276) | (0.00285) |
| Beni | | 0.0955*** | 0.0935*** | 0.0910*** |
| | | (0.00396) | (0.00406) | (0.00404) |
| Pando | | 0.128*** | 0.125*** | 0.127*** |
| | | (0.00492) | (0.00533) | (0.00544) |
| Household size | | | -0.00159*** | -0.00101*** |
| | | | (0.000351) | (0.000385) |
| Water source | | | -0.000888 | -0.000666 |
| | | | (0.00183) | (0.00184) |
| Toilet type | | | 0.00868*** | 0.00853*** |
| | | | (0.00172) | (0.00178) |
| Age | | | | 0.00127*** |
| | | | | (9.96e-05) |
| $Age^2$ | | | | -1.41e-05*** |
| | | | | (1.32e-06) |
| Female | | | | 0.000133 |
| | | | | (0.000785) |
| Years of education | | | | -0.000952*** |
| | | | | (0.000113) |
| Health Insurance | | | | 0.00402*** |
| | | | | (0.00123) |
| Income | | | | 0.00101 |
| | | | | (0.000819) |
| Observations | 252,581 | 252,581 | 252,581 | 239,486 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 35: Robustness check Recent Disease - Predicted Probabilities*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Non-indigenous language speaker | 0.0547*** | 0.0477*** | 0.0478*** | 0.0492*** |
| | (0.000778) | (0.000642) | (0.000642) | (0.000665) |
| Indigenous language speaker | 0.0277*** | 0.0600*** | 0.0583*** | 0.0532*** |
| | (0.000901) | (0.00188) | (0.00186) | (0.00181) |
| Observations | 252,581 | 252,581 | 252,581 | 239,486 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 36: Robustness check Diarrhea - Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous language speaker | 0.0558*** | 0.0286* | 0.0229 | 0.0329* |
| | (0.0157) | (0.0164) | (0.0162) | (0.0172) |
| *Base category: 2013* | | | | |
| 2014 | 0.0331*** | 0.0344*** | 0.0311*** | 0.0322*** |
| | (0.0119) | (0.0119) | (0.0120) | (0.0124) |
| 2015 | 0.0765*** | 0.0760*** | 0.0712*** | 0.0196* |
| | (0.0108) | (0.0107) | (0.0108) | (0.0114) |
| 2016 | 0.00301 | 0.00369 | 0.000902 | 0.00145 |
| | (0.0115) | (0.0115) | (0.0116) | (0.0121) |
| 2017 | 0.0526*** | 0.0539*** | 0.0506*** | 0.0552*** |
| | (0.0122) | (0.0122) | (0.0123) | (0.0129) |
| 2018 | 0.0685*** | 0.0699*** | 0.0679*** | 0.0744*** |
| | (0.0126) | (0.0126) | (0.0127) | (0.0132) |
| 2019 | 0.000985 | 0.00234 | 7.93e-05 | 0.00111 |
| | (0.0114) | (0.0114) | (0.0116) | (0.0121) |
| Rural | | 0.0380*** | 0.0201** | 0.0108 |
| | | (0.00780) | (0.00902) | (0.00932) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | -0.00812 | -0.00370 | -0.0203 |
| | | (0.0145) | (0.0147) | (0.0145) |
| Cochamba | | 0.0121 | 0.00868 | 0.00506 |
| | | (0.00992) | (0.0104) | (0.0106) |
| Oruro | | 0.00594 | 0.00195 | 0.00371 |
| | | (0.0152) | (0.0150) | (0.0154) |
| Potosi | | 0.0194 | 0.0208 | 0.00949 |
| | | (0.0151) | (0.0152) | (0.0150) |
| Tarija | | -0.0339*** | -0.0287** | -0.0382*** |
| | | (0.0116) | (0.0118) | (0.0118) |
| Santa Cruz | | 0.0117 | 0.0155 | 0.0111 |
| | | (0.00959) | (0.00972) | (0.00986) |
| Beni | | 0.0386*** | 0.0318** | 0.0290** |
| | | (0.0143) | (0.0145) | (0.0147) |
| Pando | | 0.0466*** | 0.0385** | 0.0367** |
| | | (0.0147) | (0.0151) | (0.0154) |
