

Water Affordability, Water Quality and their Consequences for Health and Education in Indonesia

Ahmad Komarulzaman

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*“... By means of water,
We give life to everything,”*
—Q.S. Al-Anbiya: 30

Dedicated to My father Cecep Iskandar, My mother Empat Fatimah,
My wife Tisa Mudi Anggarini, & My daughter Naila Cetta Sasikirana.

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Chapter 1

INTRODUCTION

1.1. Water, Health and Development

Clean and affordable water is a human right. It is a necessity for human life and well-being. Nevertheless, the provision of water is still a major problem in developing countries. Safe water infrastructure serves less than half of the population in developing countries and is distributed unevenly (UNICEF and WHO, 2015). Public (water) utilities often serve only middle and upper class households, while poor households are served by informal providers or rely on free water sources. In comparison to piped water, water from informal providers is more expensive and often of lower quality. Accordingly, poor households tend to pay a higher price for water than rich households (Gleick, 2004; World Bank, 1994). The poorest households, who cannot afford a piped water connection or water from informal providers, have to fetch water from free sources. These free water sources are often of questionable quality and may be located far away from the premises.

The use of poor quality water with a high contamination risk increases the occurrence of water borne diseases, primarily diarrhoea, which is the second leading cause of infant mortality globally (WHO and UNICEF, 2013a; WHO, 2017). Due to the lack of safe drinking water, sanitation and hygiene diarrhoea is more prevalent in developing countries (UNICEF and WHO, 2009; WHO, 2017).

The impact of poor water access extends beyond health to the economic and development aspects of life in the form of lost workdays, school absenteeism and school dropout. The lack of safe water at the premises necessitates the members of households to spend more time on fetching fresh water. This can harm those who have to collect water, who are mostly women and children (UNDP, 2006). Moreover, the health burden of unsafe water might reduce the time children can obtain education. This directly reduces the household's capacity to improve their human capital (WWAP, 2016). In the long run, those who have often been ill may later in their lives be less able to earn money. Consequently, these circumstances may lead to poverty and deprive economic growth.

The foregoing means that poor households have a higher chance of paying more for water and are hurt most by the lack of safe water. Due to availability and affordability issues, these households tend to have less access to safe water, which may result in lack of hygiene and a higher chance of water borne diseases. They have to use more time for collecting clean water, and hence have less time for education and income generating activities. This situation may lead to lower productivity and increased poverty and thus a vicious cycle sets in.

This thesis attempts to shed more light on the water, health and development linkage by taking the case of Indonesia. Indonesia is a developing economy where access to safe water still is a serious problem. The coverage of piped water is limited and it is unevenly distributed. This low coverage is exacerbated by fluctuating debit and frequent supply

interruptions. Given these circumstances, households are forced to use water from informal providers, such as mobile vendors and refilling (bottled water) depots that are relatively expensive. The majority of households cannot afford these expensive sources of water and thus have to use water from free sources, which are often of low quality and prone to contamination issues.

1.2. Water Supply Setting in Indonesia

Indonesia is home to 3.5% of the global population and has access to 4.7% of the freshwater resources of the planet (The World Bank, 2017). Hence, it is fair to say that Indonesia is not a water scarce country. However, uneven distribution together with mediocre water management and a lack of water infrastructures make that a significant number of households in the country have inadequate access to safe water.

Unlike the situation in developed countries where (almost) all households are served by a good piped water system, households in Indonesia rely on a variety of water sources. These water sources can be classified into piped water (metered and retailed), bottled water (branded and refillable) and other water sources.

Piped water is produced through a purification and sanitation process before it is distributed to consumers through a piping network (known as metered piped water) or by retail/mobile water sellers using trucks or carts (known as retailed piped water or tanker truck water). Piped water, both metered and retailed, is produced by a PAM (drinking water company), PDAM (regional drinking water company) or BPAM (drinking water management agency), which can be managed by the government or are private companies. The unit price of water from metered and retailed piped is about IDR 4.97 and IDR 25 per litre, respectively (PDAM Bandung, 2016). In addition to this, a onetime connection fee of about IDR 1.5 million (BPPSPAM, 2015) is needed to enjoy metered piped water at the premises. The supply of metered piped water is often intermittent—on average, water is running for 19.22 hours per day (BPPSPAM, 2015) —which increase (re)contamination risks and make the water not drinkable. Hence, most of the time a point-of-use water treatment, such as boiling, is needed to make the water drinkable. Given its delivery system, retailed piped water is more vulnerable to hygiene issues. Figure 1.1 shows the quality differences between water sources in Indonesia on the basis of their association with diarrhoea prevalence. It is clear that the quality of retailed piped water is lower than that of metered piped water.

Two types of bottled water are recognized in Indonesia: branded and refillable bottled water. Branded bottled water is of similar type and quality to the one sold in developed countries. This drinking water is produced and distributed by beverages companies in a

sealed bottle. The water undergoes comprehensive treatment and strict quality control as part of a strict implementation of regulations and regular monitoring by the government. Branded bottled water marketed in different packaging starting from glass/cup packaging (240 ml), small bottle (330 ml, 600 ml, and 1,500 ml) to big bottle (19 litres). The water in a glass or cup and small bottle are commonly consumed for certain occasions such as during travelling, meeting, or party. Meanwhile, the 19 litres bottled water is meant for daily consumption. The 240 ml branded bottled water is sold around IDR 500 per bottle (IDR 2,083.33 per litre), while the 19 litres is sold around IDR 16,000 per bottle (IDR 842.11 per litre).

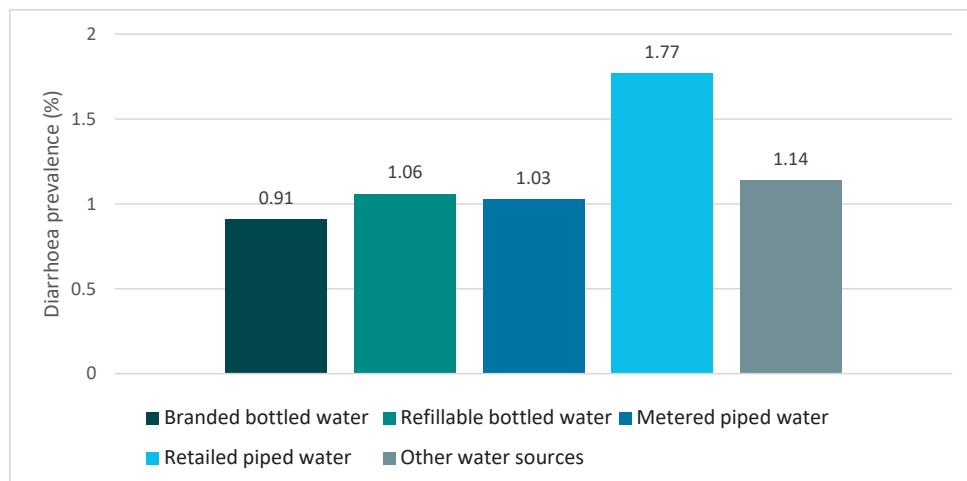


Figure 1.1 Diarrhoea prevalence by main source of drinking water, Indonesia, Susenas 2015

Unlike branded bottled water that is sold in a sealed bottle at retail stores, refillable bottled water is sold by refilling 19 litres bottles at small, privately owned local refilling depots. In these depots, the raw water is treated on-site using ultrafiltration or a reverse osmosis membrane together with UV disinfection (Keman, 2005). Provided the treatment process is properly carried out, any biological and chemical contamination of the raw water is removed (Sima and Elimelech, 2013). The price of the treated water is about IDR 4,000 per 19 litre bottle (IDR 210.53 per litre). The operation of refilling depots is regulated by the central government and must be monitored by the local government where the depot is located. However, unlike branded bottled water that is strictly regulated and monitored, the operation of refilling depots is not well monitored due to lack of resources of local governments. During recent years, the situation has worsened due to a rapid increase in the number of refilling depots. A recent study shows that refillable bottled water is often not properly treated and that the depots' hygiene and

operation are not well maintained, increasing contamination risks (Rahayu et al., 2013). Hence, it is no surprise that in an earlier study the water from about 40% of refilling depots was found to be contaminated by faecal coliform (Eflin, 2008). As can be seen in Figure 1.1, the quality of refillable bottled water (as indicated by diarrhoea prevalence) is lower than that of branded bottled water and metered piped water.

Other water sources include drilled/pumped wells, protected wells, protected springs, rain water, unprotected wells, unprotected springs, rivers, and others. Most of the water from these sources can be obtained freely by the households. The quality of these water sources varies but is often lower than that of metered piped water and bottled water.

The water supply setting in Indonesia shares the complexity of the water supply in other developing countries. It is characterized by, among others, a low rate of access to piped water, dominance of free water sources, the use of multiple water sources, low quality of water, and a rising trend towards the use of bottled water. Figure 1.2 shows the main sources of water used for different purposes. Only 17% of Indonesian households use metered piped water as the main source of water for drinking, cooking and bathing. The low development and unreliability of piped water in Indonesia has stimulates households to develop coping strategies. These strategies include the switch to refillable bottled water and using multiple water sources for different purposes. In total, about 21% of households use refillable bottled water, compared to 9% who use branded bottled water, for drinking or cooking. Recent data shows that the use of multiple water sources is prevalent to 41% of Indonesian households (Statistics Indonesia, 2015a). Only about 25% of households pay for the water they use (Statistics Indonesia, 2015a).

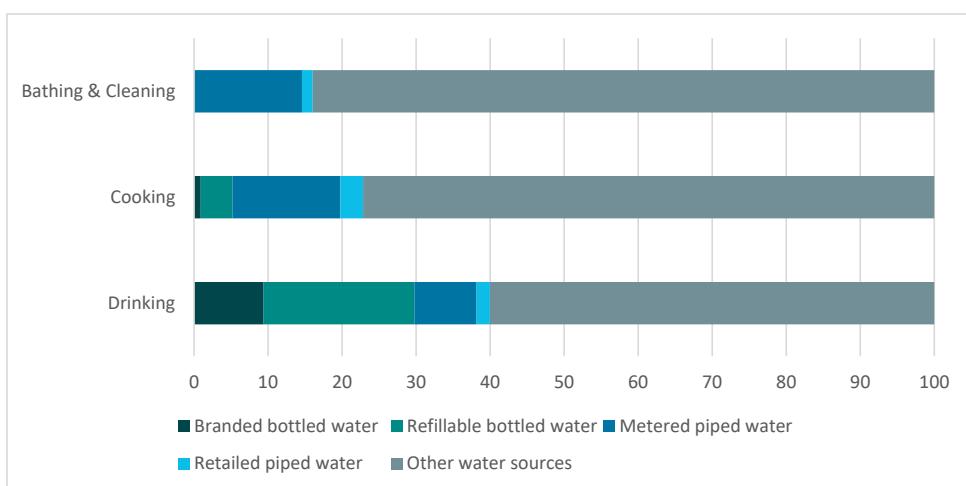


Figure 1.2 Main water sources for drinking, cooking, and bathing & cleaning, Indonesia, Susenas 2015 (% households)

1.3. Conceptual Framework

Access to safe water is critical for households' health and social dignity. Lack of safe water access takes a significant toll on health and comes at a sizeable loss of economic activity (WWAP, 2015). Accordingly, our conceptual framework assumes that access to safe water sources would have implications for family health and education outcomes. However, the households' access to different water sources depends on whether these are affordable.

Though water is crucial for human wellbeing, inequitable access to water supply invariably hurts poor households. Poor households in developing countries are less likely to be connected to a safe water source, either because safe water is expensive or because a water network is not available in the vicinity of these households. Hence, even if a water network is present in the vicinity, households with a low income find it difficult to connect due to affordability issue. Arrow A in Figure 1.3 highlights the affordability of different water sources. In this study we will pay in particular attention to households that are not paying for water. Even though water affordability issues in developing countries are well researched, research tends to focus on households that are pay for their water supply (Banerjee et al., 2008; Gawel et al., 2013; Lee, 2011; Sebri, 2015; Smets, 2009). Hardly any study includes the non-paying households. Given that generally a substantial number, often the majority, of households in developing countries use a free source, more attention should be given to the affordability issue among this group of households (Banerjee et al., 2008; Gawel et al., 2013). Given that these households get water for free, it is tempting to conclude that they have no affordability problem (Lee, 2011). This might be true for (rich) households who can, for example, dig a borehole in their premises and pump up as much water as they need for free. However, such a claim seems unrealistic for the large majority of poor households, as the free sources they use are often of questionable quality and need to be fetched from a distant location. It is therefore more likely that these households are use free sources as they have limited choices and cannot afford water of better quality (Dungumaro, 2007; UNDP, 2006).

Arrow B in Figure 1.3 highlights the recent increasing trend towards the use of refillable bottled water in Indonesia. Specifically, on the factors that drive the households to switch to refillable bottled water. As previously explained, refillable bottled water is expensive and often of questionable quality. Nevertheless, this form of bottled water is increasingly used by households in Indonesia for drinking and food preparation purposes. When households cannot access water from a utility network, using water that is served by informal providers such as refillable bottled water becomes a viable alternative for those who can pay the higher price (Sima and Elimelech, 2013). Moreover, studies found that the decision to switch to bottled water is driven by three major motives: concern about the health risks of other sources of drinking water (risk aversion motive) (Francisco, 2014; Johnstone and Serret, 2012), belief in the health benefits of bottled water (healthier

perception motive) (Anadu and Harding, 2000; Francisco, 2014; Gleick, 2010), and consumption of bottled water as a taste and lifestyle choice (lifestyle motive) (Ward et al., 2009; York et al., 2011).

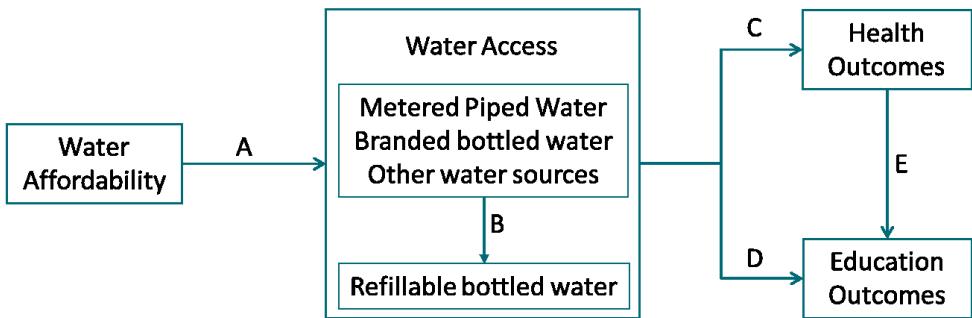


Figure 1.3 Affordability, access, health and education

Arrow C in Figure 1.3 highlights the impact of water access, on health outcome. A considerable amount of literature has been published on the health benefit of safe water access (Andres et al., 2014; Corsi et al., 2011; Fewtrell et al., 2005). The availability of clean water and of hygienic conditions are significantly related with public health, such as diarrhoea incidence (Clasen & Haller, 2008; Gamper-Rabindran, Khan, & Timmins, 2010; Mangyo, 2008; Ozkan et al., 2007; Semba et al., 2009). Specifically, Clasen & Haller (2008) estimated that about 94 percent of the burden of diarrhoea in developing countries is caused by unsafe water, lack of sanitation and poor hygiene. Furthermore, UNICEF and WHO (2009) found that the number of diarrhoea incidences can be decreased by one-third to one-fourth through a better environment which includes better conditions of those three attributes.

Lastly, the effect of safe water access on education outcome is depicted by arrows D and E in Figure 1.3. The lack of access to safe water may force children to be absent from school (Dreibelbis et al., 2013) or drop out from school completely (Nauges and Strand, 2013). There are at least two channels through which water access influences school attendance. First, households with no access to water in the dwelling have to transport the water into the house from outside, a job usually carried out by women and children. This condition is a burden on the children, who lose energy and have less time to study (Dreibelbis et al., 2013; Nauges and Strand, 2013). Hence, lack of access to safe water might directly affect educational outcome (arrow D in Figure 1.3). Second, the lack of access to clean water increases the probability of diarrhoea (Cairncross and Valdmanis, 2007; Wolf et al., 2014) and other hygiene issues among children, which might further reduce school attendance.

(Azor-Martínez et al., 2014; Neuzil et al., 2002). This indirect effect of safe water access on schooling is depicted by arrow E in Figure 1.3.

1.4. Research Questions

The aim of the current thesis is to analyse the water-health-development linkage in developing countries by taking the case of Indonesia. To achieve this aim, we have formulated the following four research questions:

1. Is water affordable? More specifically, is it affordable for households that are pay for their water (the revealed water affordability), as well for those that use water from free sources (the “hidden” water affordability).
2. To what extent and for which reasons do households switch their main source of drinking water to refillable bottled water?
3. What is the effect of (lack of) access to clean water on health outcomes? More specifically, to what extend does access to and treatment of water at the household level and water coverage at the community level, influence the prevalence of diarrhoea? Under which conditions are these effects strong?
4. What are the direct and indirect effects of access to water on school enrolment and absenteeism from school?

1.5. Data and Methods

1.5.1. Data

This thesis uses the following datasets: the Indonesian Demographic Health Survey 2007 and 2012, the annual Indonesia National Socio Economic Survey (Susenas) from 1994 to 2015, and Indonesian household panel socio-economic survey (Susenas panel) 2008 – 2010.

In Chapter 2 and 5, the annual Indonesia National Socio Economic Survey (Susenas) waves of 1994 to 2015 are used. Susenas contains household characteristics and household members' information on age, sex, education, health, and working activities. In addition, Susenas collects information on consumption, expenditure, socio-cultural characteristics and education, as well as on health and housing. For the analysis in Chapter 2, we have derived a households-level dataset with information on 285,908 households in 510 districts and 34 provinces from the Susenas survey of 2015. For the analysis in Chapter 5, the annual cross-sectional Susenas data were used to construct a balanced district panel of 259 of the 291 Indonesian districts over a period of 1994-2014. This district-level panel was created by aggregating individual and household information to the district level. The district code that was used is based on the 1994 geographical definition of districts.

Districts that were split up during the study period were merged into their 1994 parent district.

In chapter 3, we combined the 2008 and the 2010 panel round of the Indonesian household panel socio-economic survey (Susenas panel), in which 66,724 households were followed during three consecutive years. This panel dataset allows us to track the changes in drinking water choices for a large number of households in Indonesia and relate these changes to characteristics of the households.

In chapter 4, we use a cross-sectional household dataset derived from the Indonesian Demographic Health Surveys 2007 and 2012. These DHS surveys were designed to be representative at the national, urban, rural, as well as provincial level. Both datasets collected information on demographic, socioeconomic, and health-related issues. This combined dataset includes data on 33,399 children under age five, from 28,573 mothers, living in 3,069 subdistricts, within 922 districts, within 33 provinces. To study the role of the context, the household-level data were supplemented with context information at subdistrict level. This subdistrict information was aggregated from household data.

1.5.2. Methods

The methods used in each chapter are selected based on the nature of the research question, the data that are used, and the contribution to the body of knowledge we aimed to achieve. The analysis of water affordability in Chapter 2 is descriptive in nature and hence no statistical model is needed. The analysis is focused on the calculation of the net affordability ratio (NAR), i.e. the proportion of household's income/expenditure spent on the water consumption needed for fulfilling domestic essential needs and to maintain a minimum or acceptable living standard (Kessides et al., 2009). Water is said to be unaffordable for a given households when the costs of water are more than 4% of the household's income. For households with free water sources, who therefore do not report any water expenditures, we use the opportunity cost or shadow price approach to determine the price they would have to pay for better quality water. In practice, we estimate this water price on the basis of the average price paid by other households in the same area.

To analyse the driving factors of the switch to refillable bottled water in Chapter 3, we apply logistic regression analysis. The dependent variable is a dummy variable indicating whether (1) or not (0) the household switched its main source of drinking water to refillable bottled water between 2008 and 2010. The investigation is divided into three sub-analyses, which are based on the household's initial main source of drinking water: metered piped water, branded bottled water, or other water sources. In each analysis we include both households and community level factors. In addition, given the different

water supply settings in urban and rural areas, we include interactions between urbanization and the other explanatory variables.

In Chapter 4 we evaluate the effect of water access at household and community level on diarrhoea prevalence. Given that this is by its nature a multilevel problem, we apply a multilevel estimation technique. The outcome variable is a binary variable indicating whether (1) or not (0) a child suffered from diarrhoea during the two weeks before the survey. Hence, multilevel logistic regression is used. We apply four level models because we use data on households nested within subdistricts nested within districts nested within provinces. Children and households are considered to be at the same level, as the average number of children per households was small (1.2). The model contains explanatory variables at households and subdistricts levels.

In Chapter 5, panel fixed effect analyses on district panel data are used for estimating three types of models: a model for diarrhoea prevalence, one for school absenteeism and one for school enrolment. In the diarrhoea prevalence model, the dependent variable is the percentage of primary school-age children in a given district in a given year that suffered from diarrhoea in the past two weeks. This model is constructed to examine the effect of the quality and the location of water facilities on diarrhoea prevalence. The results from this analysis are used to find out whether there are indirect effect of water quality and location of water facilities on school absenteeism and enrolment. In the school absenteeism model, the outcome variable is the percentage of primary school students absent from school due to health complaint(s) during the past month. The dependent variable in the school enrolment model is the percentage of children age 7 to 15 enrolled in primary school. The last two models are constructed to evaluate the effect of diarrhoea prevalence and location of water facilities on educational outcomes. These model take into account both the cross section and time series variation in all variables. Thus, these models have the ability to infer the causality of, in our case, the water on diarrhoea prevalence and on schooling.

1.6. Overview of Chapters

This thesis consists of six chapters. Besides the current first chapter (Introduction) and the last chapter (Conclusion), there are four chapters that are based on papers.

Chapter 2 concentrates on the affordability of different water sources and is related to research question 1. The main theme of this chapter is the affordability of safe water sources in a developing country context. This chapter looks besides at households who pay for their water also at households who are using a free water source, because households who do not pay for their water may suffer from what we call a “hidden” water

affordability problem. They may use less quality water from a free source because they do not have the money to buy water from a better quality and safer source. Using data of the Indonesia National Socio Economic Survey (Susenas) 2015, we determine the net affordability ratio (NAR) for all households, those who pay for their water supply as well as those with free water sources. Subsequently, we estimate the extend of both the revealed as well as the hidden affordability problem in Indonesia. As far as we know, this is the first time this “hidden” affordability is estimated.

Chapter 3 deals with research question 2 and concentrates on the increase of the consumption of refillable bottled water in Indonesia, which comes with a serious health risk. We investigate the motives of households for switching to refillable bottled water as their main source of drinking water. For this purpose, we use the Indonesian household panel socio-economic survey (Susenas panel) 2008 – 2010, which tracked 66,724 households during three consecutive years. These data enable us to estimate a logistic model of the switch to refillable bottled water. To our knowledge, this is the first study that uses longitudinal data for investigating this switching behaviour.

Chapter 4 is related to research question 3 and focusses on the relation between water and health. This chapter looks more specifically on the effects of access to and treatment of water and sanitation at the household level, and water and sanitation coverage at the community level on diarrhoea prevalence among children under five. The role of the circumstances is explored by studying interactions between the water and sanitation variables and other risk factors. To answer our research questions, we apply a multilevel regression analysis to data from the 2007 and 2012 Indonesian Demographic and Health Surveys.

Chapter 5 focuses on the water, health and development linkage. In this chapter, the development aspect is measured by education outcomes among primary school-age children. In this chapter, we examine how the quality of and the distance to the water source affects diarrhoea prevalence and through this school enrolment and absenteeism of young children. We also examine the effect of distance to water source on these two education outcomes. These direct and indirect effects of water access on school absenteeism and enrolment are examined using panel fixed effect analysis on a balanced panel data set for 295 Indonesian districts over the period 1994-2014. This district panel dataset is constructed on the basis of the annual Indonesia National Socio Economic Survey (Susenas) datasets from 1994 to 2014.

Chapter 6 concludes this thesis. In this chapter, the main findings from Chapters 2, 3, 4 and 5 are summarized and conclusions are drawn regarding the four research questions discussed above. In addition, the limitations of our research and recommendations for policy makers and future research are discussed.

Chapter 2

WATER AFFORDABILITY IN DEVELOPING COUNTRIES: HIDDEN AFFORDABILITY PROBLEMS REVEALED

Abstract

Access to water is considered a human right. Everyone should have sufficient, safe and affordable water for personal and domestic uses. Commonly, water affordability is measured as the proportion of household income spent on water supply. For developing countries this is problematic, as many households use water from free sources, like wells, springs, rivers and lakes. As these free sources are often of questionable quality, a substantial number of households may use them because they cannot afford the better quality piped or bottled water. These households then suffer from what can be called a "hidden" affordability problem. In previous research on developing countries, households using free sources were excluded, as a result of which affordability problems were largely underestimated. We investigate both the "revealed" and this "hidden" water affordability problem in Indonesia. For households who do not report data on water expenditure, we estimate the water price on the basis of the average price paid by other households in the same area. If we look only at households with paid water, 1.8% of the Indonesian households suffer from an affordability problem. However, if the households that use free sources are included, this percentage increases to 15.2%. Hence, the scale of the hidden affordability problem is far bigger than that of the revealed affordability problem. Findings imply that water affordability problems in developing countries have been significantly masked by the fact that earlier research is restricted to households that pay for their water supply.

This chapter is based on Komarulzaman, A., de Jong, E. & Smits, J., 2017. Water affordability in developing countries: Hidden affordability problems revealed, which has been submitted to a peer reviewed international journal.

2.1. Introduction

Water is an essential component of human life. Access to water is considered internationally as a human right. Everyone should have sufficient, safe and affordable water for personal and domestic uses without discrimination (UNDP, 2006). This is echoed in the sustainable development goals (SDGs), which specify that universal and equitable access to safe and affordable drinking water has to be achieved for all people by 2030 (United Nations, 2015). In a large number of countries, such as Indonesia and France, water affordability has been accommodated in national laws (Smets, 2009). Water affordability is thus an important issue that needs to be addressed in water provision, especially in low and middle-income countries (LMIC). Policy makers should ensure the availability and affordability of safe water for all households, in particular for the poor.

Commonly, water affordability is measured as the proportion of household income spent on water supply (Kessides et al., 2009). In wealthy countries, where the majority of households are connected to a good piped water system, affordability can easily be calculated. However, the water supply setting in developing countries is far more complex, so that such a simple measure does not capture the true affordability problem. In developing countries, the water infrastructure is distributed unevenly (UNDP, 2006). Public utilities (such as piped water) often serve only middle and upper class households, while poor households are served by informal providers, such as mobile vendors, or rely on free water sources (Banerjee et al., 2008; Komarulzaman et al., n.d.; UNDP, 2006).

Studies of water affordability tend to focus on households that are connected to piped water and pay for the water service (Banerjee et al., 2008; Gawel et al., 2013; Lee, 2011; Sebri, 2015; Smets, 2009). Hardly any study includes the unconnected and non-paying households. For wealthy countries, this is acceptable, as there are few households that use a free source. However, in developing countries generally a substantial number, often the majority, of households is using free sources, like wells, springs, rivers and lakes. Under these circumstances, one could conclude that these households have no affordability problem, as they can get water for free (Lee, 2011). However, such a claim is not realistic. As these free sources are often of questionable quality (Brown et al., 2013; Komarulzaman et al., n.d.; The Water Dialogues, 2009; Tumwine et al., 2002), a substantial number of households may use them because they cannot afford the better quality piped or bottled water. These households then suffer from what we call a “hidden” affordability problem.

The study of water affordability in developing countries is further complicated by the fact that many households in these countries rely on multiple water sources. They may for example use bottled water to drink and cook, piped water to bathe, and water from a well or river for cleaning purposes. The different sources may differ between regions with

regard to availability, quality and affordability (Kessides et al., 2009; Nastiti et al., 2017), which adds even more complexity to the affordability issue. A household may for example have a “free of charge” source of water for bathing and cleaning but prefers to buy (presumably better quality) water for drinking. Thus, focusing the water affordability analysis on households that pay for their water supply underestimates the real affordability problem in developing countries.

The objective of the current study is to investigate both the “revealed” and the “hidden” water affordability problem in Indonesia, while taking into account the complexity associated with the use of multiple sources for different purposes and the variation between regions. Using data of the Indonesia National Socio Economic Survey (Susenas) 2015, we determine the net affordability ratio (NAR) for all households in Indonesia, those who pay for their water source and those who do not pay for it. For households who do not report data on water expenditure, the water price is estimated on the basis of the average price paid by other households in the same area. In this way, we are able to provide an overview of water affordability for the complete population of the country. As far as we know, this is the first study to investigate the hidden affordability problem among households with free water sources in developing countries.

The remainder of this paper is structured as follows. Section 2 presents a brief review of the existing measurement of water affordability. The dataset and methodology used in the empirical analysis are described in Section 3. The main results are presented in Section 4 and discussed further in Section 5. Section 6 concludes.

2.2. Water Affordability

Water affordability can be defined as the ability of households to pay for their water supply. In this respect, water affordability can be measured as the proportion of household income/ expenditure spent on water services. The resulting measure is called the gross affordability ratio (Kessides et al., 2009). If this ratio is high, water is categorized as too expensive or unaffordable. However, this (gross) water affordability definition might suffer from several inconsistencies. Households with a high income that use a lot of water, such as for a swimming pool, or car washing, might be classified to have an affordability problem. In addition, poor households that buy a small quantity of water might be classified as having no affordability issue. Hence, a separation between the basic water needs and luxury uses of water is needed in order to get a better measure of water affordability.

These considerations have led to the introduction of the net affordability ratio, which is based on the basic water expenditure instead of actual water expenditure. This basic

water expenditure is the amount of money a household would need to pay for basic water needs – the water consumption needed for fulfilling domestic essential needs or to maintain a minimum or acceptable living standard (Kessides et al., 2009). Yet, there is no consensus on the minimum water needed to maintain an acceptable living standard. Various studies and water organizations suggested a threshold between 15 and 100 litre per person per day (Gleick, 1998; Howard and Bartram, 2003; Sebri, 2015; WHO, 2005).

Defining water affordability also requires an income threshold under which water is said to be unaffordable for households. The suggested affordability ratio threshold for water services range from 2% to 7% of income (Martins et al., 2016; Smets, 2009).

Another important issue is that studies examining water affordability in developing countries tend to focus on households that are connected to a piped water network (Banerjee et al., 2008; Lee, 2011; Sebri, 2015; Smets, 2009). For example, Banerjee (Banerjee et al., 2008) examines water affordability among households that pay and are connected to a water network in 32 African countries. However, these households form only 13% of the total population. For this very limited subset of the population, the study found that the average spending on water rarely exceeds 3 percent of the households' budget, except for Cameroon, Mauritania, and Rwanda where it exceeds 5 percent of households' budget. This conclusion is likely to be misleading while it does not consider the water affordability of 87% of the population. The latter we call the 'hidden' affordability problem.

A similar critique pertains to Smets (2009) who reports that in developing countries the water affordability index for households with median disposable income is around 2,5% and for poor households connected to a public water supply this figure is about 7,5%. Again, this study covers only households with formal water supply and neglects the households with vended water and free water supply. A study of Malaysia (Lee, 2011) assumes that households with zero water expenditure have no access to networked water supply, and thus have no affordability problem. The study found that water is unaffordable for 1 to 2 percent of households in Malaysia. In the context of Indonesia, Bakker et al. (2006) conducted a survey among 110 households in Jakarta and found that 43% of them spent more than 5% of their income on water bills. This study already covers both the expenses for piped water and vended water, but does not consider the expenses that the households would incur from the use of free water supply. Furthermore, a report (The Water Dialogues, 2009) shows that, in Indonesia, water charges represent around 1-2% of the income of households with piped water.

An example of the rare studies on non-piped water is Gawel et al. (2013), who investigate water affordability among households that buy water from water kiosks, the most popular source, in Darkhan, Mongolia. However, this study does not include the consumption of

water from other sources, such as from rainwater harvesting, private wells or rivers, whereas the latter sources are used by 43 percent of the sample.

To sum up, little is known about water affordability among households with free water sources. By focusing the analysis on households that pay for their water supply, these studies neglect the complexity of the water supply setting in developing countries, where access to piped water is rather limited while households commonly rely on free water sources. Previous research shows that even when poor households live next to a water network, they often cannot afford this water and have to fetch water from a more distant free source (Morris and Parry-Jones, 1999). According to Lawrence et al. (2002) and Dungumaro (2007), the failure of households to obtain water from safe sources is often due to unaffordability instead of a lack of safe water in the area. Given the limited income to cater for food and water, these poor households choose to buy food and dig for water (Dungumaro, 2007). These observations indicate the existence of a hidden affordability problem among households with free water supply. We therefore expect to find a hidden affordability problem among households with free water sources in Indonesia, the scale of which might be even larger than that of the revealed affordability problem.

2.3. Data & Methodology

2.3.1. Data

This study utilizes the Indonesia National Socio Economic Survey (Susenas) year 2015. This annual survey was designed to be representative up to the district level. Susenas is composed of two questionnaires: core and module. The core questionnaire contains household characteristics and household members' information. The module questionnaire collects information on consumption and expenditure behaviour of the household, both for food and non-food expenses. Susenas 2015 contains data on 285,908 households in 510 districts and 34 provinces of Indonesia. For the current study, we dropped 566 (0.2%) households with incomplete information.

Susenas 2015 considers three purposes for a household's main source of water: drinking, cooking and bathing. Ten sources are provided for water used for bathing: metered piped water, retailed piped water, pumped wells, protected wells, unprotected wells, protected springs, unprotected springs, rainwater, rivers, and others. In addition to these ten water sources, branded and refillable bottled water are considered as water sources for drinking and cooking. For the current study, we reclassify these water sources into two groups, which are piped water (i.e. for households that use metered piped water regardless whether it is used as single source or in combination with bottled water and/or other water sources) and non-piped (i.e. for households without piped water and use other

water sources regardless whether they use it as single source or in combination with bottled water).

Susenas records quantity and expenditure of water in the last month before the survey. This water include piped water and non-piped sources from water vendors. Water from these sources is generally not directly drinkable and usually a point-of-use water treatment, such as boiling, is needed to make it drinkable. Even though a large proportion of the households get water from multiple sources, Susenas records only the total water purchased. In the survey, only 25% of households reported expenses for water supply. The rest, 75%, are households with free water supply, such as households that have access to wells, springs, rainwater, and rivers. Although a few of them might be rich and have dug a borehole in their premises to get good water for free, the large majority of these households is poor and cannot afford to buy water from better sources. These households will be the focus of our hidden affordability analysis.

2.3.2. Water affordability calculation

The current study calculates the net affordability ratio (NAR) that is the share of household's expenditures for fulfilling their basic water needs (the basic water expenditure). Following WHO (2005) and the Indonesia MoHA regulation 71/2016, we define the basic water needs to be equal to 60 LCD (litre per capita per day). A household is classified to have an affordability problem if the expenditures for water are more than 4% of household's total income or expenditures (Indonesia MoHA, 2016). For households with paid water supply, the price of water is calculated from the reported expenditures and the quantity of water purchased by the household. Thereafter, the basic water expenditure for each households is calculated by multiplying the price of water with the minimum water needs (60 LCD).

2.4. Results

This section presents the results of the calculation of water affordability. It is divided into three parts. The first part provides the analysis of revealed water affordability, for households that reported their payment for water. The second part presents the hidden affordability analysis. It describes the way we have calculated the (shadow) price for free water and presents affordability figures for the households who report the use of free water, based on the shadow price and the minimum quantity needed. Lastly, some robustness checks are described.

2.4.1. Revealed water affordability

Table 2.1 provides the characteristics of households that pay for water. About 70% of these households live in urban areas (Table 2.1, column Total). These households spent on average IDR 1.8 million monthly, which is equivalent to approximately IDR 0.5 million per capita. On average, the actual monthly expenditure for water is IDR 55,000 and the actual quantity of water purchased is 21,600 litres (Table 2.1, column Total). The calculation of the basic water expenditure shows that, on average, households would need to pay IDR 40,000 for fulfilling their basic water needs. This average basic water expenditure is considerably less than the average actual water expenditure. This is also supported by the fact that the average basic water quantity is about one third of the average actual water quantity (compare 6,900 litres with 21,700 litres). Households with paid water need to allocate on average 2.5% of their income to fulfil their basic water needs, which is lower than the 4% threshold. About 7.2% of the households who pay for their water suffer from a (revealed) water affordability problem. About 18.6% of these households buy less water than the basic water need of 60 LCD.

Table 2.1. Descriptive statistics of households with paid water supply, Indonesia, Susenas 2015

	Paid water		
	Piped	Non-piped	Total
Frequency	51,098	20,072	71,170
Urban (%)	77.74	50.98	70.19
Total expenditure: household (000 IDR)	1,893.52	1,606.27	1,812.50
Total expenditure: per capita (000 IDR)	525.75	444.02	502.70
Actual water expenditure (000 IDR)	62.74	36.42	55.32
Actual water quantity (000 litres)	24.73	13.89	21.67
Water quantity <60LCD (%)	10.25	39.86	18.60
Actual water price (000 IDR/litre)	3.76	11.06	5.82
Basic water expenditure (000 IDR)	26.36	76.79	40.58
Basic water quantity (000 litres)	6.96	6.94	6.95
Net affordability ratio (%)	1.47	5.11	2.50
Affordability problem ¹ (%)	3.60	16.37	7.20
Affordability problem ¹ (households)	1,837	3,285	5,122

Notes: ¹Households with NAR>4%.

The analysis by sources of water in Table 2.1 shows that the majority of households with paid water uses piped water. On average, the fulfilment of basic water needs would require these households to allocate 1.5% of their income (Table 2.1, column Piped).

Given this low affordability ratio, only 3.6% of piped water users have a NAR above the 4% threshold.

Table 2.1 also shows that, in general, households with non-piped water sources are worse off than those with piped water. Compared to those with piped water, households with non-piped water, on average, are poorer, pay a higher price of water and buy a lower amount of water. The average NAR of households using non-piped sources is 5.1%, which is three times higher than the NAR of piped water. Moreover, 16.4% of households with non-piped water face an affordability problem.

The weaker position of households using non-piped sources is also clear from the fact that more than one third of these households buy less water than the basic water needs (see row “Water quantity <60LCD (%)). It seems that as a consequence of the high price set by water vendors, these households tend to ration the quantity of water purchased to maintain the costs of water at an affordable level.

2.4.2. Hidden water affordability

This section presents the analysis of hidden water affordability, that is water affordability for households with free water supply. These households are not connected to a water system and do not report any water expenses. They obtain their water from alternative sources with no market price, e.g. wells, rainwater, and rivers. As the water derived from free sources is often of low quality (Brown et al., 2013; Komarulzaman et al., 2017), we assume that a substantial part of households using these sources is doing so because they cannot afford to buy better quality water. Hence, they suffer from a hidden affordability problem.

To determine the size of the hidden affordability problem, we need to know what the price of better quality water for these households would be. To determine this price, we follow Kessides (2009), who suggests to use the opportunity cost or shadow price of the alternatives. The shadow price of free water can be estimated from the water fetching time, the cost of labour if the households pay someone to fetch the water, or the price of water at the local market. (Alkon et al., 2016), for example, applied this approach to impute the price of self-produced energy (e.g. firewood collection) in the analysis of energy affordability in India. That study argues that the cost of self-produced energy, i.e. firewood collection, should be thought of as forgone revenue from the sales of firewood in the local market.

In the current study, this opportunity cost approach is adopted. We estimate the shadow price of water from a free source by a given household using the average price of water

supply in the Susenas survey paid by other households in the context. At first, the census block is taken as the context on the basis of which the shadow price is determined. When the average price of water in the census block cannot be computed because all households in the census block use water from free sources, we estimate the average price at the district cluster (i.e. urban or rural district), or provincial cluster (i.e. urban or rural province). The basic water expenditure of households that rely completely on free water sources is then estimated by multiplying the average price of water in the context level with the minimum water needs (60 LCD).

An important note to this approach is that it does not consider fixed costs, such as a connection fee for piped water or the costs of constructing a protected well. Our focus here is only on water expenditures on basic water needs, as opposed to total costs for water that would also cover connection and consumption charges. It is clear that the connection fees for piped water and other improved water sources are barriers that prevent poor households from gaining access to safe water (Kessides et al., 2009; Nastiti et al., 2017; UNDP, 2006). The data we have do not allow us to address this issue. However, it implies that the imputed price we use is an underestimation of the actual price and thus that the water affordability computed on the basis of this price is an underestimation of the hidden affordability problem.

Table 2.2 provides the summary statistics for the price of water paid by households as well as the imputed price of free water sources. In total, there are 71,170 (25%) households that are located in 12,617 (42%) census blocks, 888 (93%) district clusters, and 67 (100%) province clusters who reported the payment of water supply. The water price they paid is, on average, 5.82 IDR/litre. The price of water in rural areas is significantly higher than in urban areas. This price discrepancy is caused mainly by the unequal distribution of piped water, as a relatively cheap source. Piped water supply is mostly concentrated in urban areas where population density is relatively high and households can easily be connected to a water network. Households without piped water connection depend for good quality water on water vendors who sell water at a significantly higher price.

There are 214,172 (75%) households in the data who obtain water from free sources. For these households, we imputed the price of water using the average price of water supply paid by households in the context. For 49,023 (23%) households, we could impute the price at the census block, which on average is 6.96 IDR/ litre. For 155,820 households (73%) we imputed the price at the district cluster with an average price of 5.28 IDR/ litre in urban areas and of 11.61 IDR/ litre in rural areas. For the remaining 9,329 (4%) households, the average price of water at the provincial cluster is used, which was 8.82 IDR/ litre for urban areas and 64.91 IDR/ litre for rural areas.

Table 2.2. The imputed price of water from free sources

	Frequency					Price of water supply		
	HH	CB	DC	PC	Mean	SD	Min	Max
Paid water	71,170	12,617	888	67	5.82	28.43	0.002	2,778.00
Urban	49,955	8,276	451	34	5.41	21.62	0.014	2,778.00
Rural	21,215	4,341	437	33	6.77	40.13	0.002	2,275.07
Free water								
<i>Imputed price at:</i>								
Census block	49,023	9,371	883	67	6.96	38.86	0.05	1,986.40
Urban	28,485	5,784	447	34	5.25	17.22	0.08	400.00
Rural	20,538	3,587	436	33	9.33	56.43	0.05	1,986.40
District cluster	155,820	16,265	819	67	9.88	51.02	0.27	821.00
Urban	42,609	4,476	396	34	5.28	8.32	0.27	76.52
Rural	113,211	11,789	423	33	11.61	59.54	0.47	821.00
Province cluster	9,329	998	68	30	56.37	48.68	1.36	131.68
Urban	1,419	152	33	14	8.82	8.00	1.67	31.12
Rural	7,910	846	35	16	64.91	48.00	1.36	131.68
Total free water	214,172	26,634	953	67	11.24	49.36	0.05	1,986.40
Urban	72,513	10,412	482	34	5.34	12.60	0.08	400.00
Rural	141,659	16,222	471	33	14.25	59.80	0.05	1,986.40

Notes: HH=households; CB=census blocks; DC=district clusters; PC=province clusters.

The average price imputed at each level is higher as we move to a larger context. We think that this higher price reflects the scarcity of piped water and water supply in general. In other words, distance from the piped water network inflates the price of water (UNDP, 2006). This is supported by the fact that most of the households for whom we have to use imputed prices are located in rural areas. The very high price of water computed for rural areas at the provincial level is due to the fact that most households for which the price is computed in that way live in less developed and remote areas, such as in the province of West Papua and Nusa Tenggara Timur.

The shadow prices of water are used to estimate the basic water expenditure and subsequently to analyse the presence of a hidden affordability problem. Table 2.3 presents the result of the affordability calculation for the households with free water sources as their main water source. These households are using non-piped water and mostly living in urban areas. On average, those with free water supply have monthly total household's expenditures of IDR 1.5 million or approximately equal to IDR 0.4 million per capita (Table 2.3, row Total expenditure). These average monthly expenditures are slightly lower than those of households with paid water supply.

The average imputed price of water from free water sources is 11.24 IDR/ litre. The estimation of basic water expenditure shows that on average households with free water would need to pay IDR 79.110 monthly for fulfilling the basic water needs of 60 LCD at average local water prices. Moreover, they would need to allocate, on average, 6.3% of their household's expenditures to fulfil their basic water needs at local water prices. This is 1.6 times the affordability threshold set by the Indonesian government. As a result of this, about 17.8% of households suffers from a hidden affordability problem.

Table 2.3. Descriptive statistics of households with free water supply, Indonesia, Susenas 2015

	Free water ¹
Frequency	214,172
Urban (%)	33.86
Total expenditure: household (000 IDR)	1,497.53
Total expenditure: per capita (000 IDR)	418.42
Actual water expenditure (000 IDR)	0.00
Actual water quantity (000 litres)	0.00
Water quantity <60LCD (%)	0.00
Imputed water price (000 IDR/litre)	11.24
Basic water expenditure (000 IDR)	79.11
Basic water quantity (000 litres)	6.90
Net affordability ratio (%)	6.31
Affordability problem ² (%)	17.81
Affordability problem ² (households)	38,154

Notes: ¹ All households with free water supply are using non-piped water sources for drinking, cooking and bathing. ² Households with NAR>4%.

2.4.3. Robustness check

It is important to bear in mind that the findings on water affordability are contingent on the approach and assumptions used in the calculation. The main source of uncertainty in the hidden affordability estimation is the use of the average price of water in the context for imputing the shadow price of water for households using free sources. Given the fact that this average price is partly calculated from households that have piped water, it is possible that our imputed price is too low. If so, this would give an underestimation of the hidden affordability ratio and of the headcount of households that fall into hidden unaffordability. We therefore recalculated the hidden affordability using the average price of non-piped sources, excluding piped water, in the context. Table 2.4, heading “Upper bound” shows that the use of the average price of only the non-piped water sources in the context increases the hidden NAR by 1.6 percentage points from 6.3% to 7.9% and the size of the hidden affordability problem by 5.5 percentage points from 17.8% to 23.3%.

Our computations indicate that the total (revealed plus hidden) NAR in Indonesia ranges from 5.4% to 6.6% and that the proportion of households suffering from an affordability problem ranges from 15% to 19.3% of all households in the country. We also conclude that the total estimated NAR and prevalence are substantially higher when hidden affordability is taken into account than when the analysis is restricted to only households who pay for their water.

Table 2.4. Robustness checks of water affordability with different price setting

	Revealed	Hidden	Total
Number of households	71,170	214,172	285,342
Baseline¹			
Net affordability ratio (%)	2.50	6.31	5.36
Affordability problem ³ (%)	7.20	17.81	15.17
Upper bound²			
Net affordability ratio (%)	2.50	7.95	6.59
Affordability problem ³ (%)	7.20	23.28	19.27

Notes: ¹ In the baseline: the price of free water sources is imputed by the average price of paid (piped and non-piped) water in the context. ² In the upper bound: the price of free water sources is imputed by the average price of only paid non-piped water in the context. ³ Households with NAR>4%.

2.5. Discussion

Studies on water affordability in developing countries have focused on households that pay for their water supply, what we call ‘revealed affordability’. Little is known about the households with free water sources which still may suffer from an affordability problem. This is called here ‘hidden affordability’. This study is as far as we know the first to investigate the existence and magnitude of the hidden water affordability problem among households with free water supply in Indonesia. The concept of opportunity cost or shadow price is used to estimate the price of water from free sources given the local context. The results indicate that the scale of the hidden water affordability problem is far greater than that of the revealed affordability problem.

Results of our revealed affordability analysis highlight that while water is comparatively affordable for most Indonesian households with paid water, for about 7% of these households the water bill is unaffordable. Disaggregation by water source shows that of the households paying for their water, those with piped water are much better off than those with non-piped water. Households with piped water allocate on average 1.5% of their total expenditure on basic water needs and only 3.6% of them has an affordability problem (NAR>4), while households with non-piped water allocate 5.1% of their

expenditure on it and 16.4% of them has an affordability problem. The reasons for this difference is that households with piped water are relatively wealthy and the price of piped water is subsidized by the local government (Indonesia MoHA, 2016; Smets, 2009). Households with non-piped water are forced to pay a (three times) higher price of water than those with piped water. Hence, the problem of (revealed) affordability is most prominent among households without piped connection (Bakker et al., 2006; UNDP, 2006).

In accordance with this finding, it is not surprising that we found that many households that buy water from non-piped sources tend to ration their water purchase below the minimum water needs, probably in response to an unaffordable water bill. From the perspective of public health, this might not be a wise decision. As the water quantity is below the minimum water needs, households have less water for drinking and personal hygiene practices. Consequently, these households may become more vulnerable to water related diseases (Komarulzaman et al., 2017; Stelmach and Clasen, 2015).

An important step forward made by the current study is that also affordability problems are studied among households that do not pay for their water, which is the large majority (75%) of the Indonesian population. To estimate hidden affordability problems, the ‘shadow’ price of water from a free source is estimated on the basis of the average price paid for water by other households in the context where the households live. Our calculations reveal that if households with free water sources would buy their water according to the local prices of paid sources, they would have to pay on average IDR 11.24 per litre. Given this shadow price, households in this group would need to allocate on average 6.3% of their total expenditure on fulfilling their basic water needs. This is 1.6 times the acceptable NAR of 4%.

In Table 2.5 the outcomes of the revealed and hidden affordability analyses are summarized. Of the households who do not pay for their water, 17.8% suffers from a (hidden) affordability problem. This is significantly more than the number of households suffering from a revealed affordability problem, which hits 7.2% of households with a paid water supply. If we translate these figures to the total Indonesian population, the differences are even more staggering. Whereas the total percentage of households with an affordability problem is 15.2% of all Indonesian households, the percentage of households with a hidden affordability problem is 13.4%, which is more than seven times as large as the percentage of households with a revealed affordability problem, which is 1.8% (Table 2.5, last row). Hence, affordability analyses that focus only on households that pay for their water miss the big picture and may underestimate water affordability problems in developing countries to a large extend.

Table 2.5. Summary of revealed & hidden water affordability, Indonesia, Susenas 2015

	Paid water			Free water	Grand Total
	Piped	Non-piped	Sub total		
Number of households	51,098	20,072	71,170	214,172	285,342
Net affordability ratio (%)	1.47	5.11	2.50	6.31	5.36
Affordability problem (NAR>4%)					
Percentage from subgroup (%)	3.60	16.37	7.20	17.81	15.17
Percentage from total population (%)	0.64	1.15	1.80	13.37	15.17

Notes: All households with free water use non-piped water sources.

The size of the hidden affordability problem – and the fact that many households use insufficient water, at least in terms of quality – points towards the existence of a broader public health problem in Indonesia (Foster and Araujo, 2004). On the one hand, the high cost of water might lead households to use alternative water sources which provide water of less quality and thus increase the risk of water borne disease such as diarrhoea (Howard and Bartram, 2003; Komarulzaman et al., 2017). On the other hand, unaffordable water bills might force the households to reduce the volume of water that is used for hygiene practices (Banerjee et al., 2008; Gawel et al., 2013) and hence increase the probability of the spread of disease (WHO, 2011). In addition, when a large share of households' income is spent on water, less money is available for food, health and other essential expenses (Smets, 2009). Again, this might expose the households to other health risks (Howard and Bartram, 2003). All in all, the failure to provide households with affordable water of good quality can have further impacts on public health, that eventually exacerbate the situation.

Lastly, one might question whether the findings in the current study are also applicable to other developing countries. In general, we are inclined to answer this question affirmative. However, one should keep in mind that water affordability issues are very contextual, as they depend on both the water supply setting and the characteristics of the households in the region, as well as on the spatial scale of the analysis (Mack and Wrase, 2017). The current study improves on previous studies, which estimate the (revealed) water affordability problem in developing countries, by showing the variation of both revealed and hidden water affordability in different water supply setting. More importantly, the current study gives an alternative for unmasking the whole picture of water affordability in developing countries.

2.6. Concluding Remarks

The current study challenges the commonly used approach for studying water affordability in developing countries, which tend to focus on households that pay for their water supply. A major problem of this approach is that the majority of households in these countries are neglected, as they use free water sources. Given that these sources often are of questionable quality, we provide an alternative approach, whereby ‘hidden’ affordability problems of households that use free water sources are revealed by using the average price of paid water in the context as a proxy for what these households would have to pay if they would buy good quality water at the local market. Our analyses make clear that the size of the water affordability problem in Indonesia (and probably also other developing countries) is substantially underestimated in research that focuses only on households that pay for their water supply. Our calculation shows that the hidden affordability problem is far more significant than the revealed affordability problem.

We are aware that our findings are contingent on the assumptions made in the calculation of the size of this hidden affordability problem, especially the price imputation for water from free sources. Nevertheless, it is clear that the current paradigm which treats all households with zero water expenditure as having no affordability problem, or neglects them entirely, is not accurate and should be adjusted. Accordingly, further research is needed for a better understanding of hidden affordability, specifically in developing countries. This is important not only because access to safe and affordable water has been acknowledged as a human right, but also because of the potential effects on households’ health and public health in general. A more detailed and accurate analysis of both revealed and hidden water affordability could provide additional information for policy makers in formulating better policies and priorities on water provision in developing countries.

Chapter 3

THE SWITCH TO REFILLABLE BOTTLED WATER IN INDONESIA: A SERIOUS HEALTH RISK

Abstract

In recent years, the consumption of refillable bottled water has increased considerably in emerging countries. However, the quality of this water is often questionable, as authorities lack the capacity to properly check refilling depots. Given that refillable bottled water not only replaces unimproved water sources, but also better quality sources, like piped and branded bottled water, its increasing use poses a major health risk. We investigate the motives behind the decision to switch to refillable bottled water in Indonesia. Findings indicate that this switch is driven by lifestyle motives, as well as by cost and availability considerations. It is mostly the young affluent households who switch from piped and 'other' sources to refillable bottled water. In rural areas, the tendency to make this switch is negatively affected by availability problems and the higher price of refillable bottled water. Availability and cost also influence the switch from branded bottled to refillable bottled water, but here it is the poorer households who have a higher propensity to switch. Further exploration of the lifestyle motive and affordability issues, as well as better monitoring of the refilling depots, are needed to improve the quality of drinking water in Indonesia and other emerging countries.

This chapter is based on Komarulzaman, A., de Jong, E. & Smits, J., (forthcoming). The Switch to Refillable Bottled Water in Indonesia: A Serious Health Risk. *Journal of Water and Health*.

3.1. Introduction

Access to safe drinking water is an essential need for human beings. In high-income countries many households use bottled water as their main source of drinking water. Although these households also have access to piped water of good quality, they prefer to use bottled water because they believe it is healthier or they associate its use with good taste and a modern lifestyle (Ward et al., 2009; Wilk, 2006; York et al., 2011).

In low- and middle-income countries (LMICs) a trend towards using bottled water can be observed too (UNICEF and WHO, 2011; WHO and UNICEF, 2008). However, here this trend is more problematic as different kinds of bottled water of varying quality can be discerned. Branded bottled water is usually of similar quality compared to the bottled water sold in industrialized countries. However, its price is relatively high for LMICs' standards. Refillable bottled water is provided by refilling depots. Its price is much lower than that of branded bottled water, but it is often of inferior quality, as the refilling depots are not properly checked by local authorities. The previously mentioned trend towards bottled water is primarily driven by an increased demand for refillable bottled water.

As households in LMICs tend to switch to refillable bottled water from other (improved) sources, and even from branded bottled and piped water, this may lead to serious health problems in these countries. Table 3.1 shows some relevant figures for Indonesia. The quality of refillable bottled water (as indicated by diarrhoea prevalence) is lower than that of piped water, while its price is much higher. Nevertheless, households increasingly switch from piped to refillable bottled water as their main source of drinking water (Komarulzaman et al., 2016). An extreme example is Surabaya City, where the use of (branded and refillable) bottled water increased from 6.4% in 1998 to 79.3% in 2014, whereas during the same period the use of piped water as main source of drinking water decreased from 90.7% to 20.5% (Komarulzaman et al., 2016).

Table 3.1 The trade-off between price and quality of drinking water sources in Indonesia

Water sources	Price (IDR/ litre)	Diarrhoea prevalence (quality)	Comparison to refillable bottled water
Branded bottled water	842.11	1.53%	Higher price – higher quality
Refillable bottled water	210.53	1.71%	-
Metered piped water	4.97	1.48%	Lower price – higher quality
Other water sources	0 – 25	2.05%	Lower price – lower quality

Note: A detailed definition and characteristics of each water source can be found in the Appendix, Table A.3.1.

The increasing use of refillable bottled water, together with the associated health risks, raises the question why households are switching to this source. This question is particularly intriguing with regard to households that switch from piped water to refillable bottled water. Although they already enjoy the convenience of having access to an improved water source in their home, they switch for their drinking water to the more expensive and often lower-quality refillable bottled water.

So far little is known about the motives of consumers who make this choice. Most of the previous studies focus on the choice of branded bottled water in developed countries (Doria, 2006; Johnstone and Serret, 2012; Saylor et al., 2011; York et al., 2011). It is unclear whether these findings can be generalized to the choice of refillable bottled water in LMICs. Earlier studies of LMICs rely mostly on cross-sectional data and are limited to the analysis of factors affecting consumers' preference for refillable bottled water (Francisco, 2014) and its microbial and chemical quality (Eflin, 2008; Rahayu et al., 2013). As far as we know, there is no study for LMICs that has focused on motives affecting households' "switching behaviour", and more specifically on the switch from piped water to refillable bottled water. A reason for this could be that a proper analysis of switching behaviour requires information about households' main source of drinking water spanning at least two consecutive periods.