| Household size | | | -0.00350* | -0.00453** |
| | | | (0.00180) | (0.00187) |
| Water source | | | -0.00223 | -0.00374 |
| | | | (0.00865) | (0.00867) |
| Toilet type | | | 0.0419*** | 0.0332*** |
| | | | (0.00793) | (0.00813) |
| Age | | | | -0.0416*** |
| | | | | (0.00296) |
| Female | | | | -0.00664 |
| | | | | (0.00608) |
| Household head | | | | -0.00292*** |
| Years of education | | | | |
| | | | | (0.000719) |
| Health Insurance | | | | 0.0242*** |
| | | | | (0.00683) |
| Income | | | | -0.00484 |
| | | | | (0.00402) |
| Observations | 16,269 | 16,269 | 16,269 | 15,956 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 37: Robustness check Diarrhea - Predicted Probabilities*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Non-indigenous language speaker | 0.182*** | 0.183*** | 0.183*** | 0.181*** |
| | (0.00319) | (0.00323) | (0.00323) | (0.00324) |
| Indigenous language speaker | 0.237*** | 0.211*** | 0.206*** | 0.214*** |
| | (0.0154) | (0.0158) | (0.0157) | (0.0166) |
| Observations | 16,269 | 16,269 | 16,269 | 15,956 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

## Independent variable: all indigenous

*Table 38: Robustness check Health insurance - Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| All indigenous | -0.0903*** | -0.0367*** | -0.0440*** | -0.0286*** |
| | (0.00375) | (0.00375) | (0.00370) | (0.00392) |
| *Base category: 2013* | | | | |
| 2014 | -0.0364*** | -0.0356*** | -0.0357*** | -0.0219*** |
| | (0.00646) | (0.00581) | (0.00580) | (0.00554) |
| 2015 | -0.0660*** | -0.0647*** | -0.0686*** | -0.0500*** |
| | (0.0114) | (0.0104) | (0.0102) | (0.00984) |
| 2016 | -0.0283*** | -0.0378*** | -0.0435*** | -0.0161*** |
| | (0.00623) | (0.00562) | (0.00560) | (0.00535) |
| 2017 | -0.0404*** | -0.0434*** | -0.0505*** | -0.0224*** |
| | (0.00621) | (0.00573) | (0.00570) | (0.00545) |
| 2018 | -0.0155** | -0.0215*** | -0.0319*** | -0.00594 |
| | (0.00623) | (0.00573) | (0.00569) | (0.00540) |
| 2019 | 0.289*** | 0.282*** | 0.272*** | 0.294*** |
| | (0.00622) | (0.00591) | (0.00596) | (0.00584) |
| Rural | | -0.0509*** | -0.0467*** | 0.0187*** |
| | | (0.00391) | (0.00389) | (0.00412) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.121*** | 0.123*** | 0.142*** |
| | | (0.00738) | (0.00728) | (0.00728) |
| Cochamba | | -0.0421*** | -0.0412*** | -0.0417*** |
| | | (0.00472) | (0.00468) | (0.00450) |
| Oruro | | 0.0363*** | 0.0344*** | 0.0235*** |
| | | (0.00753) | (0.00745) | (0.00718) |
| Potosi | | 0.0940*** | 0.0989*** | 0.117*** |
| | | (0.00793) | (0.00790) | (0.00780) |
| Tarija | | 0.481*** | 0.476*** | 0.482*** |
| | | (0.00556) | (0.00565) | (0.00566) |
| Santa Cruz | | -0.0345*** | -0.0327*** | -0.0347*** |
| | | (0.00491) | (0.00486) | (0.00469) |
| Beni | | 0.281*** | 0.292*** | 0.303*** |
| | | (0.00838) | (0.00835) | (0.00823) |
| Pando | | 0.0344*** | 0.0420*** | 0.0414*** |
| | | (0.00829) | (0.00830) | (0.00808) |
| Household size | | | -0.0214*** | 0.000804 |
| | | | (0.000864) | (0.000893) |
| Age | | | | -0.0143*** |
| | | | | (0.000243) |