The current study aims to investigate the motives for households' decision to switch to refillable bottled water as their main source of drinking water. In particular, the reasons for switching from piped to refillable bottled water are investigated. Additionally, we investigate the switch to refillable bottled water from branded bottled water and other (low quality) water sources. We use the Indonesian household panel socio-economic survey (Susenas panel) 2008 – 2010, which tracked 66,724 households during three consecutive years. The panel's dataset allows us to observe the characteristics of a large number of households in Indonesia and track the changes in their choices of drinking water sources. This longitudinal aspect of the data is unique and allows us to study households' switching behaviour.

3.2. Background

3.2.1. Water sources in Indonesia

Two types of bottled water, branded and refillable bottled water, are available in Indonesia. Branded bottled water is produced and marketed in a sealed 19 litre bottle by a limited number of big beverage companies at a price of about IDR 16,000 (1.2 USD, in 2016). The water undergoes comprehensive treatment and strict quality control as part of a strict implementation of regulations and regular monitoring by the government.

Refillable bottled water is sold by refilling 5 gallon (19 litres) bottles at small, privately owned local refilling depots. In these depots the raw water (i.e. groundwater or spring water) is treated on-site using ultrafiltration or a reverse osmosis membrane together with UV disinfection (Keman, 2005). Provided the treatment process is properly carried out, any biological and chemical contamination of the raw water is removed (Sima and Elimelech, 2013). The price of treated water is about IDR 4,000 (0.3 USD, in 2016) per 19 litre bottle. This price is substantially lower than that of branded bottled water but much higher than the price of piped water (see Table 3.1).

The operation of refilling depots is regulated by the central government and must be monitored by the local government where the depot is located. However, in practice, this monitoring is hardly implemented due to a lack of resources by local governments. During recent years, the situation has worsened due to rapid increase in the number of refilling depots. A recent study shows that refillable bottled water is often not properly treated and that the depots' hygiene and operation are not well maintained, increasing contamination risks (Rahayu et al., 2013). Hence, it is no surprise that in an earlier study the water from about 40% of refilling depots was found to be contaminated by fecal coliform (Eflin, 2008).

Besides bottled water, other sources of drinking water are used in Indonesia, such as piped water and water from tanker trucks, wells, springs, rivers and lakes. Piped water is commonly produced through a purification and sanitation process by PDAM (local government-owned drinking water company). The water is distributed to consumers through a water piping network at a price of about IDR 5 per litre (PDAM Bandung, 2016). In addition, an upfront connection fee of about IDR 1,300,000 (108 USD) has to be paid (PDAM Bandung, 2016). Even though some PDAMs already produce piped water that is drinkable, a point-of-use water treatment, such as boiling, is usually needed. Most of the water from other sources can be obtained freely by the households. However, sometimes a fee has to be paid for to collectors who distribute the water from those sources and sell it to consumers. A detailed description of each water source can be found in the Appendix, Table A.3.1.

3.2.2. Motives influencing drinking water sources

A considerable amount of literature has been published on the choice of drinking water sources. The relevant studies found three major motives driving the consumption of bottled water: concern about the health risks of other sources of drinking water (risk aversion motive) (Francisco, 2014; Johnstone and Serret, 2012), belief in the health benefits of bottled water (healthier perception motive) (Anadu and Harding, 2000;

Francisco, 2014; Gleick, 2010), and consumption of bottled water as a taste and lifestyle choice (lifestyle motive) (Ward et al., 2009; York et al., 2011).

The focus of the first motive (risk aversion), is on the disadvantages of other sources of drinking water. In developed countries, the use of bottled water is to a certain extent driven by the perceived health risk posed by tap water (Johnstone and Serret, 2012). Jakus et al. (2009), for example, found that the perceived risk of arsenic contamination of tap water is positively related to the consumption of bottled water. In developing countries, these health risks are even higher, as the supply of tap water is often intermittent (UNICEF and WHO, 2011), which is inconvenient and increases contamination risks (Kumpel and Nelson, 2013). These perceived risks could push households to switch from piped water to refillable bottled water as their main source of drinking water (Francisco, 2014; Johnstone and Serret, 2012).

The second motive for choosing bottled water mentioned in the literature is consumers' perception that bottled water is healthier. While the "risk aversion" motive is related to the (supposed) risks associated with the initial water source, the "healthier perception" motive is a positive choice based on households' belief that consuming bottled water is healthier (Doria, 2006). Given the popularity of bottled water in the United Kingdom, Ward et al. (2009) found that people do not perceive any risks in drinking piped water but generally believe that the good quality and minerals contained in bottled water give a health benefit. In the same vein, Francisco (2014) found that the decision to buy refillable bottled water in Cebu, the Philippines, is mainly explained by households' perception that this type of water is healthier and safer than other sources of drinking water.

However, the "risk aversion" and "healthier perception" motives do not fully explain the decision of households to switch to bottled water. The consumption of bottled water keeps increasing, both in regions where the quality of piped water is considered excellent (Doria, 2006; York et al., 2011) and in regions where the purity and safety of (refillable) bottled water is not fully guaranteed (Rahayu et al., 2013). This leads to the third motive for the increase of refillable bottled water consumption that is attributed to a lifestyle choice (Ward et al., 2009; York et al., 2011). Bottled water is not only believed to be convenient, readily available, easily accessible (Ward et al., 2009), and tasting better but also to bestow a higher social status on the consumer (Wilk, 2006).

In addition to the three motives mentioned, we expect that the switch to refillable bottled water is a cost-based decision and affected by the product's availability in the households' neighbourhood.

3.2.3. Hypotheses

Regarding the effects of background characteristics of the household and of the context in which they live we have developed several hypotheses, which are represented by the (+) and (-) in Table 3.2. First, we predict that the more affluent and smaller households will more easily switch if they are using piped water or ‘other water sources’, as they can better afford the more expensive refillable bottled water than poor and larger households (Francisco, 2014; Johnstone and Serret, 2012; York et al., 2011). Second, previous research found that younger people have a stronger preference for bottled water, as it is more convenient and reflects their lifestyle, particularly in urban areas (Hu et al., 2011). We therefore expect urban households and those with a younger head to switch more easily to refillable bottled water.

Table 3.2 Hypotheses of the switch to refillable bottled water

Motives	Variables	Hypotheses		
		Metered piped water	Branded bottled water	Other water sources
Risk aversion	HH head year(s) of education, HH head is female, HH has infant	(+ -)		(+)
Healthier perception	HH head year(s) of education, HH head is female, HH has infant	(+ -)		(+)
Lifestyle choice	HH head age	(-)		(-)
	Urban	(+)		(+)
Cost	HH expenditure	(+)	(-)	(+)
	HH size	(-)	(+)	(-)
Availability	Coverage of branded bottled water		(-)	
	Coverage of refillable bottled water	(+)	(+)	(+)
	Coverage of metered piped water	(-)		

Explanation: HH is household; A “+”, “-” indicate a positive, respectively negative, expected effect of the variable on the switch.

Third, regarding the effect of education, formulating an expectation is more complicated. Individuals with more education will be better able to comprehend information about the quality and safety of water sources (Rahut et al., 2015) and thus be more aware of the quality of the water they use. If their current source is piped water, they will be aware of the fact that because this source is often intermittent, there is a risk of contamination as the water has to be stored in tanks or bottles. This might lead to a tendency to switch to refillable bottled water. However, from the perspective of the “healthier perception” motive, we also expect more educated households to be more aware of the fact that

refillable bottled water often is of questionable quality and thus not so healthy after all. From this perspective we would expect more educated households to have a lower tendency to switch than less educated households. Hence, for households with piped water we cannot formulate a clear expectation regarding the direction of the education effect. For households using ‘other water sources’, which are generally of lower quality, the prediction is easier. More educated households using ‘other’ sources can be expected to switch more easily, as they are more aware of the low quality of their current water source.

Fourth, for households with a female head, or with young children, we would expect extra awareness of the quality of their drinking water. Females are known to be more concerned with health risks resulting from bad quality of drinking water than males (Hu et al., 2011; Saylor et al., 2011). Households with children are likely to be more cautious with respect to the quality of drinking water as children, particularly the young ones, are more susceptible to waterborne diseases (Francisco, 2014; Komarulzaman et al., 2017). Hence, for households with female heads and with young children predictions are similar to those for educated households: a tendency to switch if they are currently using an ‘other’ source and no clear prediction if they are using piped water.

Fifth, regarding the availability of water sources, the switch to refillable bottled water can be expected to be positively affected by the availability of refillable bottled water in the market, while it may be negatively affected by the coverage of piped water networks. Sixth, as branded bottled water is of better quality than refillable bottled water, we expect that the switch to the latter is mainly motivated by cost and not by risk aversion or the healthier perception. Thus, consumers using branded bottled water who have less income might see the switch to refillable bottled water as a possibility to maintain their lifestyle at lower costs.

Seventh, for the category of other water sources, we expect that the switch to refillable bottled water differs depending on whether households’ previous main source of drinking water was other improved water or unimproved water. Households using unimproved sources will probably more easily switch if they have the possibility to do so. Finally, rural areas differ with respect to the supply of the different water sources from urban areas. Consequently, the effects of the explanatory factors might differ according to level of urbanization of the place of living. We therefore investigate whether there are significant interactions between the urbanization and the other explanatory variables in the model.

3.3. Data and Methodology

3.3.1. Data

This study utilizes the Indonesia National Socio-Economic Survey (Susenas) Panel dataset for the period 2008 – 2010. The panel surveys 66,724 households, which is a sample representative of both the national and provincial levels. The Susenas panel survey is composed of a core and a module questionnaire. The core questionnaire contains household characteristics and household members' information. The module questionnaire collects information on consumption and expenditure behaviour of the household.

We examine data related to the main drinking water sources and socio-demographic characteristics of the households, merging the 2008 and the 2010 panel rounds and dropping the households with incomplete information. The result is a balanced panel of 63,276 households.

3.3.2. Method

In developing countries, it is rather common that households get water from several sources (Nauges and Berg, 2009). One of these sources is generally the main source of drinking water. Our analysis focuses on this main source. We categorize the main sources of drinking water into four groups: (1) branded bottled water; (2) refillable bottled water; (3) piped water; and (4) other water sources. The category of other water sources includes other improved sources (tanker truck water, drilled/pumped wells, protected wells, protected springs, and rainwater) and unimproved sources (unprotected wells, unprotected springs, rivers, and others).

Our analyses focus on the switch to refillable bottled water from each of the three other sources of drinking water for each of which a separate logistic regression analysis is conducted. In each analysis, the dependent variable is a dummy variable indicating whether (1) or not (0) the household switched its main source of drinking water from one of the three other sources to refillable bottled water between 2008 and 2010.

The independent variables are characteristic of the household and area in which the household is located. Some of these variables represent the motives to switch to refillable bottled water as explained in the Background section (see Table 3.2). Education of the household head is measured by years of education completed. Female household head and the presence of children under the age of five are represented by dummy variables. The lifestyle motive is indicated by the household head's age measured in years and a dummy variable for living in an urban area. To indicate the economic situation of the household, household expenditure is used, because for income there are too many missing values in the data (about 33%).

Besides household level factors, we control for the context at the village level. The village level is chosen because it is the lowest level of public administration in Indonesia. A village covers an area of 25.3 km² on average and has a population of about 3,000 (750 households). Characteristics of areas of this size are known to have good explanatory power for studying the effects of context (Smits et al., 2005). Context factors in this study are intended to capture the potential access to the various sources in the surrounding area of the household. When there is no piped network or no market for refillable bottled water in the region, no household within that region is able to use these sources, irrespective of its income and status. We therefore include a set of water coverage variables: coverage of branded bottled water; of refillable bottled water; and of piped water. These three variables are aggregated from the households' data and are calculated as the percentage of households that report to make use of that particular source of water within the specified village. In addition, we consider the change over time of these water coverage variables. A description of the variables can be found in the Appendix, Table A.3.2. All variables are centered while the logistic regression results are presented in the form of odds ratios (OR).

Table 3.3 presents descriptive statistics of the main variables for the three subsamples, namely households that switch to refillable bottled water from 1) piped water, 2) branded bottled water and 3) other water sources. Of the households that had piped water in 2008, 15.6% switched to refillable bottled water in the period 2008-2010. For branded bottled water the corresponding percentage is about twice as high (34.9%) and for other water sources it is only 5.3%. On average, household heads who use a better source of drinking water (piped and branded bottled water) have more years of education than those who use water of lower quality. Interestingly, the heads of households using branded bottled water are on average 6 years younger than those who use piped water and other water sources. Most of the households using piped and branded bottled water live in urban areas, whereas those using other water sources are mainly located in the rural areas. About 92.6% of the users of branded bottled water live in urban areas. The average expenditure of households who initially used piped water (IDR 2.1 million) is less than the expenditure of those who used branded bottled water (IDR 3.9 million). Both types of households are considerably more affluent than the households using other water sources (IDR 1.1 million). Over the period, households using branded bottled water on average experienced a larger increase in their expenditure (IDR 0.9 million) than those with piped (IDR 0.6 million) and other water sources (IDR 0.3 million). In the villages in which in 2008 users of piped water lived, the coverage of refillable bottled water grew by 5.43 percentage points, whereas the coverage of piped water decreased by 6.34 percentage points over the period up to 2010.

Table 3.3 Descriptive statistics for subsamples of households that used to access metered piped water, branded bottled water and other water sources, panel Suseñas 2008 & 2010

	Metered piped water			Branded bottled water			Other water sources		
	n/ mean	% / (SD/ range)	n/ mean	% / (SD/ range)	n/ mean	% / (SD/ range)	n/ mean	% / (SD/ range)	n/ mean
Total	5,434	100.00		1,710	100.00		46,510	100.00	
Dependent variable									
HH switch to refillable bottled water	848	15.61	596	34.85	2,457	5.28			
HH keeps using the initial water source (Ref.)	4,586	84.39	1,114	65.15	44,053	94.72			
Household factors									
Mean HH head years education (SD/ range)	9.19	(4.53/0-23)	12.43	(3.59/0-22)	5.86	(4.13/0-22)			
HH head is female	773	14.23	271	15.85	6,102	13.12			
HH has infant (0-5 years old)	1,742	32.06	505	29.53	15,754	33.87			
Mean HH head age (SD/ range)	47.63	(13.46/14-95)	41.38	(13.42/15-90)	47.56	(14.12/12-98)			
Urban	4,058	74.68	1,583	92.57	12,641	27.18			
Mean initial HH expenditure (SD/ range)	2.05	(1.59/0.1-27.21)	3.88	(4.22/0.35-65.37)	1.18	(1.09/0.08-92.51)			
Mean Δ HH expenditure (SD/ range)	0.59	(1.72/-11.81-31.75)	0.92	(6.56/-58.82-163.55)	0.34	(1.3/-91.67-124)			
Mean HH size (SD/ range)	4.09	(1.72/1-16)	3.75	(1.85/1-12)	3.92	(1.66/1-18)			
Initial water access	-	-							
Branded bottled water	-	-	1,710	100.00	-	-			
Refillable bottled water	-	-	-	-	-	-			
Metered piped water	5,434	100.00	-	-	-	-			
Other water sources	-	-	-	-	46,510	100.00			
Other improved water	-	-	-	-	34,534	74.25			
Unimproved water (Ref.)	-	-	-	-	11,976	25.75			
Context factors									
Mean initial coverage of:									
Branded bottled water (SD/ range)	-	-	37.20	(21.73/2.08-100)	-	-			
Refillable bottled water (SD/ range)	8.24	(13.98/0-93.75)	19.57	(17.18/0-86.67)	3.20	(8.54/0-93.75)			
Metered piped water (SD/ range)	59.84	(26.56/2.27-100)	-	-	-	-			
Mean Δ coverage of:									
Branded bottled water (SD/ range)	-	-	-1.69	(17.01/-66.67-56.25)	-	-			
Refillable bottled water (SD/ range)	5.43	(17.06/-56.25-93.33)	7.87	(19.04/-60.83-75)	2.51	(9.75/-74.58-93.33)			
Metered piped water (SD/ range)	-6.34	(19.9/-92.86-81.25)	-	-	-	-			

Notes: HH is household; Ref. is reference category; Other water sources includes retailed piped water, drilled/ pumped wells, protected springs, rainwater, unprotected wells, unprotected springs, rivers and others.

3.4. Results

The results of the logistic regression analysis for the switch to refillable bottled water are presented in Table 3.4. For those variables that interacted significantly with the urban dummy, separate coefficients for urban and rural areas are presented; otherwise a general coefficient is presented under All (columns 3, 4 and 7).

The switch from piped water to refillable bottled water is significantly affected by the age of the household head. Households with a one-year-older head are 2.4% less likely to switch from piped water to refillable bottled water (see Table 3.4, columns 1-3). This result provides support for the lifestyle motive. Of the other household variables, neither the household head's education, nor having a female head or having an infant significantly affects the odds of switching from piped water to refillable bottled water. Hence, no evidence is found for either the risk aversion motive or the healthier perception motive. Of course, it could also be that both are relevant, but no single motive dominates so that the effects cancelled each other out.

Regarding the effects of household expenditure and expenditure change on the switch from piped to refillable bottled water, we find a difference between households living in urban and households living in rural areas. The effects of initial expenditure and of expenditure change are significantly positive in rural areas but not significant in urban areas. These results indicate that the switch from piped water to refillable bottled water is more costly for households in rural areas, so that only wealthier households can afford to make this switch.

Regarding the context factors, households in an area with a higher coverage of refillable bottled water and where this coverage increased are more likely to switch from piped water to refillable bottled water. Moreover, households in areas with a higher initial level or an increase in coverage of piped water are less likely to switch from piped water to refillable bottled.

As expected, the switch from branded to refillable bottled water (Table 3.4, column 4) is mainly driven by cost motives, as both expenditure variables are significantly negative. Households with higher expenditure and those with expenditure growth during this period are less likely to switch from branded bottled to refillable bottled water. As expected, the variables representing the risk aversion, healthier perception and lifestyle motives are not significant so that these motives are not relevant for this choice.

With respect to the context factors, it is obvious that the odds of switching from branded bottled to refillable bottled water are higher for households in an area with higher coverage of refillable bottled water and with a lower coverage of branded bottled water. There are no significant interaction effects with urbanization. This might be due to the

small number of households in rural areas (7%) that use branded bottled water and the even a smaller number that have made this change in the study period.

The last three columns of Table 3.4 present the results for the switch from “other water sources” to refillable bottled water. It is apparent that all motives play a role in the switching behaviour of this group. Households with a younger head and a head with more years of education, households living in urban areas, households with higher expenditure and with more expenditure growth, and smaller households are more likely to switch from other water sources to refillable bottled water. Hence, for households using these other sources both risk aversion, healthier perception, costs and lifestyle motives seem to be important.

As explained in the Data & Methodology section, the group of households relying on “other water sources” contains two subgroups, those using other improved sources and those using unimproved sources and we expected the behaviour of these groups to differ. Table 3.4 indeed shows that households who initially used “other improved water” are 23% more likely to switch to refillable bottled water than households using an “unimproved source”.

Regarding the context factors, we observe that both the initial coverage and the change of coverage of refillable bottled water significantly and positively affect the switch from “other water sources” to refillable bottled water.

For the “other water sources” group our analysis shows that four variables interact significantly with the urban area dummy: initial expenditure, change of expenditure, initial coverage of refillable bottled water and change of coverage of refillable bottled water. In rural areas, the effects of expenditure and expenditure change on the switch to refillable bottled water are significantly stronger than in urban areas, thus indicating that the cost motive is most important for rural households. Likewise, the effects of the coverage and increase in coverage of refillable bottled water are stronger in rural than in urban areas.

Table 3.4 Logistic estimation for determinants of switching the water source to refillable bottled water from metered piped water, branded bottled water and other water sources, Suseñas Panel 2008 & 2010

	All OR (SE) (1)	Metered Piped Water Urban OR (SE) (2)	Rural OR (SE) (3)	Branded Bottled Water All OR (SE) (4)	All OR (SE) (5)	Other water sources Urban OR (SE) (6)	Rural OR (SE) (7)
	Household factors						
HH head years of education	1.021 (0.017)			0.971 (0.018)		1.049 (0.007)***	
HH head is female	1.055 (0.193)			0.846 (0.159)		0.944 (0.084)	
HH has infant (0-5 years old)	1.037 (0.129)			1.008 (0.163)		0.900 (0.055)	
HH head age	0.976 (0.005)***			0.991 (0.006)		0.983 (0.002)***	
Urban	1.080 (0.198)			1.085 (0.237)		2.337 (0.166)***	
Initial HH expenditure (2008)		1.035 (0.034)	1.350 (0.126)*		0.867 (0.030)***	1.137 (0.029)***	1.408 (0.037)***
Δ HH expenditure		1.032 (0.045)	1.360 (0.089)***		0.890 (0.025)***	1.054 (0.020)**	1.335 (0.029)***
HH size	0.962 (0.034)			1.073 (0.055)		0.932 (0.017)***	
Initial water access						1.232 (0.090)*	
Other improved water						0.000 (-)	
Unimproved water (Ref.)							
Context factors							
Initial coverage of:							
Branded bottled water	1.048 (0.005)***				0.966 (0.004)***		
Refillable bottled water	0.972 (0.003)***				1.030 (0.004)***		
Metered piped water						1.064 (0.002)***	1.082 (0.004)***
Δ coverage of:							
Branded bottled water	1.060 (0.004)***				0.947 (0.005)***		
Refillable bottled water	0.956 (0.005)***				1.031 (0.004)***		
Metered piped water						1.080 (0.002)***	1.119 (0.003)***
Interaction variables							
Urban X Initial HH expenditure (2008)	0.767 (0.072)***					0.807 (0.028)***	
Urban X Δ HH expenditure	0.759 (0.057)***					0.789 (0.023)***	
Initial coverage of:							
Urban X Refillable bottled water						0.983 (0.004)***	
Δ coverage of:							
Urban X Refillable bottled water							0.965 (0.003)***
Observation	5434				1710		46510
Pseudo R ²	0.435				0.285		0.388
Log Likelihood	-1036826.5				-790.5		-5885.0

Notes: The coefficients represent odds ratio of switching to refillable bottled water. All variables are centred. HH is household. Ref is reference category. Significance level at * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

3.5. Conclusion

In low- and middle-income countries, an increasing number of households use refillable bottled water as their main source of drinking water. The price of this water is much lower than that of branded bottled water, but its quality is often questionable as local authorities lack the capacity to check the refilling depots. In Indonesia, the popularity of refillable bottled water comes even at the expense of piped water as the primary source of drinking water. Given that piped water is cheaper and safer than refillable bottled water, one can question whether the switch to refillable bottled water is an improvement.

This study investigates the households and context factors affecting the switch to refillable bottled water in Indonesia on the basis of a unique panel dataset that tracked 63,276 households in Indonesia for three consecutive years (2008-2010). These data enable us to estimate a logistic model of the switch to refillable bottled water.

Our analyses suggest that the switch from piped to refillable bottled water is caused mainly by lifestyle considerations; households with a younger head choose refillable bottled water more often than other households. This finding is consistent with previous literature (Hu et al., 2011; Ward et al., 2009; York et al., 2011). In our analyses, we use expenditure as a proxy for income. We find that in rural areas more affluent households and those households that experienced an expenditure growth have a higher tendency to switch from piped to refillable bottled water. This finding suggests that in those areas the switch to refillable bottled water is a cost-based decision. This is in accordance with previous studies indicating that more affluent households tend to choose bottled water (Johnstone and Serret, 2012; York et al., 2011).

However, it is important to note that in urban areas households' affluence does not affect the switch from piped to refillable bottled water. Apparently, the decision to make this switch is less costly for households in urban areas. The fact that refillable bottled water is widely available in urban areas, might make this type of water more accessible and less costly for urban households in comparison to households in rural areas. Lastly, as hypothesized, we find that the switching behaviour is positively affected by the proliferation of the market for refillable bottled water, while it is negatively affected by the development of the piped water networks.

For households using piped water, the household's head education, female headship and presence of infants do not affect switching behaviour. This is in line with the fact that we could not make clear predictions for these variables. More educated heads, female heads and parents of infants will on the one hand be more aware that piped water has its problems, but they might on the other hand also be more aware of -- and sensitive to -- the risks associated with refillable bottled. It therefore is not surprising to find no significant effect for these variables for households using piped water.

The switch from branded bottled water to refillable bottled water appears to be an urban phenomenon driven by cost considerations. Within the group of users of branded bottled water, households with a low initial income and those who experienced a decrease in their income during the study period are more likely to switch to refillable bottled water. Users of branded bottled water switch to the much cheaper refillable bottled water but may still take pride in having bottled water.

The sources included in the group “other water sources” are cheaper and less healthy than refillable bottled water. The switch from one of these sources to refillable bottled can be explained by a mix of all of the motives. In addition to the lifestyle motive, and the cost and availability factors, it is evident that the risk aversion strategy and a search for a healthier source are the motivating factors for households to switch from “other water sources” to refillable bottled water as their main source of drinking water. This is confirmed by the fact that for this group education – indication knowledge of the health risk of the different sources -- has a significantly positive effect on switching to refillable bottled water. However, besides health related motives, also the fact that this switch benefits the household in terms of convenience and higher social status may play a role of importance.

The interaction effects indicate that the cost and availability factors have a stronger effects for households in rural areas than those in urban areas. This could be caused by the fact that the distribution of refillable bottled water is concentrated in urban areas and hence the effect of market expansion of refillable bottled water in these areas is almost saturated. Given this distribution disparity, the switch to refillable bottled water is more costly for rural households in comparison to households in urban areas.

To sum up, the switch to refillable bottled water is mainly driven by lifestyle and, particularly in rural areas, by cost and availability motives. Our findings call for an exploration of the lifestyle choice in relation to the preference for drinking water sources and the safeguarding of the provision and quality of drinking water supplies in the LMICs. Even though the quality of refillable bottled water is often questionable, the pressure for households to switch to refillable bottled water seems strong. Thus, an urgent policy implication for local governments is to find an effective way to communicate to local residents the contamination and unsafety of refillable bottled water. Another policy issue is how the depot owners and the government can ensure the hygiene practice of the depots and the quality of the water. This highlights the urgent need for an improved surveillance system and a certification or water quality testing system for the refillable bottled water industry.

3.6. Appendix

Table A.3.1 Water supply characteristics in Indonesia

	Branded bottled water	Refillable bottled water	Metered piped water	Other water sources
Definition	Drinking water produced and distributed by beverage companies in a sealed 19 litre bottle	Drinking water produced through a purification process and not branded	Clean water produced through a purification and sanitation process before distribution to consumers through water pipes	Includes tanker truck water, drilled/ pumped wells, protected wells, protected springs, rain water, unprotected wells, unprotected springs, rivers, and others. Tanker truck water is water produced through purification and sanitation process (PDAM water), although it distributed by retail/mobile water sellers
Drinkable	Yes	Yes, but research shows that the water is often contaminated and does not meet the minimum requirements for drinking water	Mostly not drinkable. It needs further treatment such as boiling before consumption	Not drinkable. It needs further treatment such as by boiling before consumption
Producer	Big beverage companies such as Danone, Coca Cola, & Nestle	Small privately owned local businesses	Local government owned drinking water company (PDAM)	Local government owned drinking water company, private companies, etc.
Seller	Grocery stores	Refilling depots	Local government owned drinking water company, distributed to consumers through water piping system	Distributed to consumer by retail/ mobile water sellers
Diarrhoea Prevalence¹	1.53%	1.71%	1.48%	2.05%
Price	IDR 16,000/ 19 L bottle ²	IDR 4,000/ 19 L bottle ²	IDR 4,974/ M3 ³	
Price per litre	IDR 842.11	IDR 210.53	IDR 4.97	IDR 0 – 25 ³
Other characteristics			Connection fee: IDR 1,348,000 (one time) ³ On average water running for 19.22 hours per day (Range: 0-24 hours) ⁴	

Notes:

1. As a proxy for water quality, the number represents the percentage of people who had diarrhoea two weeks before the (Susenas panel) survey in 2008.
2. The prices are for bottled water in Bandung, West Java, on April 2016.
3. PDAM Bandung (2016).
4. BPPSPAM (2015).