| $Age^2$ | | | | 0.000224*** |
| | | | | (3.29e-06) |
| Female | | | | 0.0438*** |
| | | | | (0.00164) |
| Years of education | | | | 0.0113*** |
| | | | | (0.000252) |
| Health Insurance | | | | 0.0752*** |
| | | | | (0.00206) |
| Income | | | | -0.0143*** |
| | | | | (0.000243) |
| Observations | 219,515 | 219,515 | 219,515 | 210,177 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 39: Robustness check Health Insurance - Predicted Probabilities*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Non-indigenous | 0.433*** | 0.424*** | 0.425*** | 0.416*** |
| | (0.00191) | (0.00175) | (0.00173) | (0.00167) |
| All indigenous | 0.342*** | 0.388*** | 0.382*** | 0.387*** |
| | (0.00335) | (0.00339) | (0.00337) | (0.00358) |
| Observations | 219,515 | 219,515 | 219,515 | 210,177 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 40: Robustness check Chronic Disease - Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| All indigenous | 0.0748*** | 0.0938*** | 0.0881*** | 0.00312 |
| | (0.00248) | (0.00295) | (0.00289) | (0.00202) |
| *Base category: 2013* | | | | |
| 2014 | 0.0100*** | 0.0107*** | 0.0120*** | 0.0173*** |
| | (0.00258) | (0.00255) | (0.00261) | (0.00256) |
| 2015 | 0.0161*** | 0.0184*** | 0.0174*** | 0.0189*** |
| | (0.00470) | (0.00477) | (0.00474) | (0.00448) |
| 2016 | 0.0245*** | 0.0245*** | 0.0216*** | 0.0297*** |
| | (0.00257) | (0.00254) | (0.00255) | (0.00249) |
| 2017 | 0.0249*** | 0.0255*** | 0.0207*** | 0.0276*** |
| | (0.00257) | (0.00255) | (0.00253) | (0.00245) |
| 2018 | 0.0357*** | 0.0363*** | 0.0289*** | 0.0330*** |
| | (0.00265) | (0.00264) | (0.00258) | (0.00249) |
| 2019 | 0.0247*** | 0.0249*** | 0.0182*** | 0.0160*** |
| | (0.00254) | (0.00251) | (0.00248) | (0.00234) |
| Rural | | 0.00276 | 0.0156*** | 0.000729 |
| | | (0.00189) | (0.00224) | (0.00234) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | 0.0559*** | 0.0576*** | 0.0544*** |
| | | (0.00365) | (0.00349) | (0.00356) |
| Cochamba | | 0.0198*** | 0.0240*** | 0.0242*** |
| | | (0.00207) | (0.00213) | (0.00211) |
| Oruro | | -0.0147*** | -0.0159*** | -0.0224*** |
| | | (0.00263) | (0.00251) | (0.00240) |
| Potosi | | -0.00176 | 0.000884 | 0.00160 |
| | | (0.00294) | (0.00287) | (0.00300) |
| Tarija | | 0.0772*** | 0.0668*** | 0.0458*** |
| | | (0.00346) | (0.00322) | (0.00299) |
| Santa Cruz | | 0.0537*** | 0.0537*** | 0.0554*** |
| | | (0.00240) | (0.00234) | (0.00229) |
| Beni | | 0.0291*** | 0.0436*** | 0.0284*** |
| | | (0.00366) | (0.00397) | (0.00342) |
| Pando | | 0.00677* | 0.0185*** | 0.0275*** |
| | | (0.00367) | (0.00405) | (0.00418) |
| Household size | | | -0.0198*** | -0.00191*** |
| | | | (0.000476) | (0.000406) |
| Water source | | | -0.00703*** | -0.00286 |
| | | | (0.00208) | (0.00208) |
| Toilet type | | | -0.0128*** | -0.00421** |
| | | | (0.00191) | (0.00201) |
| Age | | | | 0.00830*** |
| | | | | (0.000151) |
| $Age^2$ | | | | -4.45e-05*** |
| | | | | (1.58e-06) |
| Female | | | | 0.0241*** |
| | | | | (0.00119) |
| Years of education | | | | -0.00265*** |
| | | | | (0.000143) |
| Health Insurance | | | | 0.0253*** |
| | | | | (0.00150) |
| Income | | | | 0.000881 |
| | | | | (0.000935) |
| Observations | 219,513 | 219,513 | 219,513 | 210,177 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 41: Robustness check Chronic Disease - Predicted Probabilities*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Non-indigenous | 0.0901*** | 0.0883*** | 0.0888*** | 0.105*** |
| | (0.000761) | (0.000750) | (0.000744) | (0.000846) |
| All indigenous | 0.165*** | 0.182*** | 0.177*** | 0.108*** |
| | (0.00235) | (0.00279) | (0.00273) | (0.00168) |
| Observations | 219,513 | 219,513 | 219,513 | 210,177 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 42: Robustness check Recent Disease - Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Non-indigenous | -0.0300*** | 0.00722*** | 0.00544** | 0.000220 |
| | (0.00130) | (0.00248) | (0.00242) | (0.00234) |
| *Base category: 2013* | | | | |
| 2014 | -0.0227*** | -0.0210*** | -0.0215*** | -0.0222*** |
| | (0.00192) | (0.00177) | (0.00179) | (0.00183) |
| 2015 | 0.000708 | 0.00177 | 0.00160 | 0.00148 |
| | (0.00522) | (0.00489) | (0.00491) | (0.00499) |
| 2016 | 0.0693*** | 0.0736*** | 0.0728*** | 0.0731*** |
| | (0.00301) | (0.00271) | (0.00272) | (0.00278) |
| 2017 | 0.0248*** | 0.0272*** | 0.0266*** | 0.0267*** |
| | (0.00253) | (0.00236) | (0.00238) | (0.00243) |
| 2018 | 0.0205*** | 0.0242*** | 0.0232*** | 0.0223*** |
| | (0.00248) | (0.00236) | (0.00237) | (0.00241) |
| 2019 | -0.00891*** | -0.00574*** | -0.00644*** | -0.00711*** |
| | (0.00203) | (0.00192) | (0.00193) | (0.00196) |
| Rural | | -0.00235 | -0.00549*** | -0.00572*** |
| | | (0.00176) | (0.00201) | (0.00207) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | -0.00411*** | -0.00401*** | -0.00437*** |
| | | (0.00139) | (0.00141) | (0.00144) |
| Cochamba | | 0.00391*** | 0.00369*** | 0.00390*** |
| | | (0.00113) | (0.00116) | (0.00120) |
| Oruro | | -0.00781*** | -0.00799*** | -0.00817*** |
| | | (0.00119) | (0.00118) | (0.00121) |
| Potosi | | -0.00166 | -0.00166 | -0.00194 |
| | | (0.00197) | (0.00200) | (0.00207) |
| Tarija | | 0.0368*** | 0.0368*** | 0.0342*** |
| | | (0.00265) | (0.00269) | (0.00266) |
| Santa Cruz | | 0.128*** | 0.129*** | 0.130*** |
| | | (0.00281) | (0.00300) | (0.00307) |
| Beni | | 0.0906*** | 0.0888*** | 0.0874*** |
| | | (0.00410) | (0.00423) | (0.00423) |
| Pando | | 0.129*** | 0.127*** | 0.129*** |
| | | (0.00530) | (0.00578) | (0.00591) |
| Household size | | | -0.00170*** | -0.00108** |
| | | | (0.000385) | (0.000421) |
| Water source | | | -9.01e-05 | -0.000242 |
| | | | (0.00199) | (0.00199) |
| Toilet type | | | 0.00788*** | 0.00739*** |
| | | | (0.00184) | (0.00189) |
| Age | | | | 0.00127*** |
| | | | | (0.000105) |
| $Age^2$ | | | | -1.38e-05*** |
| | | | | (1.38e-06) |
| Female | | | | 0.000492 |
| | | | | (0.000833) |
| Years of education | | | | -0.00103*** |
| | | | | (0.000119) |
| Health Insurance | | | | 0.00373*** |
| | | | | (0.00130) |
| Income | | | | 0.00128 |
| | | | | (0.000872) |