Table A.3.2 Variable definition

Variable	Definition
Dependent variable	
Household switch to refillable bottled water	Equal to 1 if in 2010 household switch their drinking water source to refillable bottled water, and equal to 0 if in 2010 households keep using the initial water source as in 2008.
Household factors	
HH head years of education	Number of years of schooling completed by the household head.
HH head is female	Equal to 1 if the household head is a female, 0 otherwise.
HH has infant (0-5 years)	Equal to 1 if the household has at least one children under age five, 0 otherwise.
HH head age	Age of the household head (in years).
Urban	Equal to 1 if household lived in urban area, 0 otherwise.
Initial HH expenditure	Household's expenditure in 2008 (in million IDR).
Δ HH expenditure	The change of household's expenditure between 2008 and 2010 (in million IDR).
HH size	Number of people in the household.
Initial water access	
Branded bottled water	Equal to 1 if the household's main drinking water source in 2008 is branded bottled water, 0 otherwise.
Refillable bottled water	Equal to 1 if the household's main drinking water source in 2008 is refillable bottled water, 0 otherwise.
Metered piped water	Equal to 1 if the household's main drinking water source in 2008 is metered piped water, 0 otherwise.
Other water sources	
Other improved water	Equal to 1 if the household's main drinking water source in 2008 is other improved water, 0 otherwise.
Unimproved water	Reference category, if the household's main drinking water source in 2008 other water sources.
Context factors	
Initial coverage of:	
Branded bottled water	Percentage of household in the region with access to branded bottled water in 2008.
Refillable bottled water	Percentage of household in the region with access to refillable bottled water in 2008.
Metered piped water	Percentage of household in the region with access to metered piped water in 2008.
Δ Coverage of:	
Branded bottled water	The change of the coverage if branded bottled water in the region between 2008 and 2010 (in percentage point).
Refillable bottled water	The change of the coverage if refillable bottled water in the region between 2008 and 2010 (in percentage point).
Metered piped water	The change of the coverage if metered piped water in the region between 2008 and 2010 (in percentage point).

Chapter 4

CLEAN WATER, SANITATION AND DIARRHOEA IN INDONESIA: EFFECTS OF HOUSEHOLD AND COMMUNITY FACTORS

Abstract

Diarrhoea is an important health issue in low and middle income countries, including Indonesia. We applied a multilevel regression analysis on the Indonesian demographic and Health Survey to examine the effects of drinking water and sanitation facilities at the household and community level on diarrhoea prevalence among children under five ($n=33,339$). The role of the circumstances was explored by studying interactions between the water and sanitation variables and other risk factors. Diarrhoea prevalence was reported by 4,820 (14.4%) children, who on average were younger, poorer and were living in a poorer environment. At the household level, piped water was significantly associated with diarrhoea prevalence ($OR=0.797$, 95%CI 0.692–0.918), improved sanitation had no direct effect ($OR=0.992$, 95%CI 0.899–1.096) and water treatment was not related to diarrhoea incidence ($OR=1.106$, 95%CI 0.994–1.232). At the community level, improved water coverage had no direct effect ($OR=1.002$, 95%CI 0.950–1.057) but improved sanitation coverage was associated with lower diarrhoea prevalence ($OR=0.917$, 95%CI 0.843–0.998). Our interaction analysis showed that the protective effects of better sanitation at the community level was increased by better drinking water at the community level. This illustrates the importance of improving both drinking water and sanitation simultaneously.

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4.1. Introduction

The latest (UNICEF and WHO, 2015) report on sanitation and drinking water worldwide indicates that over 663 million individuals still lack access to safe drinking water and 159 million persons rely on surface water for their water consumption. Within countries, the regional disparity in water access is substantial. About 79% of people depending on unimproved drinking water and 93% depending on surface water live in rural areas (UNICEF and WHO, 2015). In addition, 2.4 billion people (32%) worldwide lack access to improved sanitation facilities. In these situations, with poor water quality and high contamination risk, diseases such as diarrhoea become a major concern. Diarrhoea is still one of the most important killers of children under five (WHO and UNICEF, 2013a).

Indonesia closely reflects this global pattern. A considerable proportion (18%) of Indonesian households rely for their drinking water on surface water sources, such as springs, rivers, ponds, and lakes, which are prone to contamination problems (Statistics Indonesia, 2014a). Only 11% of Indonesian households have access to piped water inside their dwelling (Statistics Indonesia, 2014a), and even then the quality is often below the minimum requirement for drinking water, with fluctuating debit and frequent interruptions (Surjadi, 2003). Sometimes the piped water is contaminated with faecal coliform and unsafe to be consumed without processing steps (Bakker, 2007). Almost all households boil their drinking water (Prihartono et al., 1994), but this is not always done effectively, as 55% of drinking water samples were found to be contaminated with faecal coliform (Vollaard et al., 2004).

In addition, Indonesia has the second highest number of people (54 million) in the world that practice open defecation (UNICEF and WHO, 2015). This increases the risk of environmental pollution and water contamination even more. Given the poor quality of water and sanitation, it comes as no surprise that diarrhoea is still a major health concern in Indonesia, responsible for 31% of post-neonatal mortality and 25% of child mortality (UNICEF, 2012).

Whether a child suffers from diarrhoea is influenced by many factors, at the level of the household as well as at the level of the community in which the household is living. Ideally, an analysis of the determinants of diarrhoea should take all relevant factors at both levels into account (Corsi et al., 2011; Fewtrell et al., 2005). Children from a household with good quality water and sanitation are still at risk for diarrhoea if they live in a community with open defecation, due to the contamination of soil and water sources (Andres et al., 2014; Corsi et al., 2011). By focusing the analysis only on factors at the household level, an incomplete picture is obtained and interventions might appear to be less effective than they truly are (Corsi et al., 2011).

From a policy perspective, it is very important to know whether the effects of risk factors vary across circumstances. If it is known under which circumstances a certain risk factor or protective measure is important, policy makers can tailor interventions towards the requirements of the specific situation. We can find these circumstances by including interaction terms between the risk factor or protective measure and variables indicating the circumstances in our analysis. However, until now no encompassing study on diarrhoeal disease in Indonesia has been published in which both direct and interaction effects of the major risk factors are studied simultaneously.

The current study aims to fill this gap in our knowledge by examining the impact on childhood diarrhoea of the quality of water and sanitation at household and community level in Indonesia. The model includes interactions between the risk factors and variables describing the specific situation. We perform a multilevel analysis on data from the 2007 and 2012 Demographic and Health Surveys in order to answer the following research questions:

- (1) Does access to and treatment of water and sanitation at the household level influence diarrhoea prevalence? (2) Does water and sanitation coverage at the community level influence diarrhoea prevalence? (3) Under what circumstances are water access and sanitation important for preventing diarrhoea?

We expect that better quality of water and sanitation protect children against diarrhoea and that the relevant factors are found at both the household and community level. In addition, we expect that larger effects will be observed for children living in more deprived circumstances, such as in poor households and in communities with poor hygiene.

4.2. Conceptual Framework

Our theoretical framework assumes children's health condition to be influenced by individual, household and community factors (Figure 4.1). At the household level, we focus on access to drinking water, on whether the water is treated, and on the quality of the sanitation facilities (Arrow A in Figure 4.1). In Indonesia, many households still rely on unsafe drinking water, such as water from unprotected wells and rivers that are vulnerable to microbial contamination. This contamination takes place not only at the water source, but also during collection, transport, storage, and serving of the water, due to faecally contaminated hands, utensils and insects (Shaheed et al., 2014).

Piped water on the premises is expected to be less contaminated, as by the nature of its construction the piped water system protects against outside influences (WHO and

UNICEF, 2013b). In addition, households connected to piped water can improve their health outcomes because more water is available for cleaning the house, thus facilitating a better hygienic situation (Fewtrell et al., 2005). Connection to piped water does not, however, always guarantee better water quality, as in less developed regions the water is often not continuously running. This means that households still have to store water in the home that is then vulnerable to (re)contamination (Fewtrell et al., 2005; Shaheed et al., 2014; Wright et al., 2004).

When the quality of the available water supply is less than ideal, treating the water by boiling, chlorinating, filtering, or other methods is an important behavioural strategy for reducing the risk of diarrhoea (Clasen et al., 2007). Point-of-use water treatment improves the microbial safety of the water before consumption (Sodha et al., 2011) and reduces the risk of diarrhoeal diseases, specifically in developing countries (Fiebelkorn et al., 2012). However, the benefits of this treatment are not guaranteed, as the cleanliness of the treated water is often not maintained during storing and serving. It might for instance be touched while being put in or removed from the containers, which reduces the protective effects of treatment (Sodha et al., 2011; Wright et al., 2004).

Besides clean water, a good sanitation facility is protective against diarrhoea. Such a facility separates the human excreta from direct contact with humans and ensures a safe disposal of the faeces, thus reducing the risk of faecal contamination (Andres et al., 2014). However, as shown by a recent cluster-randomised trial in rural Odisha, India, proper sanitation facilities at the household level do not always improve health (Clasen et al., 2014). Exposure to faecal contamination in the community can wipe out the beneficial effects of good facilities at home.

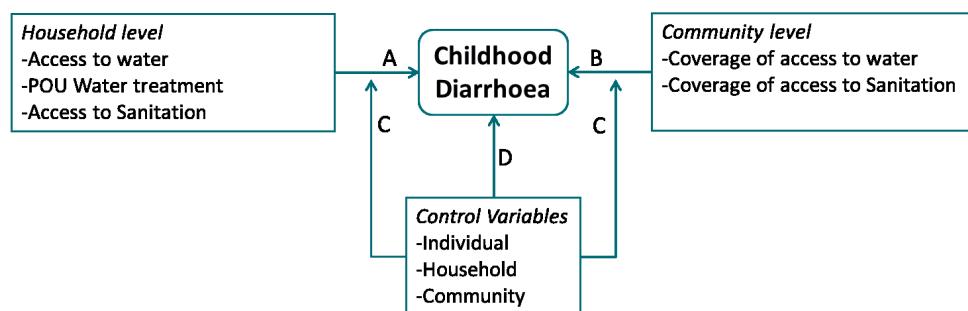


Figure 4.1. The impact of the household and community level of water and sanitation on childhood diarrhoea

Arrow B in Figure 4.1 highlights the importance of water and sanitation at the community level for children's health status. Health outcomes of children in households with good water and sanitation might be suboptimal when the hygiene level of the environment in which the household resides is low. Poor environmental hygiene may directly (e.g. by contact with contaminated water or human excreta in the open field) or indirectly (e.g. through contact with contaminated flies or other children) spread faecal contamination and water contamination over the community. In this way, members of households that already have good water and sanitation may be affected (Corsi et al., 2011; Gragnolati, 1999). Hence, important spillover effects between factors at the household and at the community level can be relevant.

Positive spillover effects may occur if households with access to clean water share their water with neighbours that have no such access (Alderman et al., 2003). This might facilitate better hygiene and health outcomes for children in the community (Corsi et al., 2011; Gragnolati, 1999). An even stronger spillover effect is expected with respect to the coverage of proper sanitation in the community (Alderman et al., 2003). Although an improved toilet increases the hygiene level of the owner, it cannot fully eliminate faecal contamination from the neighbourhood if other households lack such a facility (Andres et al., 2014; Clasen et al., 2014).

Indirect effects at the community level might also be important. Hughes & Dunleavy (2000, as cited in Alderman et al., 2001), for example, found that positive health effects of community access to water only materialized when combined with the community access to toilet. We therefore include in our model interaction terms between the water and sanitation variables at household and community level (Arrows C in Figure 4.1).

4.2.1. Control factors

Our model contains a number of control factors that are known or expected to influence diarrhoea risk (Arrows D in Figure 4.1). At the individual level, the child's age and sex are important. Approximately 80% of the total diarrhoea incidence relates to children younger than two years of age (Walker et al., 2013). After this age, the rate of illness falls as the first infections induce a certain level of immunity, which protects against following incidences (Yu et al., 2015). Gender is also important, because of differences in immune system functioning between girls and boys, and because girls have been shown to have lower morbidity and mortality rates than boys (Muenchhoff and Goulder, 2014).

At the household level, we include mother's education and household wealth. An educated mother may have a higher level of awareness about hygiene (Alderman et al., 2003) and be better able to obtain clean water and to treat water effectively (Mangyo,

2008). Poorer households have fewer resources to fulfil their basic necessities, have poorer living conditions and have a lower health status, all factors that increase diarrhoea risk (Hatt and Waters, 2006).

Control factors at community level are availability of health facilities, level of regional development, urbanization, adult education and the position of women in the area. Households in more developed or urban regions can generally benefit from better infrastructure, including more and better health facilities. Living under better circumstances in terms of infrastructure and health services may benefit the households in the area, including their children (Fotso and Kuate-Defo, 2005). Given that women are the major caretakers of young children, a stronger position of women in the household and local community might be favourable for children's health. We therefore also control for the decision making power of women.

4.3. Methods

4.3.1. Data

This study utilized the Indonesia Demographic and Health Surveys (DHS) from 2007 and 2012 (Statistics Indonesia and Macro International, 2008; Statistics Indonesia et al., 2013). These DHS surveys were designed to be representative at the national, urban, rural, as well as provincial level. Both datasets collected information on demographic, socioeconomic, and health-related issues. To ensure the protection of human subjects, all DHS protocols are reviewed by an ethics review panel or institutional review board in the country where the survey is conducted (ICF International and Macro International, 2012).

For the current study, the surveys were pooled into a single dataset. This combined dataset includes data on 33,399 children under age five, from 28,573 mothers, living in 3,069 subdistricts, within 922 districts, within 33 provinces. We excluded children with missing data on diarrhoea infection (N=338) and children with missing response(s) on explanatory variable(s) (N=1,521, or an additional 4.4% of children).

4.3.2. Outcome variable

The outcome variable is a dummy variable indicating whether or not the child suffered (yes=1, no=0) from diarrhoea in the past two weeks. This question was asked of all mothers with living children under age five.

4.3.3. Independent variables

Independent variables were included at the household and subdistrict level. A subdistrict is the second lowest public administration before village level. On average, it covers an area of 273.6 km² and has a population of about 36,000. Variables at subdistrict level were aggregated from household data. They were calculated as the proportion of individuals or the mean of the variable within each subdistrict.

The main household level predictors were variables indicating whether there was piped water in the dwelling (yes, no), whether point-of-use water treatment was used (yes, no), and whether the household had improved sanitation (yes, no). Point-of-use water treatment indicated whether the household used any treatment method, such as boiling, bleaching, chlorinating, filtering, or solar disinfection to the water before its consumption. Improved sanitation indicated a toilet facility that ensured the separation of human excreta from human contact, such as a toilet with septic tank, pit latrine, or composting toilet (UNICEF and WHO, 2015).

Other control variables were the child's gender (girl, boy), age (0-4 years) and age-squared, mother's education (years of schooling completed), household wealth, and dummy variables indicating whether the household lived in an urban (1) or rural (0) area and whether the household was interviewed in the 2007 (0) or 2012 (1) DHS survey. Household wealth was measured by an index constructed following Filmer & Pritchett (2001) by applying a principal component analysis (PCA) on the following variables: indicators of whether the household owned a radio, television, refrigerator, telephone, car, bicycle, or motor bike, whether there was electricity in the dwelling and the quality of the floor material used for the dwelling. In line with Smits & Steendijk (2015), the outcome of the PCA analysis was translated into a continuous index ranging from 0 (having none of the assets and lowest floor quality) to 100 (having all assets and highest floor quality). We could not use the regular DHS wealth index available in the dataset (Rutstein and Johnson, 2004), as it uses information on the quality of drinking water supply and toilet facilities, which we wanted to study separately in our analyses.

At the subdistrict level (i.e. community level), we included seven contextual variables. Improved water coverage was measured by the proportion of households with improved drinking water, i.e. piped water on premises, public taps, tube wells, protected dug well, protected springs and rainwater collection in the community (UNICEF and WHO, 2015). Improved sanitation coverage, as a proxy for environmental hygiene, was measured by the proportion of households with an improved toilet facility in the community. Health facilities coverage was indicated in line with Monden & Smits (2009) as the proportion of mothers who gave birth in a proper health facility, such as a hospital, health centre, village health post, or with help of a village midwife. Another health indicator at the community

level was the proportion of children who received three polio vaccinations. The community level of economic development was indicated by the proportion of households owning a car. Two context variables—adults' education and maternal decision power—were created to measure the availability of (health) knowledge and the strength of the position of women in the community. Adult education was measured by the average years of education completed by adults aged 15 and over in the community. Maternal decision power was measured by the proportion of mothers who reported that they could decide by themselves whether a child should be taken for medical treatment. Further description of variables used in the analysis can be found in the Appendix, Table A.4.1.

4.3.4. Statistical analysis

We used a four level multilevel logistic regression model, with households (level 1) nested in subdistricts (level 2), nested in districts (level 3), nested in provinces (level 4). Given that the average number of children per household was very small (1.2), children and households are considered as part of the same level (level 1). The model contains explanatory variables at levels 1 and 2. Levels 3 and 4 are included as random effects. The model was estimated with MLWin version V.2.29, using second-order PQL, the recommended estimation technique for multi-level logistic regression analysis (Goldstein, 2011). Both bivariate and multivariate multilevel models were estimated. Interaction analysis was used to study how the five main variables (piped water in the dwelling, point-of-use water treatment, improved toilet, improved water coverage, and improved sanitation coverage) varied across circumstances. Given the explorative nature of the interaction analysis, we tested for all potential interactions between the main variables and the other variables in the model. To be able to focus on the most important interaction effects, only significant interactions were included in the final model. In this way a parsimonious picture is obtained of the way in which the effects of the independent variables differ between children living under different circumstances. In the interaction analyses, centred versions of the variables were used. The main effects therefore can be interpreted as average effects. Statistical significance was evaluated at $p<0.05$ and the coefficients are presented as odds ratios (OR).

4.4. Results

Table 4.1 presents descriptive of the data. The mothers of 4,820 (14.4%) children reported that they suffered from diarrhoea in the preceding two weeks. Most households have no access to piped water in their premises (86.82%), treat the water (78.93%), and have an improved toilet (58.33%). Of the 33,399 children, 16,010 (47.94%) are girls, and 16,925 (50.68%) are from the 2007 DHS dataset. The average age of the children is about 2.0

years. About 50% of the households in the community have access to improved water and 59% to improved sanitation.

Table 4.1 Descriptive characteristics of children aged under five in Indonesia, Demographic and Health Survey, 2007 and 2012

Variables	n/ mean	%/ (SD/ range)
Total	33,399	100.00
Children having diarrhoea	4,820	14.43
Children with piped water in the dwelling	4,402	13.18
Children with point-of-use water treatment	26,361	78.93
Children with improved toilet	19,480	58.33
Gender is girl	16,010	47.94
Mean children age (SD/ range)	1.98	(1.42/ 0–4)
Mean years of mother education (SD/ range)	8.67	(3.85/ 0–15)
Mean household wealth (SD/ range)	51.62	(25.94/ 0–100)
Children living in urban area	14,037	42.03
Children from DHS 2012	16,474	49.32
Context factors		
Mean improved water coverage (SD/ range)	0.50	(0.29/ 0–1)
Mean improved sanitation coverage (SD/ range)	0.59	(0.30/ 0–1)
Mean health facilities coverage (SD/ range)	0.48	(0.37/ 0–1)
Mean vaccination coverage (SD/ range)	0.65	(0.24/ 0–1)
Mean economic development (SD/ range)	0.07	(0.10/ 0–1)
Mean adults' education (SD/ range)	7.94	(2.25/ 0.26–16)
Mean mother's decision power (SD/ range)	0.82	(0.18/ 0–1)

The results of the bivariate analysis are presented in Table 4.2. The figures in this table show how diarrhoea prevalence varies among households and communities with different characteristics. Most of the coefficients are significant and support the hypothesis that improved water and sanitation reduce the risk of childhood diarrhoea. Households with piped water or with an improved toilet facility have lower odds of diarrhoea. Interestingly, water treatment is associated with a higher risk of diarrhoea among children.

As expected, girls have a lower risk of having diarrhoea. The significance of age and its squared term suggest that the relationship between age and the odds of having diarrhoea is curvilinear with increasing prevalence in the first two years of life and decreasing prevalence afterwards. Mother's education, household wealth, and living in an urban area all are associated with significantly lower odds of having diarrhoea. There is no significant difference in diarrhoea risk between the two survey years.

Except for improved water coverage, the bivariate model shows that all community characteristics are significantly associated with diarrhoea prevalence and that the direction of their effects is in line with our hypotheses. The likelihood that children have diarrhoea is lower when more households in the community have improved water and sanitation, and the community is characterized by better health facilities, a wealthier or a better-educated population, and women with more decision-making power.

Table 4.2 Bivariate multilevel analysis of the diarrhoea prevalence of children aged under five, Indonesia, 2007 and 2012

	OR (95% CI)
Piped water in the dwelling	
<i>No (Ref)</i>	1.000
<i>Yes</i>	0.748 [0.655–0.854]*
Point-of-use water treatment	
<i>No (Ref)</i>	1.000
<i>Yes</i>	1.110 [1.003–1.227]*
Improved toilet	
<i>No (Ref)</i>	1.000
<i>Yes</i>	0.826 [0.762–0.895]*
Gender	
<i>Boy (Ref)</i>	1.000
<i>Girl</i>	0.795 [0.740–0.853]*
Child's age	1.264 [1.159–1.378]*
Child's age square	0.883 [0.863–0.902]*
Mother's education	0.979 [0.968–0.989]*
Household wealth	0.844 [0.807–0.883]*
Living in an urban area	
<i>Rural (Ref)</i>	1.000
<i>Urban</i>	0.870 [0.785–0.966]*
Survey year	
<i>2007 (Ref)</i>	1.000
<i>2012</i>	1.076 [0.961–1.205]
<i>Context factors</i>	
Improved water coverage	0.951 [0.904–1.001]
Improved sanitation coverage	0.830 [0.778–0.875]*
Health facilities coverage	0.816 [0.772–0.863]*
Vaccination coverage	0.865 [0.821–0.911]*
Economic development	0.865 [0.819–0.914]*
Adult education	0.860 [0.814–0.907]*
Mother's decision power	0.930 [0.884–0.979]*

Notes: * $p<0.05$. Ref, reference category.

4.4.1. Multivariate analysis

Results of the multivariate analysis are presented in Table 4.3. Model 1 includes only the main effects and model 2 includes both the main and interaction effects.

Table 4.3 Multilevel analysis of the diarrhoea prevalence of children aged under five, Indonesia, 2007 and 2012

	Model 1 - no interaction	Model 2 - with interaction
	OR (95% CI)	OR (95% CI)
Intercept	0.134 [0.115–0.157]*	0.137 [0.117–0.160]*
Piped water in the dwelling	0.797 [0.692–0.918]*	0.763 [0.643–0.907]*
Point-of-use water treatment	1.106 [0.994–1.232]	1.089 [0.977–1.214]
Improved toilet	0.992 [0.899–1.096]	0.951 [0.860–1.052]
Girls	0.791 [0.736–0.850]*	0.793 [0.738–0.852]*
Child's age	1.265 [1.159–1.379]*	1.276 [1.170–1.392]*
Child's age square	0.882 [0.863–0.902]*	0.880 [0.861–0.900]*
Mother education	0.994 [0.981–1.006]	0.996 [0.983–1.008]
Household wealth	0.905 [0.853–0.959]*	0.890 [0.839–0.944]*
Living in urban area	1.177 [1.035–1.338]*	1.223 [1.075–1.392]*
Survey year	1.261 [1.119–1.421]*	1.271 [1.128–1.432]*
Context factors		
Improved water coverage	1.002 [0.950–1.057]	1.013 [0.958–1.071]
Improved Sanitation coverage	0.917 [0.843–0.998]*	0.898 [0.825–0.977]*
Health facilities coverage	0.870 [0.806–0.940]*	0.858 [0.795–0.926]*
Vaccination coverage	0.944 [0.891–1.001]	0.947 [0.893–1.005]
Car ownership	0.947 [0.886–1.012]	1.001 [0.933–1.074]
Adult education	1.074 [0.981–1.174]	1.057 [0.966–1.157]
Mother decision power	0.961 [0.913–1.012]	0.970 [0.921–1.022]
Interaction Effects		
Piped water in the dwelling X Living in urban area		2.142 [1.490–3.078]*
Piped water in the dwelling X Health facilities coverage		0.704 [0.588–0.842]*
Piped water in the dwelling X Vaccination coverage		1.267 [1.063–1.512]*
Piped water in the dwelling X Adult education		0.819 [0.685–0.978]*
Improved toilet X Child age		0.906 [0.858–0.958]*
Improved toilet X Mother decision power		1.090 [1.005–1.183]*
Improved toilet X Improved water coverage		1.102 [1.005–1.207]*
Improved water coverage X Car ownership		1.154 [1.080–1.233]*
Improved water coverage X Improved Sanitation coverage		0.914 [0.860–0.972]*
Improved Sanitation coverage X Household Wealth		0.922 [0.879–0.968]*

Notes: * $p<0.05$. Ref, reference category.

After controlling for other factors, the prevalence of diarrhoea is lower among children with piped water in the premises ($OR=0.80$, 95% CI: 0.69–0.92) and, to our surprise, higher when the water is treated ($OR=1.11$, 95% CI: 0.99–1.23), whereas no significant effect is found for an improved toilet in the household ($OR=0.99$, 95% CI: 0.90–1.10). At the community level, the odds of having diarrhoea decrease as the coverage of improved sanitation in the community is higher ($OR=0.92$, 95% CI: 0.84–1.00) while no significant

effect of the coverage of improved water on diarrhoea prevalence ($OR=1.00$ 95% CI: 0.95–1.06) is found.

Children's age and age-squared are significantly related to diarrhoea risk, with a similar curvilinear shape as in the bivariate model. Also, the gender difference remains important, with lower prevalence among girls. At the household level, the effect of wealth remains significant, with less diarrhoea in wealthier households, but maternal education loses its significance. At the community level four variables--vaccination coverage, economic development, adult education and mother's decision power--lose their significance, while the other effects remain unchanged.

4.4.2. Interaction effects

To explore how the effects of the five core variables (piped water in the dwelling, water treatment, improved toilet, improved water coverage at community level, and improved sanitation coverage at community level) vary across contexts, we computed interactions between these variables and the other factors in the model. These interactions were iteratively tested and the significant interaction effects were included in the model. This explorative procedure produced ten significant interactions that were included in Model 2 of Table 4.3.

The protective effect of piped water turns out to be stronger for children living in a community with good health facilities coverage and a more highly educated population ($OR=0.70$, 95% CI: 0.59–0.84 and $OR=0.82$, 95% CI: 0.69–0.98, respectively). This stresses the importance of clean water as a basic requirement for good facilities or available knowledge to be effective. The importance of piped water is further highlighted by the fact that in rural areas and areas that are badly covered by vaccination campaigns, the availability of piped water in the dwelling is associated with less diarrhoea. The difference between urban and rural areas is particularly strong ($OR=2.14$, 95% CI: 1.49–3.08). Further analysis shows that in rural areas the OR is 0.55 (95% CI: 0.42–0.72). Consequently, in rural areas piped water is particularly important, while in urban areas piped water does not make a significant difference for diarrhoea risk ($OR=1.19$, 95% CI: 0.95–1.48).

Improved sanitation at the household level reduces diarrhoea risk for older children ($OR=0.91$, 95% CI: 0.86–0.96). This finding makes sense, given that babies and very young children do not yet use toilet facilities. The positive interactions of improved sanitation with maternal decision power ($OR=1.09$, 95% CI: 1.01–1.18) and water coverage at the community level ($OR=1.10$, 95% CI: 1.01–1.21) point towards the existence of compensatory effects, whereby better toilet facilities at the household level may compensate for lack of women's power and bad water coverage at the community level.

In situations where women's power is at its lowest level, the effect of having a better toilet facility in the house is significantly negative ($OR=0.64$, 95% CI: 0.44–0.95), hence associated with less diarrhoea. This is also true in communities with bad water coverage ($OR=0.81$, 95% CI: 0.66–0.98).

Improved water coverage at the community level is most effective in reducing diarrhoea risk in less developed areas. It is also more effective if it goes together with better sanitation coverage at the community level and vice versa ($OR=0.91$, 95% CI: 0.86–0.97), so that improvement of water and sanitation facilities in regions and villages should go hand in hand.

Finally, we see that the children of the wealthiest households profit most from improved sanitation at the community level. Although these children experience the most favourable circumstances at home, their risk of getting diarrhoea remains high as long as they live and play in a polluted community.

4.5. Discussion

The results of the current study indicate that having piped water in the dwellings reduces the odds of childhood diarrhoea by 24%. This percentage is similar to the 22% reduction in diarrhoea risk reported in a meta study (Fewtrell et al., 2005). However, we also find that piped water is particularly important in rural areas, where the circumstances are more difficult and hence improvement of water supply can make more of a difference. The fact that in urban areas the effect of piped water is weaker might have to do with the poor quality of the piped water system or with fluctuation debit. When the pressure in the pipes is low, polluted water from outside may enter and reduce the water quality (Shaheed et al., 2014). Another consequence of this fluctuating debit is that households need to store the water which again increases microbial (re)contamination that may increase diarrhoea risks (Wright et al., 2004).