| Observations | 219,503 | 219,503 | 219,503 | 210,168 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 43: Robustness check Recent Disease - Predicted Probabilities*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Non-indigenous | 0.0541*** | 0.0486*** | 0.0487*** | 0.0496*** |
| | (0.000817) | (0.000689) | (0.000688) | (0.000705) |
| All indigenous | 0.0240*** | 0.0558*** | 0.0542*** | 0.0498*** |
| | (0.00105) | (0.00238) | (0.00233) | (0.00222) |
| Observations | 219,503 | 219,503 | 219,503 | 210,168 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 44: Robustness check Diarrhea - Marginal Effects*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| All indigenous | 0.0698*** | 0.0516** | 0.0449** | 0.0496** |
| | (0.0200) | (0.0211) | (0.0207) | (0.0215) |
| *Base category: 2013* | | | | |
| 2014 | 0.0325*** | 0.0339*** | 0.0307** | 0.0290** |
| | (0.0120) | (0.0119) | (0.0120) | (0.0118) |
| 2015 | 0.0380 | 0.0380 | 0.0365 | 0.0352 |
| | (0.0521) | (0.0529) | (0.0529) | (0.0569) |
| 2016 | 0.00243 | 0.00402 | 0.00117 | 0.00195 |
| | (0.0115) | (0.0115) | (0.0115) | (0.0115) |
| 2017 | 0.0516*** | 0.0532*** | 0.0500*** | 0.0520*** |
| | (0.0123) | (0.0122) | (0.0123) | (0.0123) |
| 2018 | 0.0686*** | 0.0701*** | 0.0678*** | 0.0726*** |
| | (0.0127) | (0.0126) | (0.0127) | (0.0127) |
| 2019 | 0.000642 | 0.00291 | 0.000489 | 0.00325 |
| | (0.0115) | (0.0115) | (0.0116) | (0.0116) |
| Rural | | 0.0375*** | 0.0190* | 0.0137 |
| | | (0.00860) | (0.0101) | (0.0104) |
| *Base category: La Paz* | | | | |
| Chiquisaca | | -0.0116 | -0.00868 | -0.0211 |
| | | (0.0161) | (0.0163) | (0.0162) |
| Cochamba | | 0.00174 | -0.00353 | -0.00332 |
| | | (0.0111) | (0.0117) | (0.0119) |
| Oruro | | -0.00569 | -0.0103 | -0.00800 |
| | | (0.0163) | (0.0161) | (0.0167) |
| Potosi | | -0.0201 | -0.0194 | -0.0279* |
| | | (0.0156) | (0.0158) | (0.0156) |
| Tarija | | -0.0428*** | -0.0401*** | -0.0509*** |
| | | (0.0128) | (0.0130) | (0.0129) |
| Santa Cruz | | 0.0119 | 0.0152 | 0.0128 |
| | | (0.0110) | (0.0112) | (0.0113) |
| Beni | | 0.0354** | 0.0266 | 0.0219 |
| | | (0.0161) | (0.0163) | (0.0164) |
| Pando | | 0.0269* | 0.0175 | 0.0170 |
| | | (0.0162) | (0.0166) | (0.0167) |
| Household size | | | -0.00301 | -0.00428** |
| | | | (0.00206) | (0.00215) |
| Water source | | | 0.00191 | -0.000769 |
| | | | (0.00995) | (0.00986) |
| Toilet type | | | 0.0375*** | 0.0283*** |
| | | | (0.00907) | (0.00915) |
| Age | | | | -0.0534*** |
| | | | | (0.00409) |
| Female | | | | -0.0105 |
| | | | | (0.00678) |
| Household head | | | | -0.00325*** |
| Years of education | | | | |
| | | | | (0.000794) |
| Health Insurance | | | | 0.0161** |
| | | | | (0.00761) |
| Income | | | | -0.00179 |
| | | | | (0.00461) |
| Observations | 16,269 | 16,269 | 16,269 | 15,956 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 45: Robustness check Diarrhea - Predicted Probabilities*

| **Variables** | **Model (1)** | **Model (2)** | **Model (3)** | **Model (4)** |
|---|---|---|---|---|
| Non-indigenous language speaker | 0.170*** | 0.170*** | 0.171*** | 0.170*** |
| | (0.00356) | (0.00358) | (0.00359) | (0.00358) |
| Indigenous language speaker | 0.240*** | 0.222*** | 0.216*** | 0.220*** |
| | (0.0196) | (0.0205) | (0.0202) | (0.0209) |
| Observations | 12,330 | 12,330 | 12,330 | 12,229 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

## Models with household fixed effects[1]

*Table 46: Household fixed effects First stage Health Insurance - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | 0.697*** | 0.697*** | 0.697*** | 0.926* |
| | (0.0243) | (0.0243) | (0.0243) | (0.0408) |
| Age | | | | 0.909*** |
| | | | | (0.00272) |
| $Age^2$ | | | | 1.002*** |
| | | | | (4.21e-05) |
| Female | | | | 1.541*** |
| | | | | (0.0249) |
| Years of education | | | | 1.044*** |
| | | | | (0.00283) |
| Observations | 98,081 | 98,081 | 98,081 | 71,783 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 47: Household fixed effects Second stage Health Insurance - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 0.658*** | 0.658*** | 0.658*** | 0.815*** |
| | (0.0350) | (0.0350) | (0.0350) | (0.0513) |
| Quechua | 0.760*** | 0.760*** | 0.760*** | 1.003 |
| | (0.0386) | (0.0386) | (0.0386) | (0.0658) |
| Other indigenous | 0.788** | 0.788** | 0.788** | 1.007 |
| | (0.0928) | (0.0928) | (0.0928) | (0.152) |
| Afro-Bolivian | 0.999 | 0.999 | 0.999 | 0.930 |
| | (0.541) | (0.541) | (0.541) | (0.511) |
| Age | | | | 0.908*** |
| | | | | (0.00299) |
| $Age^2$ | | | | 1.002*** |
| | | | | (4.61e-05) |
| Female | | | | 1.537*** |
| | | | | (0.0266) |
| Years of education | | | | 1.048*** |
| | | | | (0.00319) |
| Observations | 84,749 | 84,749 | 84,749 | 62,357 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

[1] Since many variables were omitted due to the use of household fixed effecst, these analyses contain smaller sample sizes. Odd ratios are given because postestimations were not possible.

*Table 48: Household fixed effects Third stage Chronic Disease - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | 6.156*** | 6.156*** | 6.156*** | 1.153*** |
| | (0.279) | (0.279) | (0.279) | (0.0632) |
| Age | | | | 1.123*** |
| | | | | (0.00300) |
| $Age^2$ | | | | 0.999*** |
| | | | | (3.21e-05) |
| Female | | | | 1.352*** |
| | | | | (0.0265) |
| Years of education | | | | 0.960*** |
| | | | | (0.00304) |
| Health Insurance | | | | 1.520*** |
| | | | | (0.0594) |
| Observations | 67,823 | 67,823 | 67,823 | 62,187 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 49: Household fixed effects Fourth stage Chronic Disease - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 6.598*** | 6.598*** | 6.598*** | 1.158* |
| | (0.492) | (0.492) | (0.492) | (0.0993) |
| Quechua | 6.248*** | 6.248*** | 6.248*** | 1.176** |
| | (0.395) | (0.395) | (0.395) | (0.0887) |
| Other indigenous | 5.214*** | 5.214*** | 5.214*** | 1.563*** |
| | (0.671) | (0.671) | (0.671) | (0.221) |
| Afro-Bolivian | 0.730 | 0.730 | 0.730 | 0.499 |
| | (0.582) | (0.582) | (0.582) | (0.386) |
| Age | | | | 1.123*** |
| | | | | (0.00321) |