The benefit from high coverage of health facilities complements the protective effect of piped water in the dwellings on childhood diarrhoea. Meanwhile, this protective effect is more effective in a community with low vaccination coverage. This indicates the complexity of diarrhoea disease, which can be transmitted not only through water but also through other routes such as food contamination (Agustina et al., 2013) that cannot be solved merely by the provision of safe water at the household level.

A surprising finding is that point-of-use water treatment is not significantly associated with diarrhoea prevalence and that there are no significant interactions with this factor. This result contrasts with research summarized in Fiebelkorn et al. (2012). It might indicate

that in many Indonesian households water treatment is ineffective. This would be in line with previous studies (Sodha et al., 2011; Vollaard et al., 2004), which find that in Indonesia a significant proportion of the treated water is (re)contaminated by *E. coli* while being stored.

In contrast to previous studies (Fewtrell et al., 2005), the quality of the toilet facility at the household level has no direct effect, although we found some significant interaction effects. Having an improved toilet facility is associated with lower diarrhoea prevalence for older children, and in areas where mothers have less decision power, or improved water coverage is low. That older children (but still younger than 5 years) benefit from an improved toilet seems logical as these children are able to use toilet facilities independently.

The significance of the main effect of improved sanitation at the community level confirms the results presented in Buttenheim (2008). The effect of improved sanitation coverage is strengthened in communities with improved water coverage, which indicates that improvement of water and sanitation should go hand in hand to get the best results. This is consistent with the result reported by Hughes and Dunleavy (2000, as cited in Alderman et al., 2001) who found joint externality effects of community access to water and sanitation in rural India, while their direct effect was not detected.

In sum, the fact that we found ten significant interaction terms illustrates the importance of studying the circumstances under which particular measures (piped water, better sanitation) are effective in reducing children's odds for getting diarrhoea. A limitation of this study is the use of a cross sectional design, which reduces the possibility to determine causal relationships. Lastly, this study focuses on Indonesia only, which could limit the applicability to other countries. However, the current study complements previous studies (Fuller et al., 2015, 2014), which document variation in the effect of water and sanitation on childhood diarrhoea between countries, by showing this variation between subdistricts in one country.

4.6. Conclusion

Diarrhoea is an important health issue in Indonesia as well as in many other developing countries. This study finds that piped water in the dwelling reduces diarrhoea risk for young children, whereas point-of-use water treatment and improved toilet appear to have no significant direct influence. This suggests that treatment is not done effectively and that it might be good that the government starts campaigns to make the public aware of this.

We hypothesized that the protective effect of water and sanitation facilities would be higher in poor situations. This appeared to be not always the case. We indeed found piped water at the household level to be particularly important in rural areas. However, the positive effect of better sanitation at the community level turned out to be stronger in communities with better water quality. This last finding illustrates the importance of improving drinking water and sanitation simultaneously and at the community level instead of some households only.

4.7. Appendix

Table A.4.1Description of variables used in the analysis

Variable	Description
Child level variable	
Diarrhoea incidence	Equal to 1 if child suffered from diarrhoea in the past two weeks, 0 otherwise.
Gender	Equal to 1 if child was girl, 0 otherwise.
Child's age	Child's age in years (0–4).
Household level variable	
Piped water in the dwelling	Equal to 1 if household had access to piped water in the dwelling, 0 otherwise.
Point-of-use water treatment	Equal to 1 if household treated the water before consumption by boiling, bleaching, chlorinating, filtering or solar disinfection, 0 otherwise.
Improved toilet	Equal to 1 if household had private toilet with septic tank, pit latrine or composting toilet, 0 otherwise.
Mother's education	Number of years of schooling completed by mother
Household wealth	Continuous variable of household's assets (1–100)
Living in an urban area	Equal to 1 if household lived in urban area, 0 otherwise.
Survey year	Equal to 1 if the year of DHS survey is 2012, 0 otherwise.
Community level variable	
Improved water coverage	Proportion of households in the community with access to improved water sources (piped water on premises, public taps, tube wells, protected dug wells, protected springs and rainwater collections).
Improved sanitation coverage	Proportion of households in the community with access to improved sanitation facilities (toilet with septic tank, pit latrine, or composting toilet)
Health facilities coverage	Proportion of mothers in the community who gave birth in a proper health facility (hospital, health centre, village health post, or with help of a village midwife).
Vaccination coverage	Proportion of children in the community who received three polio vaccinations.
Economic development	Proportion of households in the community owning a car.
Adult education	Average years of education completed by adults aged 15 and over in the community.
Mother's decision power	Proportion of mothers in community who reported that they could decide by themselves whether a child should be taken for medical treatment.

Chapter 5

DIRECT AND INDIRECT EFFECTS OF WATER ACCESS ON SCHOOL ABSENTEEISM AND ENROLMENT IN INDONESIA

Abstract

The provision of clean water remains a serious problem, especially in developing countries. About 11 percent of the world population relies on unimproved water sources which have to be brought to the house from outside, mostly by women and children. This situation might increase the prevalence of water related diseases such as diarrhoea and reduce study time for the children. School attendance may therefore decrease due to the combined effects of diarrhoea disruption and fetching water. The current study investigates the direct and indirect effect of water access on school absenteeism and school enrolment in Indonesia using a balanced panel data set for 295 districts over the period 1994-2014. Our data show that even though the primary school enrolment in Indonesia already reached 95%, a significant portion of students are absent due to health problems. Our results show that the access to piped and bottled water and access to a private water facility—above and beyond the access to water and health—can potentially improve both short- and long-term measures of education outcomes. The availability of piped and bottled water, and access to a private water facility are inversely related with school absenteeism and positively related to school enrolment. Accordingly, this benefit should be taken into account by the policy makers in identifying and quantifying the potential benefit of water infrastructure development in developing countries.

5.1. Introduction

The provision of clean water remains a serious problem, especially in developing countries. About 11 percent of the world population relies on unimproved water sources (WHO and UNICEF, 2013b). Those sources are often located far from the house, so that some people (mainly women and children) have to invest a lot of time walking and waiting. On average, they have to walk to fetch the water from a distance of as far as 6 kilometres (UNICEF, 2011), which may take up to 60 minutes a day (Sorenson et al., 2011). This leads to two essential problems: water contamination and wasted time. The risk of contamination is high, because the water source is often unprotected and the water is transported over a long distance in barrels or tanks that are not completely clean. Consequently, this may increase the prevalence of diseases, of which diarrhoea is the most important one, specifically among children (Fischer Walker et al., 2012; Komarulzaman et al., 2017). Furthermore, as children are often involved in helping their family fetch water, they might lose precious study time and attend school less often (Dreibelbis et al., 2013; Nauges and Strand, 2013). Thus, school attendance may decrease due to the combined effects of diarrhoea disruption and fetching water.

A large and growing body of literature has reported on the association between clean water provision and diarrhoea morbidity and mortality (Fischer Walker et al., 2012; Komarulzaman et al., 2017; Wolf et al., 2014) as well as the impact of water and sanitation improvement on school attendance (Dreibelbis et al., 2013; Hunter et al., 2014; Nauges and Strand, 2013). However, as far as we are aware of, no empirical investigation has studies these three aspects simultaneously. These studies directly link water provision to school attendance while at the same time these studies accept that better access to clean water leads to less diarrhoea. Hence, to investigate the net effect of clean water access on school attendance, diarrhoea prevalence should also be incorporated in the analysis.

The current study aims to investigate both the direct effect of clean water access on school attendance and its indirect effect, which runs through diarrhoea prevalence. We consider the case of Indonesia, where water access and diarrhoea as well as school attendance are still a major problem. The provision of piped water is limited (covers 20% of the population), and not distributed evenly throughout the country. In relation to this, Indonesia needs to cope with the problem of diarrhoea, which is the third major cause of child mortality (UNICEF, 2012). Lastly, even though primary school enrolment in Indonesia reached 95 percent in 2014, this figure does not capture the true reality of school participation as about 12.5% of the students have been absent from school due to illnesses (Statistics Indonesia, 2014b). Thus, an improved understanding of the effect of clean water access on both school attendance measures could support policymakers in formulating better interventions within the broader health and development sector.

The aim of this study is to analyse the direct and indirect (through diarrhoea) effect of access to clean water primary school enrolment and school absenteeism. A panel dataset for 259 districts in Indonesia over the period of 1994-2014 is used in the empirical analysis. Our study has three unique characteristics. First, besides the direct effect of water access on school attendance we include the indirect effect of water access on schooling through diarrhoea. Secondly, unlike previous studies which analyse the effect of water on either school absenteeism (Dreibelbis et al., 2013) or school enrolment (Nauges and Strand, 2013; Zhang and Xu, 2016), the current study explores the benefit of water access on both school attendance measurements. Lastly, the panel structure of the dataset with a large number of districts over an extended period of time is exploited by estimating panel models. This is an important extension of earlier studies (Dreibelbis et al., 2013) of water and schooling which have focused on the cross-section variation within a single period. Panel analysis is powerful enough to capture both the variation among observations across sections and over time. Moreover, the model allows us to control for the time effect to test whether the magnitude of the effect of water on schooling changes over time. Hence, exploring both the variation across sections and over time could give a better understanding on the effect of water supply on school attendance.

This paper is organized as follows. Section 2 provides some theoretical consideration behind the effect of water on school attendance. Section 3 outlines the data, and introduces the econometric methodology. Section 4 presents the empirical results which are discussed in Section 5. Section 6 summarizes the results and concludes.

5.2. A Theoretical Framework of Direct and Indirect Effects of Water on School Attendance

In the current study, school attendance is measured by school absenteeism and school enrolment. These two measures proxy, respectively, the short- and long-term aspect of school attendance. School enrolment does not capture the entire reality of school participation, because many pupils are absent from school due to illnesses, child labour and household responsibilities (Azor-Martínez et al., 2014).

The demand for primary education can originate from policy measures by which the government obliges its citizen to attend a school in order to acquire the basic skills needed for economic participation (Checchi, 2006). In Indonesia, the 1990 basic education law regulates 9 years of compulsory education for all children aged 7-15 years. However, this top-down approach is not sufficient to explain the variation in primary school attendance. Education can also be seen as an investment in human capital made by individuals to acquire future benefit (Eide and Showalter, 2010; Todaro and Smith, 2012). Based on this

view, school attendance depends on both the benefits and costs of education accrued by the individual or population. The costs of education include the direct costs of tuition fees, books, and transport costs and indirect or opportunity costs of forgone income due to school attendance (Eide and Showalter, 2010; Huisman and Smits, 2015; Todaro and Smith, 2012). In low-income countries, parents who decide on their children's education tend to be more myopic than the ones in high-income countries and base their choices more on current costs than on future gains, resulting in a lower demand for education (Checchi, 2006). In addition, Checchi (2006) elucidates some important factors that affect the optimal demand for education that include talent (i.e. personal intelligence or family background), current and expected future gains (i.e. employment condition and expectation of higher returns in the future), the initial level of human capital, and the available and allocated resources for education in the region.

Based on these views on school attendance, there are at least two channels through which water access influences school attendance. First, households with no access to water in the dwelling have to transport the water into the house from outside, a job usually carried out by women and children. This condition is a burden on the children, who lose energy and have less time to study (Dreibelbis et al., 2013; Nauges and Strand, 2013). In such a situation, the parents might consider that the current costs of sending their children to school are higher than possible future benefits. Second, the lack of access to clean water increases the probability of diarrhoea (Cairncross and Valdmanis, 2007; Komarulzaman et al., 2017; Wolf et al., 2014) and other hygiene issues among children, which might further reduce school attendance (Azor-Martínez et al., 2014; Neuzil et al., 2002). Thus, lack of supporting resources, i.e. clean water, reduces school attendance. This sub-optimal water condition may force children to be absent from school (Dreibelbis et al., 2013) or at worst drop out from school completely (Nauge and Strand, 2013).

Figure 5.1 gives an overview of the relations between water access, diarrhoea and other factors that affect school attendance. The relations that are depicted with solid lines are the most important ones for this paper. The relations indicated by dashed lines (the diarrhoea prevalence model) are of secondary importance, as they indirectly influence school attendance.

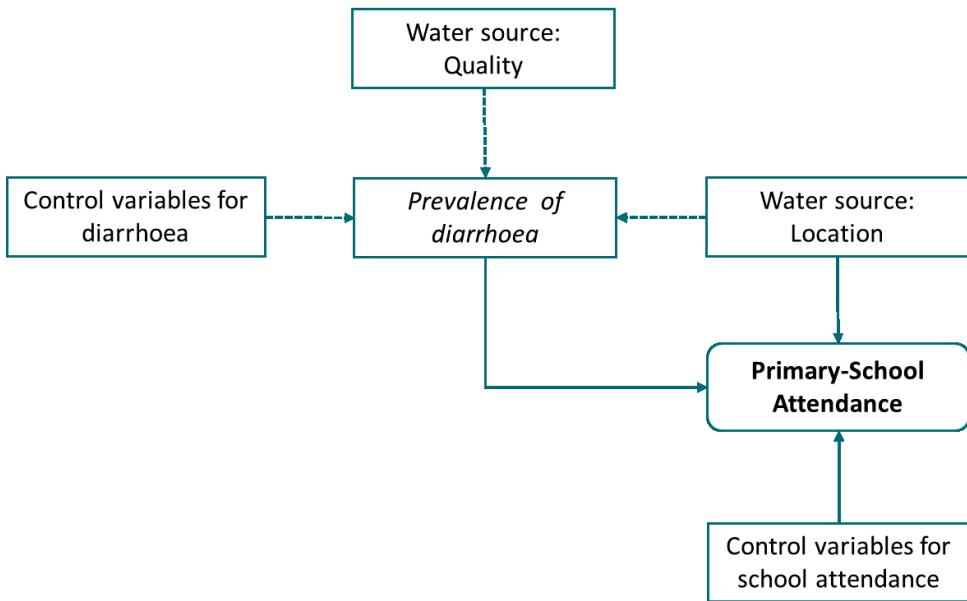


Figure 5.1 Theoretical model of water, diarrhoea and school attendance

5.2.1. Control variables for district primary school attendance

Primary school attendance in a district is expected to be influenced not only by the prevalence of diarrhoea and the availability of water, but also by the level of wealth, education, culture and urbanization in the region. Poverty is often a key reason that restricts children from attending school (Checchi, 2006; Huisman and Smits, 2015). A wealthy household typically has more resources to support the children and to offer them a good education. They also have lower opportunity costs to keep their children at home to help the family or to earn additional income from child labour. In addition, when financial markets are imperfect or absent, poor families are often constrained in getting credit and tend to acquire less education compared to children from richer families (Checchi, 2006; Todaro and Smith, 2012). Likewise, adults' education, primarily the level of parental education, has been found to influence children's schooling (Glick and Sahn, 2000; Huisman and Smits, 2015). Parents often set their own education level as a benchmark for their children, so that children from a well-educated family have a higher probability to achieve a higher level of education. Moreover, gender differences of parents' education level reflect the effect of cultural conditions in the region and the degree of mother's position in decision-making process. A more educated mother might have more power within the household and this increases the chance of the children, especially girls, attending school (Glick and Sahn, 2000). Lastly, children in an urban area might benefit from better education and other infrastructure conditions, e.g. number of

schools, electricity, roads, water and sanitation facilities, which can reduce the direct costs of education, which in turn positively affects the rate of primary school attendance (Daka and Ballet, 2011; Nauges and Strand, 2013).

5.2.2. Control variables for prevalence of diarrhoea

The prevalence of diarrhoea plays a significant role in this model as it mediates the effect of clean water on primary school attendance. There is ample evidence that children who lack access to safe drinking water and improved sanitation facilities have a bigger risk of getting diarrhoea (Fischer Walker et al., 2012; Komarulzaman et al., 2017; WHO and UNICEF, 2013a; Wolf et al., 2014). Clasen & Haller (2008), for example, found that about 94 percent of the disease burden is attributed to unsafe water, lack of sanitation and poor hygiene. Furthermore, WHO and UNICEF (2009) found that the incidences of diarrhoea could be decreased by one-third to one-fourth through improved living conditions such as access to safe water, improved sanitation, and better hygiene.

The children's health status is not only influenced by the water and sanitation facilities available, but also by many other factors related to their parents' behaviour, including parental education and wealth status of the family (Jalan and Ravallion, 2003). Using a propensity score matching technique, Jalan & Ravallion (Jalan and Ravallion, 2003) found a larger health gain of piped water on children with better educated mothers and this effect is even significant among poor households, most probably because an educated mother may have a better understanding of how to get and treat clean water. She will also be more likely to practice better hygiene in the family, specifically for her children. Consequently, a better health outcome is reached (Mangyo, 2008).

5.3. Methods

5.3.1. Data

This study uses a district panel data constructed on the basis of the annual Indonesia National Socio Economic Survey (Susenas) datasets from 1994 to 2014. Susenas was initiated in 1963-1964 and is composed of two questionnaires. The first is a core questionnaire which contains household characteristics and household members' information on age, sex, education, health, and working activities. The core questionnaire is fielded to about 200,000 – 286,000 households and 0.7-1.1 millions household members. With this sample size, the core data is representative at national, provincial, and district level. The survey is supplemented by a module questionnaire that collects additional information on consumption, expenditure, socio-cultural characteristics and

education, as well as on health and housing. The module is fielded to about 65,000 households and representative at the national and provincial level.

The annual cross-sectional data from the core questionnaire is used to construct a balanced district panel of 259 of the 291 Indonesian districts over a period of 1994-2014. The 32 districts that were not included are located in the provinces of Aceh, Sulawesi Tenggara, Maluku, Papua and Papua Barat. These districts were not surveyed in one or more years due to conflicts in the regions. In the current study, the district code is based on the 1994 geographical definition of the districts which was taken as the basic definition to accommodate the splitting up of districts during the period. Thus, the split districts were merged into their original parent district. A detailed district proliferation crosswalk can be found in the Appendix at the end of this thesis. All district level variables were aggregated from the individual and household data.

SUSENAS provides information on household's access to clean water, which varies from piped water inside the dwellings to surface water. The survey also contains a question on whether the household members had some illness(es) during the two weeks preceding the survey. The illnesses specifically asked for are fever, cough, flu/cold, asthma, diarrhoea, headache, and toothache. This question is followed by another one that asks whether the health complaint(s) disrupted their work, school or daily activities. Information on school attendance was obtained from the questions regarding current school participation and recent school absenteeism due to any health complaint(s).

5.3.2. Long term trend of piped water coverage, diarrhoea prevalence, and school attendance

This section presents a descriptive analysis of the long-term trend in clean water access, in diarrhoea prevalence among school-aged children, and in primary school attendance among 259 districts in Indonesia over the period 1994 to 2014. To reduce complexity, the descriptive analyses are at the national as well as the island level. Where necessary, additional information at the district level is given.

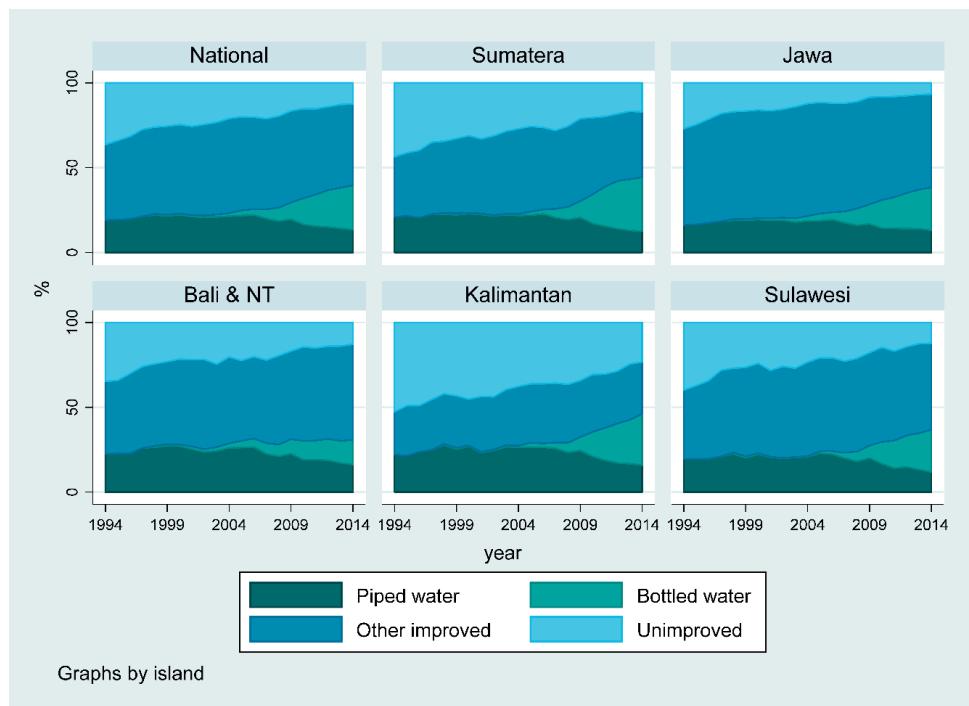


Figure 5.2 Percentage of households by main drinking water sources in Indonesia 1994 – 2014

Figure 5.2 shows the distribution of the main drinking water sources at national as well as island level from 1994 to 2014. In general, water provision in Indonesia improved significantly over the last two decades. Nationally, the percentage of households relying on safe water sources is increasing. Regarding the source of improved water, we see an increase of the use of bottled water and a decrease of the coverage of piped water. This increase in bottled water and decrease in piped water mainly took place in the big cities, such as Kota Surabaya (East Java province), all districts in the Jakarta Province, Kota Banda Aceh (Aceh Province) and Kota Bukit Tinggi (West Sumatera province). Kota Surabaya experienced the biggest fall in the use of piped water as the main drinking water source: in 2014 the percentage of households using piped water was 72.7 percentage points lower than its level in 1994. It seems that the ability of the government to provide a reliable piped water service cannot keep up with the rapid population increase, while, at the same time, it is overtaken by the widespread consumption of bottled water. On the other hand, there are only 83 districts (from 259 districts) with an increase in piped water coverage. Kota Tegal (Central Java province) experienced the largest increase (26.5 percentage points over 21 years).

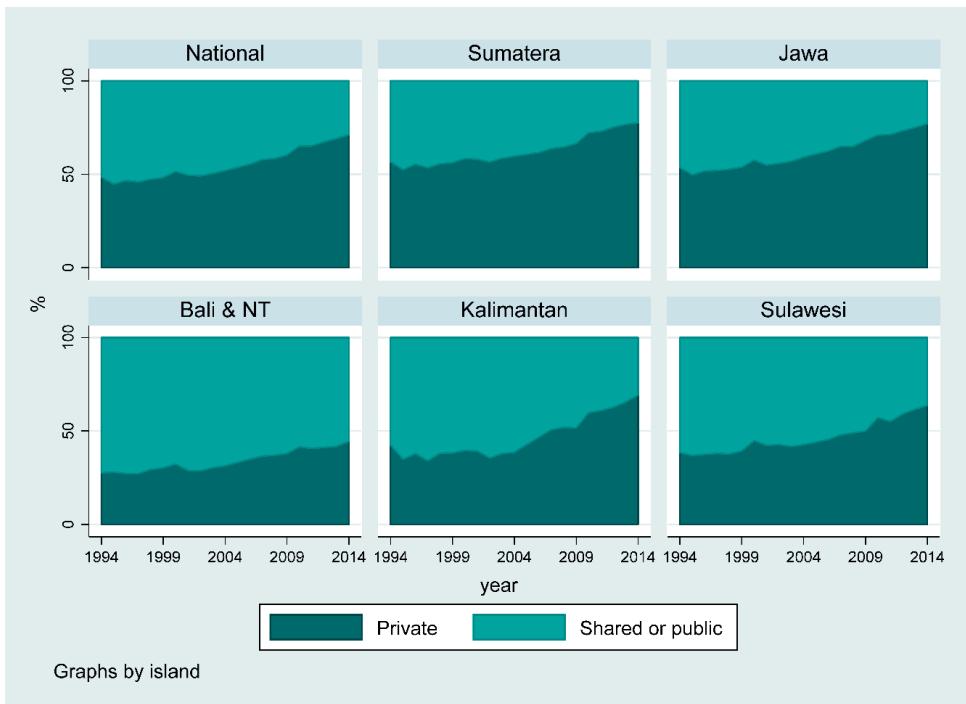


Figure 5.3 Percentage of households by type of main drinking water sources in Indonesia 1994 – 2014

As shown in Figure 5.3, about 50% of the households in 1994 has access to a private source of drinking water. This proportion is steadily increasing over the study period and reached 71% in 2014. Meanwhile, the rest of the population has to obtain drinking water from a shared or public source. This means that these households need to walk from home to the source and queue there to get the water. Having a private source of drinking water is more prominent in Sumatera and Java Island. This is related to the relatively high coverage of piped and bottled water and urbanization in municipalities at these two islands. The lowest percentage of households with a private drinking water source is found at Bali & NT Island. In this island, only 28% of households had access to a private water source in 1994 and 45% in 2014.

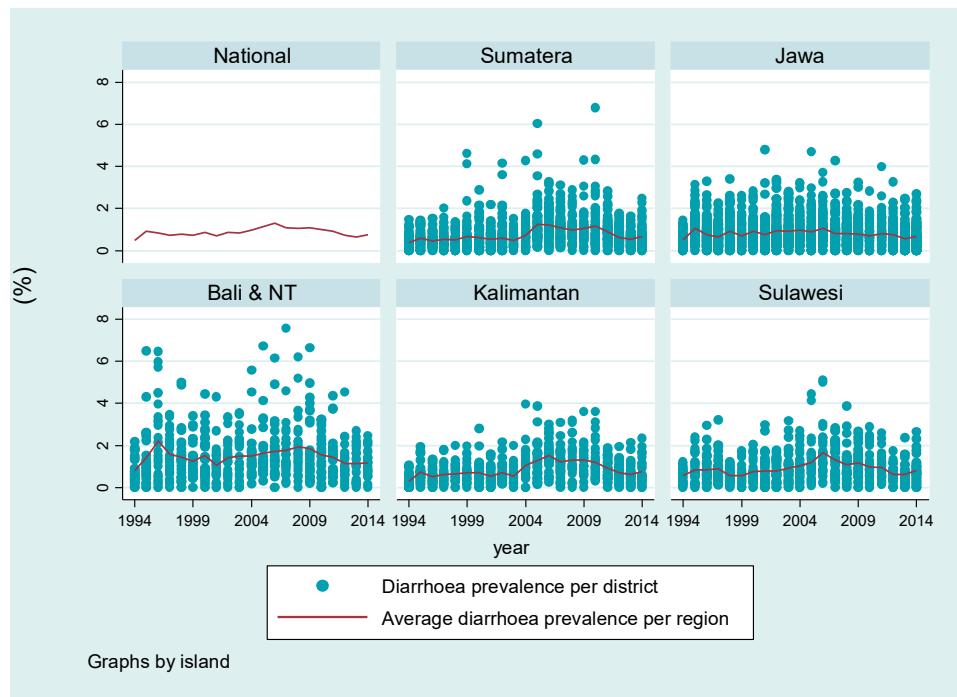


Figure 5.4 Diarrhoea prevalence among school-aged children in Indonesia, by Island and National, 1994 – 2014

From Figure 5.4, it can be seen that the diarrhoea prevalence among school-aged children fluctuates, in a quite low range (less than 2%), over the years and between regions. Diarrhoea is most prominent in Bali & Nusa Tenggara islands, specifically in the Nusa Tenggara Timur province. The rest of the provinces in Indonesia experienced a considerably lower prevalence of diarrhoea. However, if we look at the district level, the picture is worse. The highest prevalence of diarrhoea, 7.6%, was experienced in the Sumba Timur District (Bali & NT Island) in 2007.