| $Age^2$ | | | | 0.999*** |
| | | | | (3.44e-05) |
| Female | | | | 1.345*** |
| | | | | (0.0281) |
| Years of education | | | | 0.957*** |
| | | | | (0.00338) |
| Health Insurance | | | | 1.540*** |
| | | | | (0.0641) |
| Observations | 84,749 | 84,749 | 84,749 | 62,357 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 50: Household fixed effects Third stage Recent Disease - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Indigenous | 1.780*** | 1.780*** | 1.780*** | 1.162* |
| | (0.133) | (0.133) | (0.133) | (0.0949) |
| Age | | | | 1.034*** |
| | | | | (0.00425) |
| $Age^2$ | | | | 1.000*** |
| | | | | (5.64e-05) |
| Female | | | | 0.975 |
| | | | | (0.0280) |
| Years of education | | | | 0.990** |
| | | | | (0.00444) |
| Health Insurance | | | | 1.277*** |
| | | | | (0.0676) |
| Observations | 24,555 | 24,555 | 24,555 | 21,050 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 51: Household fixed effects Fourth stage Recent Disease - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 1.330** | 1.330** | 1.330** | 0.867 |
| | (0.191) | (0.191) | (0.191) | (0.130) |
| Quechua | 1.912*** | 1.912*** | 1.912*** | 1.217* |
| | (0.207) | (0.207) | (0.207) | (0.142) |
| Other indigenous | 2.068*** | 2.068*** | 2.068*** | 1.422** |
| | (0.279) | (0.279) | (0.279) | (0.203) |
| Afro-Bolivian | 0.561 | 0.561 | 0.561 | 0.385 |
| | (0.765) | (0.765) | (0.765) | (0.451) |
| Age | | | | 1.033*** |
| | | | | (0.00434) |
| $Age^2$ | | | | 1.000*** |
| | | | | (5.77e-05) |
| Female | | | | 0.986 |
| | | | | (0.0289) |
| Years of education | | | | 0.992* |
| | | | | (0.00463) |
| Health Insurance | | | | 1.247*** |
| | | | | (0.0672) |
| Observations | 23,572 | 23,572 | 23,572 | 20,209 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 52: Household fixed effects Third stage Diarrhea - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| All indigenous | 0.729 | 0.729 | 0.729 | 1.670 |
| | (0.300) | (0.300) | (0.300) | (0.756) |
| Age | | | | 0.743*** |
| | | | | (0.0194) |
| Female | | | | 0.978 |
| | | | | (0.0843) |
| Health Insurance | | | | 1.515** |
| | | | | (0.260) |
| Observations | 2,723 | 2,723 | 2,723 | 2,669 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

*Table 53: Household fixed effects Fourth stage Diarrhea - Odds Ratios*

| **Variables** | Model (1) | Model (2) | Model (3) | Model (4) |
|---|---|---|---|---|
| *Base category: Non-indigenous* | | | | |
| Aymara | 0.678 | 0.678 | 0.678 | 1.723 |
| | (0.552) | (0.552) | (0.552) | (1.526) |
| Quechua | 0.740 | 0.740 | 0.740 | 2.137 |
| | (0.484) | (0.484) | (0.484) | (1.472) |
| Other indigenous | 0.319 | 0.319 | 0.319 | 0.414 |
| | (0.346) | (0.346) | (0.346) | (0.344) |
| Afro-Bolivian | 0.678 | 0.678 | 0.678 | 1.723 |
| | (0.552) | (0.552) | (0.552) | (1.526) |
| Age | | | | 0.753*** |
| | | | | (0.0215) |
| Female | | | | 0.966 |
| | | | | (0.0910) |
| Health Insurance | | | | 1.458** |
| | | | | (0.269) |
| Observations | 2,269 | 2,269 | 2,269 | 2,215 |

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1