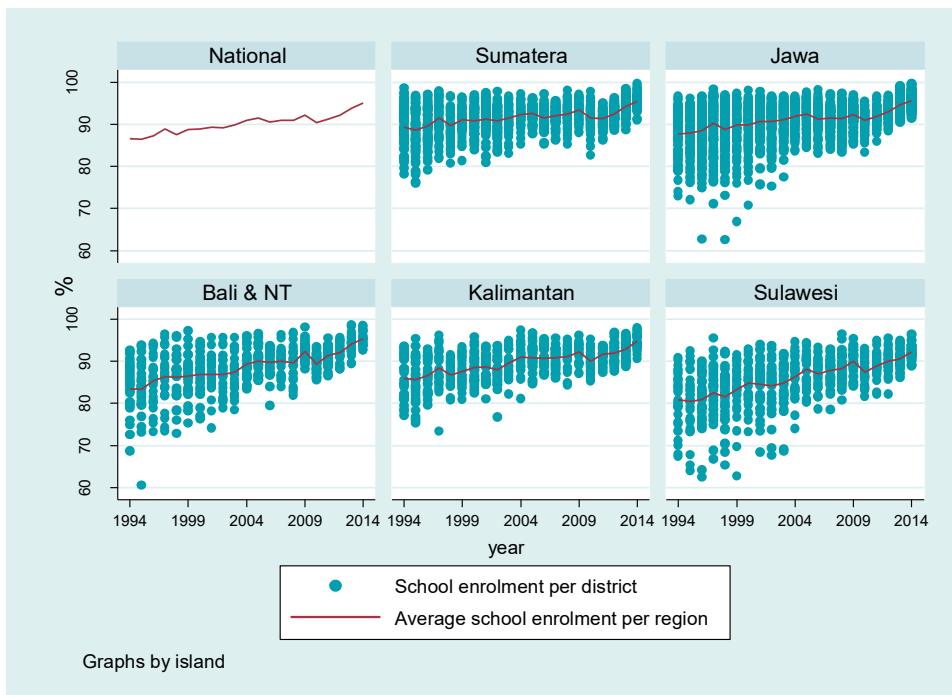


Figure 5.5 Percentage of primary school enrolment in 23 provinces in Indonesia, by islands and total, 1994 – 2014

Regarding primary school enrolment, Figure 5.5 shows a clear increasing trend for Indonesia as a whole as well as for the different regions. Nationally, primary school enrolment increased 8.5 percentage points from 86.5% in 1994 to 95.0% in 2014. The figure also shows disparities in school attendance across regions of Indonesia. The districts on Nusa Tenggara, Kalimantan, and Sulawesi islands (which are all in eastern Indonesia) are lagging behind those on Sumatera, Java & Bali islands (which are situated in western Indonesia).

In order to get more insight into actual school attendance, Figure 5.6 shows the absenteeism rate due to health complaints in the districts as well as the average by island and national. Nationally, on average 12.9 percent of the students was absent (at least one day) from school due to health complaints annually. In 1994, about 9.4 percent of students missed school days and there is hardly any improvement over the following two decades, as in 2014 still 12.5 percent of student was absent from school.

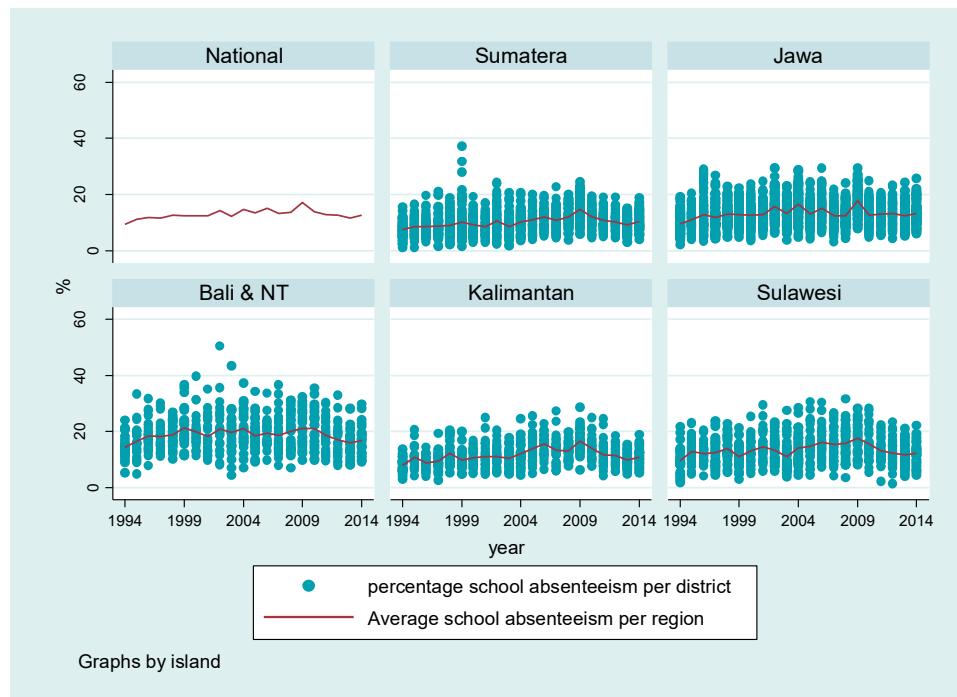


Figure 5.6 Percentage of primary school student absent from school due to health complaints (from the enrolled student), by island and total, 1994-2014

5.3.3. Statistical analysis

5.3.3.1. OUTCOME VARIABLE

The outcome variable of interest is the school attendance in district i at time t . In the current study, we consider two types of school attendance variables. First, school enrolment measures the school attendance variables as the percentages of children age 7 to 15 enrolled in primary school. The second type of school attendance is school absenteeism that is measured by the percentage of primary school students absent from school due to health complaint(s) during the past month.

5.3.3.2. INDEPENDENT VARIABLES

The main predictors in this study are quality of the water source, location of the water source, and the prevalence of diarrhoea in district i at time t . Good quality water is captured by the percentage of households with access to piped and bottled water. Following (Mangyo, 2008) who uses the water access within yard as the physical proximity of a drinking water source to the dwelling, in the current study nearby (location)

water source is measured by the percentage of households having access to a private water facility as opposed to sources that are shared or public. Diarrhoea prevalence is measured by the percentage of school-aged children who suffered from diarrhoea in the past month (preceding the Susenas survey).

Control variables are household wealth, parents' education, urbanization, health facilities coverage, access to improved sanitation, as well as a cultural factor. All control variables are at the district level. Household wealth is measured by the average monthly food expenditure in the given district. For each district, parents' education is calculated as the average years of education of both father and mother. The cultural factor is measured by the relative difference between mother's and father's education years (the ratio of mother divided by father education years). Urbanization is specified as the percentage of population living in urban areas in each district. Furthermore, there are two other control variables for the diarrhoea prevalence model, namely: the coverage of health facilities in a district as measured by the percentage of birth assisted by a skilled health care worker such as doctor, midwife, or paramedic; and the access to improved sanitation is computed by the percentage of households that have a private toilet with septic tank.

5.3.3.3. PANEL ANALYSIS

Our model is based on the assumption that school attendance is a linear function of access to a nearby water source, diarrhoea prevalence, control variables, time trend and district fixed effects. Moreover, we assume that diarrhoea prevalence is determined by the quality of water, the location of water source and a set of control variables. The diarrhoea model needs to be tested in the first place as the indirect effect of water on schooling (the contamination effect) to be exist when the effect of water on diarrhoea is evident. In order to explore how the effect of the main variables varies over time, we computed interactions between the main explanatory variables and a time trend.

These models are then estimated by a panel fixed effect method that allows for district specific intercepts. The district fixed effects captures the variability over the regions as well as the effects of omitted variables. These models take into account both the cross section and time series variation in all variables. In principle, these models capture the long run relationship between the variables of interest while taking the advantage of the time series variation in the data.

5.4. Results

The main aim of this paper is to examine both the direct and indirect effects of clean water on two school attendance variables, i.e. school absenteeism and school enrolment. The direct effect, or the water collection problem, occurs when the children suffer from tiredness and have less time to study, as they have to collect water outside their premises. The indirect effect is the water contamination problem that arises when the household has no access to safe clean water as a result of which the children have a higher chance of getting diarrhoea and therefore could not attend school. To shed more light on these effects, we start with the (static) panel fixed effect model that is preceded by a short description of the statistical characteristics of all variables in the model. Thereafter, some robustness checks are presented. Note that only the effect of the variables of main interest (percentage households using piped and bottled water, percentage households with private water facility, and diarrhoea prevalence) are presented in the tables. The full table of results can be found in the Appendix.

Table 5.1 Descriptive statistics of selected variables for 259 Districts in Indonesia, 1994 - 2014

Variables	Mean (level)	Mean (change)
Primary school enrolment (%)	90.10	0.42
Student absent from school (%)	12.91	0.16
Diarrhoea prevalence (7-15 years; %)	0.88	0.01
Household using piped and bottled water (%)	25.69	1.03
Household with private water facility (%)	56.84	1.05
Household have improved sanitation (%)	36.06	1.66
Health facilities coverage (%)	66.26	1.88
Average food expenditure (000,000 IDR)	0.70	0.07
Mean years of parents' education	6.78	0.13
Relative difference of mother & father education years	0.89	0.01
Household living in urban area (%)	39.75	0.61

Table 5.1 presents the descriptive characteristics of the main and control variables for 259 districts in Indonesia from 1994 to 2014. The average level of primary school enrolment is 90% with an average annual change of 0.4 percentage points. On average 13% of these students are absent from school due to health complaints. Over the period, almost 1% of the primary school students suffered from diarrhoea. Overall, about 26% households use piped and bottled water (good quality water source) as the main drinking water source. Moreover, 57% households have access to a nearby water source. The hygiene level is quite low as indicated by the low access to improved sanitation (36%) with a low rate of improvement (1.7 percentage points per year). The coverage of health facilities in the

country, over the period, is 66% and each year it increases by almost 2 percentage points. Even though the average primary school enrolment is quite high, the average education level of the parents is still low, namely 6.8 years. On average, the relative difference of mother and father education years is 0.89. This indicates that the education level of mothers is lower than that of fathers. Lastly, about 40% of households are living in urban areas.

5.4.1. Panel analysis

Table 5.2 presents the panel fixed effect analysis for diarrhoea (D1 & D2), school absenteeism model (A1), and school enrolment model (E1 & E2). Model D1, A1 and E1 include only the main effects, and model D2 and E2 include both the main and interaction effects.

Table 5.2 Estimating the effect of access to water on diarrhoea prevalence (D1 & D2), school absenteeism (A1), and school enrolment (E1 & E2), 259 districts in Indonesia, 1994-2014.

	D1 b/se	D2 b/se	A1 b/se	E1 b/se	E2 b/se
Main effects					
HH using piped & bottled water (%)	-0.004 (0.002)*	-0.003 (0.002)*			
Diarrhoea prevalence (%)			2.334 (0.117)***	-0.202 (0.072)**	-0.263 (0.063)***
HH with private water facility (%)	-0.000 (0.001)	0.000 (0.001)	-0.027 (0.008)**	0.025 (0.009)**	0.012 (0.008)
Time trend	0.052 (0.009)***	0.047 (0.009)***	0.375 (0.039)***	0.419 (0.052)***	0.298 (0.043)***
Interaction term					
HH using piped & bottled water (%) X Time trend			-0.000 (0.000)***		
Diarrhoea prevalence (%) X Time trend				0.035 (0.015)*	
HH with private water facility (%) X Time trend					-0.008 (0.001)***

Notes: Dependent variable in Model D1 and D2 is Diarrhoea prevalence (7-15 years; %), Model A1 is Student absent from school (%), and Model E1 and E2 is Primary school enrolment (%). Control variables in Model D1 and D2 are HH with Improved sanitation (%), Health facility coverage (%), Food expenditure (000,000 IDR), Parents' education (year), Relative difference of mother & father education years, and Household living in urban area (%). Control variables in Model A1, E1 and E2 are Food expenditure (000,000 IDR), Parents' education (year), Relative difference of mother & father education years, and Household living in urban area (%). All models are estimated using (static) panel fixed effect. Full results are listed in Appendix, Table A.5.1. Significance level at 0.1% ***, 1% **, and 5% *.

The results for diarrhoea (D1) show that the coefficient of the percentage of households using piped and bottled water is negative and significant, as expected. The estimated coefficient of the percentage households with private water facility is not significant. In addition, the coefficients of the interaction terms (model D2) show that the protective effect of piped and bottled water on diarrhoea prevalence becomes stronger over time. This stronger effect might be caused by the increase in quality of water used by households over the period under examination. This quality change is driven by the change in the mixture of piped and bottled water over the period, in particular the increasing use of bottled water that of better quality than piped water (please refer to Figure 5.1 in Method section). All in all, these significant results are used to support the existence of indirect effect of good quality on school attendance (model A1, E1 and E2).

The results for school absenteeism (A1) show that the coefficient of diarrhoea prevalence and percentage household with private water facility are significant with expected signs. Private water facility is negatively associated with school absenteeism. Meanwhile, diarrhoea prevalence is associated with a higher rate of school absenteeism. The latter, together with the significant results of good quality water on diarrhoea, provides an evidence for the indirect effect of good quality water on the reduction of school absenteeism. No interaction effects with time trend are significant, which indicates that the effects do not change over time.

Lastly, school enrolment is significantly affected by diarrhoea prevalence and the percentage of households with private water facility (E1). After controlling for other factors, school enrolment in a district is negatively affected by diarrhoea prevalence and positively by the percentage of households with private water facility. The coefficients of the interaction terms (model E2) suggest that both effects are diminishing over time. These diminishing effects indicate convergence process as primary school enrolment in Indonesia is close to full enrolment and hence the contribution of water supply on school enrolment is saturated. Diarrhoea prevalence and private water facilities increasingly become less important for explaining differences between districts in school enrolment.

5.4.2. Robustness check: dynamic fixed effect

Even though the current study has benefited from an ample number of time series observations (T), this raises the problem of non-stationarity in the model, which cannot be solved with a static panel analysis and calls for a dynamic panel analysis. Hence, as a robustness check, we extend our analysis by estimating a dynamic panel model using the dynamic fixed effect (DFE) method (Blackburne and Frank, 2007). In addition, since the DFE analysis is used as a robustness check of our long run analysis as estimated by the

(static) panel fixed effect model, we do not make inference of the short-run solution of our DFE models.

The long run equilibrium relationship cannot be estimated if all individual variables have unit roots, unless the variables in the long run relationship are co-integrated. However, according to Pesaran and Shin (1999), panel ARDL such as DFE models can provide consistent and efficient estimates of the parameter in a long run relationship even with variables with different orders of integration: I(0) or I(1) or the mix of these two. Consequently, a co-integration test is unnecessary (Pesaran and Shin, 1999). Nevertheless, we performed two panel unit root tests, i.e. Harris–Tzavalis, and Im–Pesaran–Shin tests, to ensure that no series exceeds I(1). The unit root test results, presented in Table A.5.2 in the Appendix, imply no rejection of the presence of a unit root for percentage households with piped and bottled water, percentage households with improved sanitation, food expenditure, and parents education in the level form but become stationary after first differencing. Hence, the panel ARDL, in particular DFE, model can be used.

Table 5.3 Estimating the effect of access to water on diarrhoea prevalence (D3 & D4), school absenteeism (A2), and school enrolment (E3 & E4) based on dynamic fixed effect (DFE) analysis, 259 districts in Indonesia, 1994–2014.

	D3 b/se	D4 b/se	A2 b/se	E3 b/se	E4 b/se
Main effects					
HH using piped & bottled water (%)	-0.006 (0.002)**	-0.004 (0.002)*			
Diarrhoea prevalence (%)			2.710 (0.182)***	-0.426 (0.155)**	-0.519 (0.137)***
HH with private water facility (%)	-0.000 (0.002)	0.001 (0.002)	-0.032 (0.011)**	0.013 (0.012)	0.011 (0.011)
Time trend	0.026 (0.013)*	0.022 (0.013)	0.339 (0.053)***	0.356 (0.080)***	0.222 (0.067)***
Interaction term					
HH using piped & bottled water (%) X Time trend			-0.000 (0.000)***		
Diarrhoea prevalence (%) X Time trend					0.041 (0.019)*
HH with private water facility (%) X Time trend					-0.008 (0.001)***
Error correction coefficient					
	-0.855 (0.022)***	-0.858 (0.022)***	-0.814 (0.018)***	-0.485 (0.024)***	-0.550 (0.023)***

Notes: Dependent variable in Model D3 and D4 is Δ Diarrhoea prevalence (7-15 years; %), Model A2 is Δ Student absent from school (%), and Model E3 and E4 is Δ Primary school enrolment (%). Control variables in Model D3 and D4 are, both the level and the difference of, HH with Improved sanitation (%), Health facility coverage (%), Food expenditure (000,000 IDR), Parents' education (year), Relative difference of mother & father education years, and Household living in urban area (%). Control variables in Model A2, E3 and E4 are, both the level and the difference of, Food expenditure (000,000 IDR), Parents' education (year), Relative difference of mother & father education years, and Household living in urban area (%). All models are estimated using dynamic fixed effect (DFE) method. Full results are listed in Appendix, Table A.5.3. Significance level at 0.1% ***, 1% **, and 5% *.

Table 5.3 reports the robustness check using the dynamic fixed effect (DFE) analysis for diarrhoea (D3 & D4), school absenteeism (A2), and school enrolment (E3 & E4). Model D3, A2 and E3 include only the main effects, and model D4 and E4 include both the main and interaction effects. In general, results from DFE analysis show that the sign of the long run coefficient of our main variables remain similar to those obtained by (static) panel fixed effect analysis and are consistent with theory. The percentage of households with piped and bottled water is supportive for reducing diarrhoea prevalence (model D3), and this effect is stronger over time (model D4). The direct and indirect effect of water on school absenteeism is reconfirmed (model A2). However, the direct effect of (nearby) water on school enrolment becomes insignificant (model E3). The analysis with interaction terms (model E4) again demonstrates that the direct and indirect effect of water on school enrolment become less and less important over time. Lastly, for all models, the error correction coefficient is negative and highly significant indicating the existence of convergence effects in the long run equilibrium.

5.5. Discussion

To this date, the provision of clean water remains a serious problem for developing countries. In Indonesia, for example, access to water with good quality in the premises is still limited with a relatively slow improvement over the last two decades. These circumstance burden households, as water needs to be brought to the house from outside and low quality water increase the risk of water borne diseases, in particularly diarrhoea. In these circumstances, the burden to fetch water is often inflicted on children and women, while the risk of having diarrhoea is higher among children. Accordingly, the lack of good quality water at the vicinity of the households might, directly and indirectly, result in a higher school absenteeism in the short term or school dropout in a longer term. Hence, the current study explores the direct and indirect effect of access to good quality water and nearby water source on primary school absenteeism and school enrolment. Besides school enrolment we consider school absenteeism because school enrolment often does not capture actual school attainment as research shows that many pupils are absent from school due to illnesses, child labour and household responsibilities (Azor-Martínez et al., 2014; Neuzil et al., 2002).

Our panel fixed effect analysis confirms the existence of a direct and indirect effect of water on both school absenteeism and school enrolment. The results are obtained after controlling for households wealth, parents education, urbanization, health facilities coverage as well as a cultural factor. These results appear to be robust to the use a dynamic fixed effects estimation.

The percentage of households with a private water facility, the proxy for nearby water facility, (directly) decreases school absenteeism and increases school enrolment. These results are in line with those of previous studies on water and schooling in developing countries (Dreibelbis et al., 2013; Hunter et al., 2014; Nauges and Strand, 2013; Zhang and Xu, 2016). The provision of drinking water nearby households' vicinity reduces the burden of water fetching, which is often borne by the children. This circumstance would lead to a better schooling outcomes for the children - the provision of a nearby water source would reduce school absenteeism (Dreibelbis et al., 2013; Hunter et al., 2014) and increase school enrolment (Nauges and Strand, 2013). However, the direct effect of nearby water source on school enrolment should be interpreted cautiously as it is not confirmed in the robustness check.

Regarding the indirect effect, we found that the percentage of households using piped and bottled water, the proxy for access to good quality water, reduces diarrhoea prevalence which in turn leads to lower absenteeism and higher enrolment in primary school. This finding is a confirmation of Dreibelbis et al.'s (2013) suggestion that improved health is a pathway to the explanation of the association between access to clean water and better school attendance. We argue that good quality drinking water could improve children's health outcome (Fischer Walker et al., 2012; Komarulzaman et al., 2017), and hence allows them to improve their educational attendance through a reduction in absenteeism (Dreibelbis et al., 2013; Hunter et al., 2014). In addition to this short term benefit, access to drinking water of higher quality would (indirectly) benefit children's education in a longer term by improving school enrolment (Zhang and Xu, 2016).

Unexpectedly, we could not confirm the effect of having private water facility on diarrhoea prevalence, and hence an indirect effect of private water on schooling cannot be inferred. However, this could be caused by the common practice of storing water by households. Hence, the benefits of having a private water facility is not guaranteed, as the cleanliness of the water is often not maintained during storing (Komarulzaman et al., 2017).

Lastly, our interaction analysis shows that, the direct effect of having a private water facility and the indirect effects of access to piped and bottled water on school enrolment are diminishing over time. Given the increasing trend of school enrolment in Indonesia, this diminishing effect is obvious. The role of water access saturates as school enrolment get close to full coverage.

There are a number of limitation to this study. First, we realize that having a private water facility is a weak proxy of location of water source. We suggest that location of water source would be better measured by fetching time as it includes both the walking and queuing time. However, we believe that the current study complements the current body

of knowledge on the importance of the provision of safe drinking water on school attendance, specifically in developing countries. Secondly, the finding in this study might be context-specific. This paper gives a base analysis to comprehend the analysis of water on health and schooling, specifically in Indonesia. Hence, further studies on the impact of water on both school absenteeism and school enrolment are needed.

5.6. Concluding Remarks

The current study extends the understanding of the impact of water on schooling in two ways. Firstly, while previous studies have focused on the direct effect, our study provides evidence of both the direct and the indirect effect of water on schooling. Secondly, we demonstrate the effect of water access on education outcomes as measured by school absenteeism and school enrolment. Our results suggest that the access to safe water at the premises-above and beyond the access to water and health-can potentially improve both short- and long-term education outcomes. The availability of good-quality and nearby water facilities are inversely related with school absenteeism and positively related to school enrolment. These findings further highlight the importance of safe water provision on children's health and schooling. Consequently, this benefit should be taken into account by the policy makers in identifying and quantifying the potential benefits of developing water infrastructure in developing countries.

5.7. Appendix

Table A.5.1 Estimating the effect of access to water on diarrhoea prevalence (D1 & D2), school absenteeism (A1), and school enrolment (E1 & E2) based on panel analysis, 259 districts in Indonesia, 1994-2014

	D1 b/se	D2 b/se	A1 b/se	E1 b/se	E2 b/se
HH using piped & bottled water (%)	-0.004 (0.002)*	-0.003 (0.002)*			
Diarrhoea prevalence (%)			2.334 (0.117)***	-0.202 (0.072)**	-0.263 (0.063)***
HH with private water facility (%)	-0.000 (0.001)	0.000 (0.001)	-0.027 (0.008)**	0.025 (0.009)**	0.012 (0.008)
HH with Improved sanitation (%)	-0.007 (0.001)***	-0.008 (0.001)***			
Health facility coverage (%)	-0.009 (0.001)***	-0.010 (0.001)***			
Food expenditure (000,000 IDR)	-0.179 (0.076)*	-0.085 (0.083)	-2.165 (0.411)***	-2.681 (0.443)***	-0.370 (0.452)
Parents' education (year)	-0.004 (0.029)	-0.004 (0.029)	-0.791 (0.153)***	0.140 (0.189)	0.151 (0.166)
Relative difference of mother & father education years	0.381 (0.339)	0.346 (0.336)	1.038 (2.045)	10.962 (2.153)***	7.533 (1.874)***
Household living in urban area (%)	-0.000 (0.002)	-0.000 (0.002)	0.015 (0.011)	-0.017 (0.013)	-0.007 (0.011)
Time trend	0.052 (0.009)***	0.047 (0.009)***	0.375 (0.039)***	0.419 (0.052)***	0.298 (0.043)***
<i>Interaction term</i>					
HH using piped & bottled water (%) X Time trend		-0.000 (0.000)***			
Diarrhoea prevalence (%) X Time trend				0.035 (0.015)*	
HH with private water facility (%) X Time trend				-0.008 (0.001)***	
Intercept	0.008 (0.067)	0.027 (0.067)	-0.597 (0.447)	0.645 (0.509)	0.584 (0.433)

Notes: Dependent variable in Model D1 and D2 is Diarrhoea prevalence (7-15 years; %), in Model A1 is Student absent from school (%), and in Model E1 and E2 is Primary school enrolment (%). All models are estimated using (static) panel fixed effect analysis. Significance level at 0.1% ***, 1% **, and 5% *.

Table A.5.2 Panel unit root tests

	Level		First difference	
	HT	IPS	HT	IPS
	Rho (p-value)	Zt (p-value)	Rho (p-value)	Zt (p-value)
Primary school enrolment	0.635 (0.000)	-16.232 (0.000)	-0.431 (0.000)	-43.367 (0.000)
Student absent from school	0.204 (0.000)	-26.636 (0.000)	-0.427 (0.000)	-43.836 (0.000)
Diarrhoea prevalence (7-15 years)	0.180 (0.000)	-28.813 (0.000)	-0.430 (0.000)	-43.893 (0.000)
Households with private water facility	0.752 (0.000)	0.862 (0.806)	-0.377 (0.000)	-43.584 (0.000)
Households using piped and bottled water	0.861 (0.651)	2.194 (0.986)	-0.353 (0.000)	-40.946 (0.000)
Households with improved sanitation	0.849 (0.186)	6.348 (1.000)	-0.382 (0.000)	-42.847 (0.000)
Health facilities coverage	0.840 (0.033)	-1.821 (0.034)	-0.437 (0.000)	-43.480 (0.000)
Food expenditure	0.911 (1.000)	3.777 (1.000)	-0.104 (0.000)	-26.230 (0.000)
Parents' education	0.844 (0.082)	2.909 (0.998)	-0.466 (0.000)	-44.697 (0.000)
Relative difference of mother and father education years	0.663 (0.000)	-9.784 (0.000)	-0.492 (0.000)	-44.904 (0.000)
Households living in urban areas	0.784 (0.000)	. . .	-0.203 (0.000)	. . .

Notes: HT: Harris-Tzavalis; IPS: Im-Pesaran-Shin test; The "Households living in urban areas" cannot be tested using IPS test as there are some municipalities with 100% urbanization rate for the whole period; Models include an intercept.

Table A.5.3 Estimating the effect of access to water on diarrhoea prevalence (D3 & D4), school absenteeism (A2), and school enrolment (E3 & E4) based on dynamic fixed effect (DFE) analysis, 259 districts in Indonesia, 1994-2014

	D3 b/se	D4 b/se	A2 b/se	E3 b/se	E4 b/se
HH using piped & bottled water (%)	-0.006 (0.002)**	-0.004 (0.002)*			
Diarrhoea prevalence (%)			2.710 (0.182)***	-0.426 (0.155)**	-0.519 (0.137)***
HH with private water facility (%)	-0.000 (0.002)	0.001 (0.002)	-0.032 (0.011)**	0.013 (0.012)	0.011 (0.011)
HH with Improved sanitation (%)	-0.004 (0.002)	-0.005 (0.002)*			
Health facility coverage (%)	-0.008 (0.002)***	-0.010 (0.002)***			
Food expenditure (000,000 IDR)	0.007 (0.115)	0.113 (0.123)	-1.615 (0.521)**	-1.365 (0.639)*	0.977 (0.615)
Parents' education (year)	-0.040 (0.045)	-0.037 (0.045)	-1.041 (0.256)***	0.423 (0.321)	0.455 (0.283)
Relative difference of mother & father education years	0.857 (0.528)	0.787 (0.520)	1.900 (3.156)	12.049 (4.657)**	6.775 (3.983)
Household living in urban area (%)	-0.002 (0.002)	-0.002 (0.002)	-0.001 (0.015)	-0.057 (0.019)**	-0.039 (0.016)*
Time trend	0.026 (0.013)*	0.022 (0.013)	0.339 (0.053)***	0.356 (0.080)***	0.222 (0.067)***
Interaction term					
HH using piped & bottled water (%) X Time trend		-0.000 (0.000)***			
Diarrhoea prevalence (%) X Time trend					0.041 (0.019)*
HH with private water facility (%) X Time trend					-0.008 (0.001)***
Error correction coefficient					
Δ HH using piped & bottled water (%)	-0.855 (0.022)***	-0.858 (0.022)***	-0.814 (0.018)***	-0.485 (0.024)***	-0.550 (0.023)***
Δ Diarrhoea prevalence (%)	0.002 (0.002)	0.001 (0.002)			
Δ HH with private water facility (%)	0.001 (0.001)	0.001 (0.001)	0.017 (0.007)*	0.014 (0.006)*	0.010 (0.006)
Δ HH with Improved sanitation (%)	0.001 (0.002)	0.002 (0.002)			
Δ Health facility coverage (%)	0.001 (0.001)	0.002 (0.002)			
Δ Food expenditure (000,000 IDR)	0.261 (0.105)*	0.205 (0.106)	0.133 (0.735)	-1.136 (0.453)*	-1.709 (0.439)***
Δ Parents' education (year)	0.004 (0.025)	0.004 (0.025)	0.047 (0.168)	0.020 (0.125)	0.006 (0.122)
Δ Relative difference of mother & father education years	-0.597 (0.357)	-0.566 (0.355)	-1.001 (1.695)	0.462 (1.503)	1.202 (1.480)
Δ Household living in urban area (%)	0.003 (0.002)	0.003 (0.002)	0.038 (0.012)**	0.017 (0.009)	0.012 (0.009)
Intercept	0.034 (0.074)	0.053 (0.074)	0.058 (0.484)	1.385 (0.361)***	1.355 (0.346)***

Notes: Dependent variable in Model D3 and D4 is Δ Diarrhoea prevalence (7-15 years; %), in Model A2 is Δ Student absent from school (%), and in Model E3 and E4 is Δ Primary school enrolment (%). All models are estimated using dynamic fixed effect (DFE) analysis. Significance level at 0.1% ***, 1% **, and 5% *.

Chapter 6

CONCLUSIONS

6.1. Introduction

Access to safe water is a basic human right. However, its provision, specifically in developing countries, is still a challenge. While households in developed countries take good quality water from tap for granted, for many households in developing countries clean water is out of reach. Even when a clean water facility is available in the vicinity, affordability issues often restrict the households to be connected to a water network. Under these circumstances, many households are forced to turn to water sources that could jeopardize their health. The consequences may be detrimental and water borne disease, primarily diarrhoea, are often a major concern. Diarrhoea is one of the major killers of children under five. Beyond these health consequences, the effect of poor access to good quality water has also economic and development consequences, in the form of lost workdays, school absenteeism and school dropout.

The aim of this thesis is to analyse the linkage between water, health and development in developing countries by taking the case of Indonesia. Though Indonesia is a water abundant country, water is not equally distributed across the country. The water supply setting in Indonesia shares the complexity of water supply in many developing countries, which is characterized by, among others, a low rate of access to piped water, the dominance of free water sources, the use of multiple water sources, low water quality, and the increasing use of bottled water. Only 17% of the Indonesian households use (metered) piped water (Statistics Indonesia, 2015a). In addition to this low coverage, the distribution of piped water is skewed toward rich and urban households. This situation is in sharp contrast with that of unconnected households, who have to rely on informal vendors and refilling (bottled) water depots. The quality of this water is lower and the price is much higher than water from a piped network (Bakker et al., 2006). As much as three quarter of Indonesian households use free water sources, including wells, springs, and rivers. Given that this water is generally of questionable quality (Bakker et al., 2006; Statistics Indonesia, 2015a, 2015b), these households are suspected to suffer from a (hidden) affordability problem.

In this thesis, I assume that availability and affordability problems strongly influence the water sources that are used by households, and through this affect the households (members) health status and educational outcomes. My first aim is therefore to analyse water affordability problems among households which pay for their water as well as among the (majority of) households with free water sources. Related to the choice of water sources and given the increasing use of refillable bottled water, my second aim was to investigate the motives influencing the decision of households to switch to refillable bottled water. Because I think that the sources of water used by households may have

implications for the household members' health, my third aim is to study the effects of the water source used by households on the incidence of diarrhoea among children under five. My last aim is to analyse the effect of water on educational outcomes, especially on school enrolment and school absenteeism.

To achieve these four aims, in Chapters 2-5 of this thesis four studies are presented each of which uses a different dataset. The annual Indonesia National Socio Economic Survey (Susenas) 2015 was used to analyse the affordability problems in Chapter 2. The Indonesian household panel socio-economic survey (Susenas panel) 2008 – 2010 was used in Chapter 3 to investigate the motives behind households' decision to switch to refillable bottled water. In Chapter 4, I used the Demographic Health Survey 2007 and 2012 to investigate effect of water access on children's risk of diarrhoea. Lastly, a district panel dataset derived from the annual Indonesia National Socio Economic Survey (Susenas) from 1994 to 2014 was used to study the direct and indirect effects of water on education outcomes.

6.2. Results

6.2.1. Research question 1

The first research question I aimed to answer in this thesis is as follows:

1. Is water affordable? More specifically, is it affordable for households that pay for their water (the revealed water affordability), as well for those that use water from free sources (the "hidden" water affordability).

The results from Chapter 2 indicate that water is relatively affordable for most of the Indonesian households who pay for their water. Households with paid water need to allocate on average 2.5% of their income to fulfil their basic water needs, which is lower than the 4% threshold. To estimate the hidden affordability problems, the 'shadow' price of water from a free source was estimated on the basis of the average price paid for water by other households in the context where the households live. Given this shadow price, households in this group would need to allocate on average 6.3% of their total expenditure on fulfilling their basic water needs according to local prices. This is 1.6 times the acceptable NAR of 4%. Of the households who do not pay for their water, 17.8% suffers from a (hidden) affordability problem. This is significantly more than the number of households suffering from a revealed affordability problem, which hits 7.2% of households with a paid water supply. If we translate these figures to the total Indonesian population, the differences are even more staggering. Whereas the total percentage of households with an affordability problem is 15.2% of all Indonesian households, the percentage of households with a hidden affordability problem is 13.4%, which is more than seven times

as large as the percentage of households with a revealed affordability problem, which is 1.8% of Indonesian households. Hence, affordability analyses that focus only on households that pay for their water miss the big picture and may underestimate water affordability problems in developing countries to a large extend.

6.2.2. Research question 2

The second research question which I formulated for this thesis is the following:

2. To what extent and for which reasons do households switch their main source of drinking water to refillable bottled water?

In Chapter 3, I consider three main motives driving the switch to refillable bottled water: concern about the health risks of other sources of drinking water (risk aversion motive), belief in the health benefits of bottled water (healthier perception motive), and consumption of bottled water as a taste and lifestyle choice (lifestyle motive). While the “risk aversion” motive is related to the (supposed) risks associated with the initial water source, the “healthier perception” motive is a positive choice based on households’ belief that consuming bottled water is healthier. In addition to the three motives mentioned, we expect that the switch to refillable bottled water is a cost-based decision and affected by the product’s availability in the households’ neighbourhood.

The analysis in Chapter 3 shows that the switch from metered piped to refillable bottled water is mainly caused by lifestyle considerations; households with a younger head and living in urban areas choose refillable bottled water more often than other households. Moreover, I find that in rural areas more affluent households and households that experienced an expenditure growth have a higher tendency to switch from metered piped to refillable bottled water. This finding suggests that in those areas the switch to refillable bottled water is a cost-based decision. Next, I found no support for the risk aversion and healthier perception motives. I suspect that the risk aversion and healthier perception motives are cancelling each other out. The intention of households using metered piped water to switch to refillable bottled water due to a negative experience with the former, conflicts with those households’ reluctance to switch in view of the questionable quality of refillable bottled water. However, both lines of reasoning underscore that the main reason for the switch is the convenience of having bottled water that suits the household’s lifestyle.

The switch from branded bottled water to refillable bottled water appears to be an urban phenomenon driven by cost considerations. Users of branded bottled water switch to the much cheaper refillable bottled water but may still take pride in having bottled water.

Lastly, the sources included in the group “other water sources” are cheaper and less healthy than refillable bottled water. The switch from one of these sources to refillable bottled can be explained by a mix of all of the motives. Households switch to refillable bottled water not only in view of the health risk of “other water sources” but also due to the fact that refillable bottled water is relatively safer than “other water sources”. On the other hand, this switch gives an extra benefit for households for the convenience and a higher social status associated with refillable bottled water.

6.2.3. Research question 3

The third research question answered in this thesis is the following:

3. What is the effect of (lack of) access to clean water on health outcomes? More specifically, to what extend does access to and treatment of water at the household level and water coverage at the community level, influence the prevalence of diarrhoea? Under which conditions are these effects strong?

I perform a multilevel analysis on data from the 2007 and 2012 Demographic and Health Surveys in order to answer this question. The results, presented in Chapter 4 of the current study, indicate that having piped water in the dwellings reduces the odds of childhood diarrhoea. I also find that piped water is particularly important in rural areas, where the circumstances are more difficult and hence improvement of water supply can make more of a difference.

An important finding is that point-of-use water treatment is not significantly associated with diarrhoea prevalence and that there are no significant interactions with this factor. It might indicate that in many Indonesian households water treatment is ineffective. It could be that the treated water is (re)contaminated by E. coli while being stored.

I find that the odds of having diarrhoea decrease as the coverage of improved sanitation in the community is higher. Moreover, the positive effect of a better sanitation at the community level turned out to be stronger in communities with better water quality. This last finding illustrates the importance of improving drinking water and sanitation simultaneously and at the community level instead of some households only.

6.2.4. Research question 4

The fourth research question in this thesis was formulated as follows:

4. What are the direct and indirect effects of access to water on school enrolment and absenteeism from school?

The main aim of Chapter 5 was to examine both the direct and indirect effects of clean water on two school attendance variables, namely school enrolment and school absenteeism. The panel fixed effect analysis reveals the existence of both direct and indirect effects of water on school enrolment and school absenteeism. The percentage of households with a private water facility, the proxy for location of water facility, is (directly) supportive of decreasing school absenteeism and increasing school enrolment. This indicates that the availability of drinking water in the households' vicinity reduces the burden of water fetching borne by children and improves their schooling outcomes.

Regarding the indirect effect, I found that the percentage of households using piped and bottled water, the proxy for water quality, is associated with reduced diarrhoea prevalence. This in turn leads to a lower absenteeism and to a higher enrolment of children. Safe drinking water may thus improve children's health outcomes through this allow them to improve their educational outcomes.

6.3. Contribution of the Research

This thesis makes several theoretical and empirical contributions to the water supply literature, and more specifically to the water-health-development linkage in developing countries. The first contribution is my attempt to reveal the hidden affordability problem in developing countries. Households with free water sources often represent the majority of the households in developing countries; however, until now no attempt has been made to estimate their water affordability. Often, households with free water sources are regarded as having no affordability problem, as they can get water for free. I challenge this claim and argue that a substantial number of households may use free water sources because they cannot afford the better quality piped or bottled water. The estimation of hidden water affordability was made possible by the use of shadow prices of water in the context. The findings shows that the issue of water affordability in developing countries has been greatly underestimated by studies that focus on piped water only. This study is as far as I know the first to investigate the existence and magnitude of the hidden water affordability problem among households with free water supply in developing countries.

Another important empirical contribution is the investigation of the motives influencing households' decisions to switch to refillable bottled water in Indonesia. As far as I know, there is no study for developing countries that has focused on motives affecting households' "switching behaviour", and more specifically on the switch to refillable bottled water. Presumably, this is due to the fact that an appropriate analysis requires the use of longitudinal data. The Susenas panel dataset allows us to observe the characteristics of a large number of households in Indonesia and track the changes in their choices of drinking water sources.

My research also contributes new knowledge to the water-health and the water-education linkages. I have explored the effect of water and sanitation at both the household and community level on the prevalence of diarrhoea. I also have explored the circumstances under which water and sanitation are important for preventing diarrhoea. This has been one of the few encompassing study on diarrhoeal disease in Indonesia, in which both direct and interaction effects of the major risk factors are studied simultaneously.

The present study provides additional knowledge of how safe and accessible water—above and beyond the access to water and health—can potentially improve both short- and long-term measures of education outcomes. My approach is unique in that it determines both the direct and indirect effect of water facilities on school enrolment and school absenteeism. The study extends previous studies on water and schooling through the use of panel analysis on a dataset with a large number of districts over an extended period of time. My finding of a robust relationship between water, health and education is of interest to researcher and policy makers.

6.4. Policy Implications

The findings of this thesis have important implications for policy makers in water supply areas. Our findings provide additional insight on the importance of safe, accessible and affordable water for households in Indonesia. This is not only because access to clean and affordable water is a human right, but also because the provision of safe, accessible and affordable water can potentially improve health and development/educational outcomes. My research further provides policy makers with valuable insight on the supportive effect of piped water in the dwellings on reducing diarrhoea prevalence. Moreover, the supportive effect of the availability of piped water on the premises on health and education, found in Chapter 5, calls policy makers to incorporate these benefits when they make cost benefit analyses with regard to investment in water infrastructure.

Still, given the complexity of the water supply setting in developing countries, and particularly in Indonesia, it will not be easy to provide safe, accessible and affordable water to all households. Policy makers should therefore accept that there might be different solutions for different groups of households. I have shown that the effect of water and sanitation condition on health outcomes varies across circumstances, hence policy makers should tailor interventions towards the requirements of the specific situation. As an example, I would recommend policy makers to further improve the coverage and service quality of the piped water system, in particular in rural areas. The circumstances in rural areas are more difficult than in urban areas, hence improving the coverage and service quality of piped water can make more of a difference, particularly on

reducing diarrhoea prevalence. My findings suggest that to get a stronger impact, the improvement of water and sanitation should be done simultaneously at both household and community level.

The substantial proportion of households with hidden affordability problems found in Chapter 2 stresses the importance of acknowledging the affordability problems among many households with free water sources and of formulating water provision policies tailored towards these households. This, for example, can be done by expanding piped water network in areas where hidden affordability problems are highly prevalent. Moreover, the government could provide subsidies or loans for paying the connection fee and/or the water tariff of piped water for households with affordability problems. However, this intervention is often difficult to be implemented as it is costly and some households are geographically difficult to reach.

For meeting the needs of the majority of households who do not enjoy access to piped water at the premises, policy could consider refillable bottled water as a promising alternative. Refillable bottled water can be regarded as the second best alternative particularly for drinking and cooking purposes. However, given the findings on the switch to refillable bottled water, I would advise local governments to develop suitable regulatory tools that includes an improved surveillance system and a certification or water quality testing system for the refillable bottled water industry.

6.5. Limitations

While presenting important findings, the research presented in this thesis also has some limitations. I would like to mention these shortcomings and give suggestions for further research. The main issue I would like to mention is the household's water related data. There is no single dataset that provides complete information on water related aspects at the level of individual households. The household survey datasets used in this thesis do not fully capture the complexity of water supply setting in Indonesia. The Indonesia DHS dataset provides information on drinking water sources, time to fetch water, and point of use water treatment. The latest Susenas data provide information on water sources used for three different purposes: drinking, cooking and bathing. Susenas also contains information on quantity of and expenditure on water bought last month, and whether the drinking water facility is used privately, shared or publicly. However, it does not include detailed information on the quality, quantity, and expenditure on water used for each purposes (i.e. drinking, cooking and bathing). To overcome these data constraints, I would advise organizations such as Indonesia Statistics to add questions on this issue, such as on the quality of water used by households, how much water households buy and use from each source for different purposes, how they treat and store water, water collection time

and household's member who fetch water. Moreover, I would suggest equipping the survey with the geographic location of households as well as water sources. GIS allows us to map all water sources that are available in the surrounding of the households, which may improve our understanding on households' choices regarding water sources. When more detailed data on water is available, the estimation of the water affordability problems can be more precise and the effect of water on health and education can be better estimated.

A restriction is also that this thesis focuses only on Indonesia, which limits the applicability of its findings to other countries. However, one should keep in mind that water-health-development issues are contextual, as they depend on both the water supply setting and the characteristics of the households in the region. This calls for comparative studies using data for a large number of developing countries which could give a more comprehensive insight from various water contexts.

To sum up, the water supply setting in developing countries is complex. The available water related data are often limited and cannot fully capture this complexity. These circumstances make research in this area very challenging. I hope that the findings of my research can inspire other researcher interested in water related issues in developing countries. For a better understanding of revealed and hidden affordability problems, further research might assess these problems in a more detailed and disaggregated analysis by household income, household composition and spatial location. Given the low rate of piped water use, it is worth to identify the demand (e.g. affordability) and supply (e.g. distance to existing network) factors that restrict households in their access to the piped water network. Moreover, as a substantial number of households suffer from an affordability problem, follow up studies are needed to identify and assess suitable policy interventions, such as subsidies for paying the connection fee or the water tariff, for solving this affordability problem. Lastly, further research using other empirical strategies, particularly the use of panel data at household level, would be of much use in solidifying our understanding of the water-health-development linkages.

REFERENCES

- Agustina, R., Sari, T.P., Satroamidjojo, S., Bovee-Oudenhoven, I.M.J., Feskens, E.J.M., Kok, F.J., 2013. Association of food-hygiene practices and diarrhea prevalence among Indonesian young children from low socioeconomic urban areas. *BMC Public Health* 13, 977. doi:10.1186/1471-2458-13-977
- Alderman, H., Hentschel, J., Sabates, R., 2003. With the help of one's neighbors of nutrition in Peru. *Soc. Sci. Med.* 56, 2019–2031. doi:10.1016/S0277-9536(02)00183-1
- Alkon, M., Harish, S.P.P., Urpelainen, J., 2016. Household energy access and expenditure in developing countries: Evidence from India, 1987–2010. *Energy Sustain. Dev.* 35, 25–34. doi:10.1016/j.esd.2016.08.003
- Anadu, E.C., Harding, A.K., 2000. Risk perception and bottled water use. *J. Am. Water Works Assoc.* 92, 82–92.
- Andres, L. a, Briceño, B., Chase, C., Echenique, J.A., 2014. Sanitation and externalities: evidence from early childhood health in rural India (No. 6737), The World Bank Policy Research Working Paper.
- Azor-Martínez, E., Gonzalez-Jimenez, Y., Seijas-Vazquez, M.L., Cobos-Carrascosa, E., Santisteban-Martínez, J., Martínez-López, J.M., Jimenez-Noguera, E., Galan-Requena, M.D.M., Garrido-Fernández, P., Strizzi, J.M., Gimenez-Sanchez, F., 2014. The impact of common infections on school absenteeism during an academic year. *Am. J. Infect. Control* 42, 632–7. doi:10.1016/j.ajic.2014.02.017
- Bakker, K., 2007. Trickle down? Private sector participation and the pro-poor water supply debate in Jakarta, Indonesia. *Geoforum* 38, 855–868. doi:10.1016/j.geoforum.2005.11.011
- Bakker, K., Kooy, M., Shofiani, N.E., 2006. Human Development Report 2006 Human Development Report Office Disconnected : Poverty, Water Supply and Development in Jakarta, Indonesia.
- Banerjee, S., Wodon, Q., Diallo, A., Pushak, T., Uddin, E., Tsimo, C., Foster, V., 2008. Access, affordability, and alternatives: Modern infrastructure services in Africa (No. 27740), Munich Personal RePEc Archive.
- Blackburne, E.F., Frank, M.W., 2007. Estimation of non-stationary heterogenous panels. *Stata J.* 7, 197–208.
- BPPSPAM, 2015. Water utilities performance 2015 (Kinerja PDAM 2015).
- Brown, J., Hien, V.T., McMahan, L., Jenkins, M.W., Thie, L., Liang, K., Printy, E., Sobsey, M.D., 2013. Relative benefits of on-plot water supply over other “improved” sources in rural Vietnam. *Trop. Med. Int. Heal.* 18, 65–74. doi:10.1111/tmi.12010
- Buttenheim, A.M., 2008. The sanitation environment in urban slums: implications for child health. *Popul. Environ.* 30, 26–47. doi:10.1007/s11111-008-0074-9
- Cairncross, S., Valdmanis, V., 2007. Water supply, sanitation, and hygiene promotion., in: DT, J., JG, B., AR, M., Al., E. (Eds.), *Disease Control Priorities in Developing Countries*. World Bank, Washington (DC).
- Checchi, D., 2006. *The economics of education: Human capital, family background and inequality*. Cambridge University Press, New York.
- Clasen, T., Boisson, S., Routray, P., Torondel, B., Bell, M., Cumming, O., Ensink, J., Freeman, M.,

- Jenkins, M., Odagiri, M., Ray, S., Sinha, A., Suar, M., Schmidt, W.-P., 2014. Effectiveness of a rural sanitation programme on diarrhoea, soil-transmitted helminth infection, and child malnutrition in Odisha, India: a cluster-randomised trial. *Lancet Glob. Heal.* 1–9. doi:10.1016/S2214-109X(14)70307-9
- Clasen, T., Schmidt, W.-P., Rabie, T., Roberts, I., Cairncross, S., 2007. Interventions to improve water quality for preventing diarrhoea: systematic review and meta-analysis. *BMJ* 334, 782. doi:10.1136/bmj.39118.489931.BE
- Clasen, T.F., Haller, L., 2008. Water Quality Interventions to Prevent Diarrhoea: Cost and Cost-Effectiveness. Geneva.
- Corsi, D.J., Chow, C.K., Lear, S. a, Rahman, M.O., Subramanian, S. V, Teo, K.K., 2011. Shared environments: a multilevel analysis of community context and child nutritional status in Bangladesh. *Public Health Nutr.* 14, 951–959. doi:10.1017/S1368980010003356
- Daka, K.R., Ballet, J., 2011. Children's education and home electrification: A case study in northwestern Madagascar. *Energy Policy* 39, 2866–2874. doi:10.1016/j.enpol.2011.02.060
- Doria, M.F., 2006. Bottled water versus tap water: Understanding consumer's preferences. *J. Water Health* 4, 271–276. doi:10.2166/wh.2006.008
- Dreibelbis, R., Greene, L.E., Freeman, M.C., Saboori, S., Chase, R.P., Rheingans, R., 2013. Water, sanitation, and primary school attendance: A multi-level assessment of determinants of household-reported absence in Kenya. *Int. J. Educ. Dev.* 33, 457–465. doi:10.1016/j.ijedudev.2012.07.002
- Dungumaro, E.W., 2007. Socioeconomic differentials and availability of domestic water in South Africa. *Phys. Chem. Earth, Parts A/B/C* 32, 1141–1147. doi:10.1016/j.pce.2007.07.006
- Eflin, 2008. Manajemen pengawasan dan kondisi Higiene Sanitasi hubungannya kualitas bakteriologi air minum pada Depot Air Minum isi ulang di Kabupaten Morowali, Propinsi Sulawesi Tengah. Universitas Gadjah Mada, Indonesia.
- Eide, E.R., Showalter, M.H., 2010. Human capital, in: Brewer, D.J., McEwan, P.J. (Eds.), *Economics of Education*. Elsevier Ltd, pp. 27–32.
- Fewtrell, L., Kaufmann, R.B., Kay, D., Enanoria, W., Haller, L., Colford, J.M., Dis, L.I., Fewtrell, L., Kaufmann, R.B., Kay, D., Enanoria, W., Haller, L., Colford, J.M., 2005. Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *Lancet Infect. Dis.* 5, 42–52. doi:10.1016/S1473-3099(04)01253-8
- Fiebelkorn, A.P., Person, B., Quick, R.E., Vindigni, S.M., Jhung, M., Bowen, A., Riley, P.L., Parker, A., 2012. Systematic review of behavior change research on point-of-use water treatment interventions in countries categorized as low- to medium-development on the human development index. *Soc. Sci. Med.* 75, 622–633. doi:10.1016/j.socscimed.2012.02.011
- Filmer, D., Pritchett, L., 2001. Estimating wealth effects without expenditure data--or tears: an application to educational enrollments in states of India. *Demography* 38, 115–132. doi:10.1353/dem.2001.0003
- Fischer Walker, C.L., Perin, J., Aryee, M.J., Boschi-Pinto, C., Black, R.E., 2012. Diarrhea incidence in low- and middle-income countries in 1990 and 2010: a systematic review. *BMC Public Health* 12, 220. doi:10.1186/1471-2458-12-220

- Foster, V., Araujo, M.C., 2004. Does infrastructure reform work for the poor? A case study from Guatemala, World Bank Policy Research Working Paper.
- Fotso, J.-C., Kuate-Defo, B., 2005. Socioeconomic inequalities in early childhood malnutrition and morbidity: modification of the household-level effects by the community SES. *Health Place* 11, 205–25. doi:10.1016/j.healthplace.2004.06.004
- Francisco, J.P.S., 2014. Why households buy bottled water: a survey of household perceptions in the Philippines. *Int. J. Consum. Stud.* 38, 98–103. doi:10.1111/ijcs.12069
- Fuller, J. a., Clasen, T., Heijnen, M., Eisenberg, J.N.S., 2014. Shared sanitation and the prevalence of diarrhea in young children: Evidence from 51 countries, 2001–2011. *Am. J. Trop. Med. Hyg.* 91, 173–180. doi:10.4269/ajtmh.13-0503
- Fuller, J. a., Westphal, J. a., Kenney, B., Eisenberg, J.N.S., 2015. The joint effects of water and sanitation on diarrhoeal disease: a multicountry analysis of the Demographic and Health Surveys. *Trop. Med. Int. Heal.* 20, 284–292. doi:10.1111/tmi.12441
- Gamper-Rabindran, S., Khan, S., Timmins, C., 2010. The impact of piped water provision on infant mortality in Brazil: A quantile panel data approach. *J. Dev. Econ.* 92, 188–200. doi:<http://dx.doi.org/10.1016/j.jdeveco.2009.02.006>
- Gawel, E., Sigel, K., Bretschneider, W., 2013. Affordability of water supply in Mongolia: Empirical lessons for measuring affordability. *Water Policy* 15, 19–42. doi:10.2166/wp.2012.192
- Gleick, P., 1998. The human right to water. *Water Policy* 1, 487–503. doi:10.1016/S1366-7017(99)00008-2
- Gleick, P.H., 2010. Bottled and Sold: The Story Behind Our Obsession with Bottled Water. Island Press.
- Gleick, P.H., 2004. The Myth and Reality of Bottled Water, in: The World's Water, The Biennial Report on Freshwater Resources: 2004–2005. Pacific Institute, pp. 17–43.
- Glick, P., Sahn, D.E., 2000. Schooling of girls and boys in a West African country: the effects of parental education, income, and household structure. *Econ. Educ. Rev.* 19, 63–87. doi:10.1016/S0272-7757(99)00029-1
- Goldstein, H., 2011. Multilevel Statistical Models, 4th ed. John Wiley & Sons.
- Gragnolati, M., 1999. Children's growth and poverty in rural Guatemala (No. 2193), Policy Research Working Paper.
- Hatt, L.E., Waters, H.R., 2006. Determinants of child morbidity in Latin America: a pooled analysis of interactions between parental education and economic status. *Soc. Sci. Med.* 62, 375–86. doi:10.1016/j.socscimed.2005.06.007
- Howard, G., Bartram, J., 2003. Domestic water quantity, service level, and health. WHO Press, Geneva.
- Hu, Z., Morton, L.W., Mahler, R.L., 2011. Bottled water: United States consumers and their perceptions of water quality. *Int. J. Environ. Res. Public Health* 8, 565–578. doi:10.3390/ijerph8020565
- Huisman, J., Smits, J., 2015. Keeping Children in School. SAGE Open 5.

doi:10.1093/jhered/12.3.137

- Hunter, P.R., Risebro, H., Yen, M., Lefebvre, H., Lo, C., Hartemann, P., Longuet, C., Jaquenoud, F., 2014. Impact of the provision of safe drinking water on school absence rates in Cambodia: a quasi-experimental study. *PLoS One* 9, e91847. doi:10.1371/journal.pone.0091847
- ICF International, Macro International, 2012. Survey Organization Manual for Demographic and Health Surveys. Calverton, Maryland.
- Indonesia MoHA, 2016. Calculation and determination of drinking water tariff (Permendagri no. 71/2016 tentang perhitungan dan penetapan tarif air minum). Indonesia.
- Jakus, P.M., Shaw, W.D., Nguyen, T.N., Walker, M., 2009. Risk perceptions of arsenic in tap water and consumption of bottled water. *Water Resour. Res.* 45, 1–8. doi:10.1029/2008WR007427
- Jalan, J., Ravallion, M., 2003. Does piped water reduce diarrhea for children in rural India? *J. Econom.* 112, 153–173. doi:10.1016/S0304-4076(02)00158-6
- Johnstone, N., Serret, Y., 2012. Determinants of bottled and purified water consumption: results based on an OECD survey. *Water Policy* 14, 668–679. doi:10.2166/wp.2011.048
- Keman, S., 2005. Quality of Refilled Drinking Water in Surabaya City. *Folia Medica Indones.* 41, 29–35.
- Kessides, I., Miniaci, R., Scarpa, C., Valbonesi, P., 2009. Toward defining and measuring the affordability of public utility services. *World Bank Policy Res. Work. Pap.* 4915.
- Komarulzaman, A., de Jong, E., Smits, J., 2016. Direct and indirect effects of water access on school absenteeism and enrolment in Indonesia. Mimeo Radboud Univ. Nijmegen, Netherlands.
- Komarulzaman, A., de Jong, E., Smits, J., n.d. The Switch to Refillable Bottled Water in Indonesia: A Serious Health Risk. *J. Water Health.*
- Komarulzaman, A., Smits, J., de Jong, E., 2017. Clean Water, Sanitation and Diarrhoea in Indonesia : Effects of household and community factors. *Glob. Public Health* 12, 1141–1155. doi:10.1080/17441692.2015.1127985
- Kumpel, E., Nelson, K.L., 2013. Comparing microbial water quality in an intermittent and continuous piped water supply. *Water Res.* 47, 5176–5188. doi:10.1016/j.watres.2013.05.058
- Lawrence, P., Meigh, J., Sullivan, C., 2002. The Water Poverty Index: An International Comparison. *Keele Econ. Res. Pap.* 19, 17. doi:10.1111/1477-8947.00054
- Lee, C., 2011. Privatization, water access and affordability: Evidence from Malaysian household expenditure data. *Econ. Model.* 28, 2121–2128. doi:10.1016/j.econmod.2011.05.003
- Mack, E.A., Wrage, S., 2017. A Burgeoning Crisis? A Nationwide Assessment of the Geography of Water Affordability in the United States. *PLoS One* 12. doi:10.1371/journal.pone.0169488
- Mangyo, E., 2008. The effect of water accessibility on child health in China. *J. Health Econ.* 27, 1343–56. doi:10.1016/j.jhealeco.2008.04.004
- Martins, R., Quintal, C., Cruz, L., Barata, E., 2016. Water affordability issues in developed countries – The relevance of micro approaches. *Util. Policy.* doi:10.1016/j.jup.2016.04.012

- Monden, C.W., Smits, J., 2009. Maternal height and child mortality in 42 developing countries. *Am. J. Hum. Biol.* 21, 305–311. doi:10.1002/ajhb.20860
- Morris, N.G., Parry-Jones, S.A., 1999. The affordability of water in an African town. *J. Chart. Inst. Water Environ. Manag.* 13, 1–6.
- Muenchhoff, M., Goulder, P.J.R., 2014. Sex differences in pediatric infectious diseases. *J. Infect. Dis.* 209 Suppl, S120–6. doi:10.1093/infdis/jiu232
- Nastiti, A., Muntalif, B.S., Roosmini, D., Sudradjat, A., Meijerink, S.V., Smits, A.J.M., 2017. Coping with poor water supply in peri- urban Bandung , Indonesia : towards a framework for understanding risks and aversion behaviours. *Environ. Urban.* 29, 1–20. doi:10.1177/0956247816686485
- Nauges, C., Berg, C., 2009. Demand for Piped and Non-piped Water Supply Services: Evidence from Southwest Sri Lanka. *Environ. Resour. Econ.* 42, 535–549. doi:10.1007/s10640-008-9222-z
- Nauges, C., Strand, J., 2013. Water Hauling and Girls ' School Attendance Some New Evidence From Ghana (No. 6443), Policy Research Working Paper.
- Neuzil, K.M., Hohlbein, C., Zhu, Y., 2002. Illness Among Schoolchildren During Influenza Season: Effect on School Absenteeism, Parental Absenteeism From Work, and Secondary Illness in Families. *Arch. Pediatr. Adolesc. Med.* 156, 986–991. doi:10.1001/archpedi.156.10.986
- Ozkan, S., Tüzün, H., Görer, N., Ceyhan, M., Aycan, S., Albayrak, S., Bumin, M.A., 2007. Water usage habits and the incidence of diarrhea in rural Ankara, Turkey. *Trans. R. Soc. Trop. Med. Hyg.* 101, 1131–5. doi:10.1016/j.trstmh.2007.05.011
- PDAM Bandung, 2016. Drinking water tariff (Tariff air minum) [WWW Document]. URL http://www.pambdg.co.id/new/index.php?option=com_content&view=article&id=73&Itemid=87 (accessed 6.10.16).
- Pesaran, M.H., Shin, Y., 1999. An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis, in: Strom, S. (Ed.), *Econometrics and Economic Theory in the 20th Century: The Ragnar Frish Centennial Symposium*. Cambridge University Press, Cambridge, pp. 371–413.
- Prihartono, N., Adisasmita, A., Costello, C., Damayanti, R., Prasetyo, S., Syarif, S., 1994. Water Preparation Practices in South Kalimantan, Indonesia. *J. Diarrhoeal Dis. Res.* 12, 279–286.
- Rahayu, C.S., Setiani, O., Nurjazuli, N., 2013. Microbiological Contamination Risk Factor of Drinking Water Refilling in Tegal Regency (Faktor Risiko Pencemaran Mikrobiologi pada Air Minum Isi Ulang di Kabupaten Tegal). *J. Kesehat. Lingkung. Indones.* 12, 1–9.
- Rahut, D.B., Behera, B., Ali, A., 2015. Household access to water and choice of treatment methods: Empirical evidence from Bhutan. *Water Resour. Rural Dev.* 5, 1–16. doi:10.1016/j.wrr.2014.09.003
- Rutstein, S.O., Johnson, K., 2004. The DHS Wealth Index. DHS Comparative Reports No. 6. Calverton, Maryland.
- Saylor, A., Prokopy, L.S., Amberg, S., 2011. What's wrong with the tap? Examining perceptions of tap water and bottled water at Purdue University. *Environ. Manage.* 48, 588–601. doi:10.1007/s00267-011-9692-6

- Sebri, M., 2015. Water affordability and social equity in Tunisian governorates: A distributive approach. *Water Policy* 17, 26–45. doi:10.2166/wp.2014.142
- Semba, R.D., de Pee, S., Kraemer, K., Sun, K., Thorne-Lyman, A., Moench-Pfanner, R., Sari, M., Akhter, N., Bloem, M.W., 2009. Purchase of drinking water is associated with increased child morbidity and mortality among urban slum-dwelling families in Indonesia. *Int. J. Hyg. Environ. Health* 212, 387–97. doi:10.1016/j.ijheh.2008.09.001
- Shaheed, A., Orgill, J., Montgomery, M.A., Jeuland, M.A., Brown, J., 2014. Why “improved” water sources are not always safe. *Bull. World Health Organ.* 92, 283–289. doi:<http://dx.doi.org/10.2471/BLT.13.119594>
- Sima, L.C., Elimelech, M., 2013. More than a drop in the bucket: decentralized membrane-based drinking water refill stations in Southeast Asia. *Environ. Sci. Technol.* 47, 7580–7588. doi:dx.doi.org/10.1021/es304384n
- Smets, H., 2009. Access to Drinking Water at an Affordable Price in Developing Countries, in: M., E.M., L., M., G., T.-L., I., M., A., R., R., R. (Eds.), *Technological Perspectives for Rational Use of Water Resources in the Mediterranean Region*. Bari: CIHEAM, pp. 57–68.
- Smits, J., Keij-Deerenberg, I., Westert, G., 2005. Effects of socio-economic status on mortality: separating the nearby from the farther away. *Health Econ.* 14, 595–608. doi:10.1002/hec.950
- Smits, J., Steendijk, R., 2015. The international wealth index (IWI). *Soc. Indic. Res.* 122, 65–85. doi:10.1007/s11205-014-0683-x
- Sodha, S. V., Menon, M., Trivedi, K., Ati, A., Figueroa, M.E., Ainslie, R., Wannemuehler, K., Quick, R., 2011. Microbiologic effectiveness of boiling and safe water storage in South Sulawesi, Indonesia. *J. Water Health* 9, 577–585. doi:10.2166/wh.2011.255
- Sorenson, S.B., Morssink, C., Campos, P.A., 2011. Safe access to safe water in low income countries: Water fetching in current times. *Soc. Sci. Med.* 72, 1522–1526. doi:<http://dx.doi.org/10.1016/j.socscimed.2011.03.010>
- Statistics Indonesia, 2015a. Survei Sosial Ekonomi Nasional (Susenas) 2015. Jakarta, Indonesia.
- Statistics Indonesia, 2015b. Water quality survey in Yogyakarta (Hasil survei kualitas air di Daerah Istimewa Yogyakarta). Jakarta, Indonesia.
- Statistics Indonesia, 2014a. Statistical Yearbook of Indonesia 2014. Jakarta, Indonesia.
- Statistics Indonesia, 2014b. Survei Sosial Ekonomi Nasional (Susenas) 2014. Jakarta, Indonesia.
- Statistics Indonesia, Macro International, 2008. Indonesia Demographic and Health Survey 2007. Calverton, Maryland, USA.
- Statistics Indonesia, NPaFPBB, MOH, ICF International, 2013. Indonesia Demographic and Health Survey 2012. Jakarta, Indonesia.
- Stelmach, R., Clasen, T., 2015. Household Water Quantity and Health: A Systematic Review. *Int. J. Environ. Res. Public Health* 12, 5954–5974. doi:10.3390/ijerph120605954
- Surjadi, C., 2003. PPP and the poor: case study- Jakarta, Indonesia. Drinking water concessions, (a study for better understanding public-private partnerships and water provision in low-income settlements). WEDC Loughborough, UK.

- The Water Dialogues, 2009. Indonesia Contextual Analysis in Water Supply and Sanitation Sector.
- The World Bank, 2017. World Development Indicators [WWW Document]. URL <http://wdi.worldbank.org/> (accessed 7.1.17).
- Todaro, M.P., Smith, S.C., 2012. Economic development, 11th ed. Addison-Wesley.
- Tumwine, J.K., Thompson, J., Katua-Katua, M., Mujwajuzi, M., Johnstone, N., Wood, E., Porras, I., 2002. Diarrhoea and effects of different water sources, sanitation and hygiene behaviour in East Africa. *Trop. Med. Int. Heal.* 7, 750–756. doi:10.1046/j.1365-3156.2002.00927.x
- UNDP, 2006. Human Development Report 2006. Beyond scarcity: Power, poverty and the global water crisis. doi:10.1016/S1352-0237(02)00387-8
- UNICEF, 2012. Issue Brief. Water, sanitation & hygiene. Indonesia.
- UNICEF, 2011. Children and water: global statistics [WWW Document]. URL <http://www.unicef.org/wash/31600.html> (accessed 5.12.15).
- UNICEF, WHO, 2015. Progress on Sanitation and Drinking Water – 2015 update and MDG assessment.
- UNICEF, WHO, 2011. Drinking Water Equity, Safety and Sustainability: JMP Thematic report on drinking water 2011.
- UNICEF, WHO, 2009. Diarrhoea: why children are still dying and what can be done.
- United Nations, 2015. Global Sustainable Development Report.
- Vollaard, A.M., Ali, S., van Asten, H. a G.H., Widjaja, S., Visser, L.G., Surjadi, C., van Dissel, J.T., 2004. Risk factors for typhoid and paratyphoid fever in Jakarta, Indonesia. *JAMA* 291, 2607–15. doi:10.1001/jama.291.21.2607
- Walker, C.L.F., Rudan, I., Liu, L., Nair, H., Theodoratou, E., Bhutta, Z. a., O'Brien, K.L., Campbell, H., Black, R.E., Fischer Walker, C.L., Rudan, I., Liu, L., Nair, H., Theodoratou, E., Bhutta, Z. a., O'Brien, K.L., Campbell, H., Black, R.E., 2013. Global burden of childhood pneumonia and diarrhoea. *Lancet* 381, 1405–1416. doi:10.1016/S0140-6736(13)60222-6
- Ward, L. a, Cain, O.L., Mullally, R. a, Holliday, K.S., Wernham, A.G., Baillie, P.D., Greenfield, S.M., 2009. Health beliefs about bottled water: a qualitative study. *BMC Public Health* 9, 196. doi:10.1186/1471-2458-9-196
- WHO, 2017. Diarrhoeal disease: Fact sheet [WWW Document]. URL <http://www.who.int/mediacentre/factsheets/fs330/en/> (accessed 7.1.17).
- WHO, 2011. WHO guidelines for drinking-water quality 4th ed.
- WHO, 2005. Minimum water quantity needed for domestic uses, Technical Notes for Emergency.
- WHO and UNICEF, 2008. Progress on drinking-water and sanitation: Joint monitoring programme - special focus on sanitation.
- WHO, UNICEF, 2013a. Ending preventable child deaths from pneumonia and diarrhoea by 2025: the integrated global action plan for pneumonia and diarrhoea (GAPPD).
- WHO, UNICEF, 2013b. Progress on sanitation and drinking-water - 2013 update.

- Wilk, R., 2006. Bottled Water: The pure commodity in the age of branding. *J. Consum. Cult.* 6, 303–325. doi:10.1177/1469540506068681
- Wolf, J., Prüss-Ustün, A., Cumming, O., Bartram, J., Bonjour, S., Cairncross, S., Clasen, T., Colford, J.M., Curtis, V., De France, J., Fewtrell, L., Freeman, M.C., Gordon, B., Hunter, P.R., Jeandon, A., Johnston, R.B., Mäusezahl, D., Mathers, C., Neira, M., Higgins, J.P.T., 2014. Assessing the impact of drinking water and sanitation on diarrhoeal disease in low- and middle-income settings: systematic review and meta-regression. *Trop. Med. Int. Health* 19, 928–42. doi:10.1111/tmi.12331
- World Bank, 1994. World Development Report 1994. The World Bank.
- World Bank Group, 2016. Indonesia Database for Policy and Economic Research (INDO-DAPOER) [WWW Document]. URL <http://data.worldbank.org/data-catalog/indonesia-database-for-policy-and-economic-research> (accessed 2.16.15).
- Wright, J., Gundry, S., Conroy, R., 2004. Household drinking water in developing countries: A systematic review of microbiological contamination between source and point-of-use. *Trop. Med. Int. Heal.* 9, 106–117. doi:10.1046/j.1365-3156.2003.01160.x
- WWAP, 2016. Launch of the UN World Water Development Report 2016. UNESCO.
- WWAP, 2015. The United Nations World Water Development Report 2015: Water for a Sustainable World. UNESCO, Paris.
- York, A.M., Barnett, A., Wutich, A., Crona, B.I., 2011. Household bottled water consumption in Phoenix: a lifestyle choice. *Water Int.* 36, 708–718. doi:10.1080/02508060.2011.610727
- Yu, J., Jing, H., Lai, S., Xu, W., Li, M., Wu, J., Liu, W., Yuan, Z., Chen, Y., Zhao, S., Wang, X., Zhao, Z., Ran, L., Wu, S., Klena, J.D., Feng, L., Li, F., Ye, X., Qiu, Y., Wang, X., Yu, H., Li, Z., Yang, W., 2015. Etiology of diarrhea among children under the age five in China: Results from a five-year surveillance. *J. Infect.* 19–27. doi:10.1016/j.jinf.2015.03.001
- Zhang, J., Xu, L.C., 2016. The long-run effects of treated water on education: The rural drinking water program in China. *J. Dev. Econ.* 122, 1–15. doi:10.1016/j.jdeveco.2016.04.004

APPENDIX

Table A.8.1, below, presents a detailed district proliferation crosswalk of Indonesia based on Susenas 1994-2014. This table is adapted from the district proliferation crosswalk published by INDO-DAPOER (World Bank Group, 2016). The adaptation is made as the crosswalk made by INDO-DAPOER represents the actual district list at the end date (30 December) of the specified year. Meanwhile, the Susenas is fielded each year on March and September. It is likely that Susenas is fielded using the district list of the previous year(s).

This crosswalk table maps district proliferation in Indonesia, hence allowing us to trace back the parent district that split into new districts. As an illustration, in 1994 Indonesia had 26 provinces and 291 districts. During the study period, some provinces and districts were split and in 2014 the number of provinces and districts was 33 and 497, respectively.

I would like to use the proliferation crosswalk of Kab. Aceh Selatan (row 2-5, highlighted in blue) that during the study period split into four districts, as an example on how to read this table. This district is split into two districts and recorded in Susenas 2001-2003 as Kab. Aceh Singkil (Column Susenas 2001-2003, row 2 and 3) and Kab. Aceh Selatan (Column Susenas 2001-2003, row 4 and 5). The latest Kab. Aceh Selatan is split again into two districts and recorded in Susenas 2004 up to Susenas 2014 as Kab. Aceh Selatan (row 4) and Kab. Aceh Barat Daya (row 5). In addition, Kab. Aceh Singkil is split into two districts and recorded in Susenas 2007 up to Susenas 2014 as Kab. Aceh Singkil (row 2) and Kota Subulussalam (row 3). For creating the district panel dataset, that is used for the analysis in Chapter 5, the district code is based on the 1994 geographical definition of the districts which was taken as the basic definition to accommodate the splitting up of districts during the period. Thus, the split districts were merged into their original parent district. For example, in Susenas 2014, the data of Kab. Aceh Singkil (row 2), Kota Subulussalam (row 3), Kab. Aceh Selatan (row 4) and Kab. Aceh Barat (row 5) are merged to form data of Kab. Aceh Selatan, following the district frame in 1994.

Table A.8.1 District proliferation crosswalk, Indonesia, Susenas 1994-2014

Susenus 2001-2003		Susenus 2004		Susenus 2005		Susenus 2006	
Code5	Name	Code6	Name	Code7	Name	Code8	Name
1100	Prov. Nanggroe Aceh Darussalam	1100	Prov. Nanggroe Aceh Darussalam	1100	Prov. Nanggroe Aceh Darussalam	1100	Prov. Nanggroe Aceh Darussalam
1102	Kab. Aceh Singkil	1102	Kab. Aceh Singkil	1102	Kab. Aceh Singkil	1102	Kab. Aceh Singkil
1102	Kab. Aceh Singkil	1102	Kab. Aceh Singkil	1102	Kab. Aceh Singkil	1102	Kab. Aceh Singkil
1103	Kab. Aceh Selatan	1103	Kab. Aceh Selatan	1103	Kab. Aceh Selatan	1103	Kab. Aceh Selatan
1103	Kab. Aceh Selatan	1112	Kab. Aceh Barat Daya	1112	Kab. Aceh Barat Daya	1112	Kab. Aceh Barat Daya
1104	Kab. Aceh Tenggara	1104	Kab. Aceh Tenggara	1104	Kab. Aceh Tenggara	1104	Kab. Aceh Tenggara
1104	Kab. Aceh Tenggara	1113	Kab. Gayo Lues	1113	Kab. Gayo Lues	1113	Kab. Gayo Lues
1105	Kab. Aceh Timur	1105	Kab. Aceh Timur	1105	Kab. Aceh Timur	1105	Kab. Aceh Timur
1105	Kab. Aceh Timur	1114	Kab. Aceh Tamiang	1114	Kab. Aceh Tamiang	1114	Kab. Aceh Tamiang
1173	Kota Langsa	1173	Kota Langsa	1173	Kota Langsa	1173	Kota Langsa
1106	Kab. Aceh Tengah	1106	Kab. Aceh Tengah	1106	Kab. Aceh Tengah	1106	Kab. Aceh Tengah
1106	Kab. Aceh Tengah	1106	Kab. Aceh Tengah	1117	Kab. Bener Meriah	1117	Kab. Bener Meriah
1107	Kab. Aceh Barat	1107	Kab. Aceh Barat	1107	Kab. Aceh Barat	1107	Kab. Aceh Barat
1107	Kab. Aceh Barat	1115	Kab. Nagan Raya	1115	Kab. Nagan Raya	1115	Kab. Nagan Raya
1107	Kab. Aceh Barat	1116	Kab. Aceh Jaya	1116	Kab. Aceh Jaya	1116	Kab. Aceh Jaya
1101	Kab. Simeuleu	1101	Kab. Simeuleu	1101	Kab. Simeuleu	1101	Kab. Simeuleu
1108	Kab. Aceh Besar	1108	Kab. Aceh Besar	1108	Kab. Aceh Besar	1108	Kab. Aceh Besar
1109	Kab. Pidie	1109	Kab. Pidie	1109	Kab. Pidie	1109	Kab. Pidie
1109	Kab. Pidie	1109	Kab. Pidie	1109	Kab. Pidie	1109	Kab. Pidie
1110	Kab. Bireuen	1110	Kab. Bireuen	1110	Kab. Bireuen	1110	Kab. Bireuen
1111	Kab. Aceh Utara	1111	Kab. Aceh Utara	1111	Kab. Aceh Utara	1111	Kab. Aceh Utara
1174	Kota Lhokseumawe	1174	Kota Lhokseumawe	1174	Kota Lhokseumawe	1174	Kota Lhokseumawe
1171	Kota Banda Aceh	1171	Kota Banda Aceh	1171	Kota Banda Aceh	1171	Kota Banda Aceh
1172	Kota Sabang	1172	Kota Sabang	1172	Kota Sabang	1172	Kota Sabang
1200	Prov. Sumatera Utara	1200	Prov. Sumatera Utara	1200	Prov. Sumatera Utara	1200	Prov. Sumatera Utara
1201	Kab. Nias	1201	Kab. Nias	1201	Kab. Nias	1201	Kab. Nias
1201	Kab. Nias	1201	Kab. Nias	1201	Kab. Nias	1201	Kab. Nias
1201	Kab. Nias	1201	Kab. Nias	1201	Kab. Nias	1201	Kab. Nias
1201	Kab. Nias	1201	Kab. Nia	1214	Kab. Nias Selatan	1214	Kab. Nias Selatan
1202	Kab. Mandailing Natal	1202	Kab. Mandailing Natal	1202	Kab. Mandailing Natal	1202	Kab. Mandailing Natal
1203	Kab. Tapanuli Selatan	1203	Kab. Tapanuli Selatan	1203	Kab. Tapanuli Selatan	1203	Kab. Tapanuli Selatan
1203	Kab. Tapanuli Selatan	1203	Kab. Tapanuli Selatan	1203	Kab. Tapanuli Selatan	1203	Kab. Tapanuli Selatan
1203	Kab. Tapanuli Selatan	1203	Kab. Tapanuli Selatan	1203	Kab. Tapanuli Selatan	1203	Kab. Tapanuli Selatan
1277	Kota Padang Sidempuan	1277	Kota Padang Sidempuan	1277	Kota Padang Sidempuan	1277	Kota Padang Sidempuan
1204	Kab. Tapanuli Tengah	1204	Kab. Tapanuli Tengah	1204	Kab. Tapanuli Tengah	1204	Kab. Tapanuli Tengah
1205	Kab. Tapanuli Utara	1205	Kab. Tapanuli Utara	1205	Kab. Tapanuli Utara	1205	Kab. Tapanuli Utara
1205	Kab. Tapanuli Utara	1205	Kab. Tapanuli Utara	1215	Kab. Humbang Hasundutan	1215	Kab. Humbang Hasundutan
1206	Kab. Toba Samosir	1206	Kab. Toba Samosir	1206	Kab. Toba Samosir	1206	Kab. Toba Samosir
1206	Kab. Toba Samosir	1206	Kab. Toba Samosir	1217	Kab. Samosir	1217	Kab. Samosir
1207	Kab. Labuhan Batu	1207	Kab. Labuhan Batu	1207	Kab. Labuhan Batu	1207	Kab. Labuhan Batu
1207	Kab. Labuhan Batu	1207	Kab. Labuhan Batu	1207	Kab. Labuhan Batu	1207	Kab. Labuhan Batu
1207	Kab. Labuhan Batu	1207	Kab. Labuhan Batu	1207	Kab. Labuhan Batu	1207	Kab. Labuhan Batu
1208	Kab. Asahan	1208	Kab. Asahan	1208	Kab. Asahan	1208	Kab. Asahan
1208	Kab. Asahan	1208	Kab. Asahan	1208	Kab. Asahan	1208	Kab. Asahan
1209	Kab. Simalungun	1209	Kab. Simalungun	1209	Kab. Simalungun	1209	Kab. Simalungun
1210	Kab. Dairi	1210	Kab. Dairi	1210	Kab. Dairi	1210	Kab. Dairi
1210	Kab. Dairi	1210	Kab. Dairi	1216	Kab. Pakpak Bharat	1216	Kab. Pakpak Bharat
1211	Kab. Karo	1211	Kab. Karo	1211	Kab. Karo	1211	Kab. Karo
1212	Kab. Deli Serdang	1212	Kab. Deli Serdang	1212	Kab. Deli Serdang	1212	Kab. Deli Serdang
1212	Kab. Deli Serdang	1212	Kab. Deli Serdang	1218	Kab. Serdang Bedagai	1218	Kab. Serdang Bedagai
1213	Kab. Langkat	1213	Kab. Langkat	1213	Kab. Langkat	1213	Kab. Langkat
1271	Kota Sibolga	1271	Kota Sibolga	1271	Kota Sibolga	1271	Kota Sibolga
1272	Kota Tanjung Balai	1272	Kota Tanjung Balai	1272	Kota Tanjung Balai	1272	Kota Tanjung Balai
1273	Kota Pematang Siantar	1273	Kota Pematang Siantar	1273	Kota Pematang Siantar	1273	Kota Pematang Siantar
1274	Kota Tebing Tinggi	1274	Kota Tebing Tinggi	1274	Kota Tebing Tinggi	1274	Kota Tebing Tinggi
1275	Kota Medan	1275	Kota Medan	1275	Kota Medan	1275	Kota Medan
1276	Kota Binjai	1276	Kota Binjai	1276	Kota Binjai	1276	Kota Binjai
1300	Prov. Sumatera Barat	1300	Prov. Sumatera Barat	1300	Prov. Sumatera Barat	1300	Prov. Sumatera Barat
1302	Kab. Pesisir Selatan	1302	Kab. Pesisir Selatan	1302	Kab. Pesisir Selatan	1302	Kab. Pesisir Selatan
1303	Kab. Solok	1303	Kab. Solok	1303	Kab. Solok	1303	Kab. Solok
1303	Kab. Solok	1303	Kab. Solok	1310	Kab. Solok Selatan	1310	Kab. Solok Selatan
1304	Kab. Sawahlunto/Sijunjung	1304	Kab. Sawahlunto/Sijunjung	1304	Kab. Sawahlunto/Sijunjung	1304	Kab. Sawahlunto/Sijunjung
1304	Kab. Sawahlunto/Sijunjung	1304	Kab. Sawahlunto/Sijunjung	1311	Kab. Dharmas Raya	1311	Kab. Dharmas Raya
1305	Kab. Tanah Datar	1305	Kab. Tanah Datar	1305	Kab. Tanah Datar	1305	Kab. Tanah Datar
1301	Kab. Kepulauan Mentawai	1301	Kab. Kepulauan Mentawai	1301	Kab. Kepulauan Mentawai	1301	Kab. Kepulauan Mentawai
1306	Kab. Padang Pariaman	1306	Kab. Padang Pariaman	1306	Kab. Padang Pariaman	1306	Kab. Padang Pariaman
1306	Kab. Padang Pariaman	1377	Kota Pariaman	1377	Kota Pariaman	1377	Kota Pariaman
1307	Kab. Agam	1307	Kab. Agam	1307	Kab. Agam	1307	Kab. Agam
1308	Kab. Lima Puluh Koto	1308	Kab. Lima Puluh Koto	1308	Kab. Lima Puluh Koto	1308	Kab. Lima Puluh Koto
1309	Kab. Pasaman	1309	Kab. Pasaman	1309	Kab. Pasaman	1309	Kab. Pasaman
1309	Kab. Pasaman	1309	Kab. Pasaman	1312	Kab. Pasaman Barat	1312	Kab. Pasaman Barat
1371	Kota Padang	1371	Kota Padang	1371	Kota Padang	1371	Kota Padang
1372	Kota Solok	1372	Kota Solok	1372	Kota Solok	1372	Kota Solok
1373	Kota Sawahlunto	1373	Kota Sawahlunto	1373	Kota Sawahlunto	1373	Kota Sawahlunto
1374	Kota Padang Panjang	1374	Kota Padang Panjang	1374	Kota Padang Panjang	1374	Kota Padang Panjang
1375	Kota Bukittinggi	1375	Kota Bukittinggi	1375	Kota Bukittinggi	1375	Kota Bukittinggi
1376	Kota Payakumbuh	1376	Kota Payakumbuh	1376	Kota Payakumbuh	1376	Kota Payakumbuh
1400	Prov. Riau	1400	Prov. Riau	1400	Prov. Riau	1400	Prov. Riau
1400	Prov. Riau	1400	Prov. Riau	2000	Prov. Kepulauan Riau	2000	Prov. Kepulauan Riau
1401	Kab. Kuantan Singingi	1401	Kab. Kuantan Singingi	1401	Kab. Kuantan Singingi	1401	Kab. Kuantan Singingi
1402	Kab. Indragiri Hulu	1402	Kab. Indragiri Hulu	1402	Kab. Indragiri Hulu	1402	Kab. Indragiri Hulu
1403	Kab. Indragiri Hilir	1403	Kab. Indragiri Hilir	1403	Kab. Indragiri Hilir	1403	Kab. Indragiri Hilir
1410	Kab. Kepulauan Riau	1410	Kab. Kepulauan Riau	2002	Kab. Kepulauan Riau	2002	Kab. Kepulauan Riau
1410	Kab. Kepulauan Riau	1410	Kab. Kepulauan Riau	2004	Kab. Lingga	2004	Kab. Lingga
1411	Kab. Karimun	1411	Kab. Karimun	2001	Kab. Karimun	2001	Kab. Karimun
1412	Kab. Natuna	1412	Kab. Natuna	2003	Kab. Natuna	2003	Kab. Natuna
1474	Kota Tanjung Pinang	1474	Kota Tanjung Pinang	2072	Kota Tanjung Pinang	2072	Kota Tanjung Pinang
1404	Kab. Pelalawan	1404	Kab. Pelalawan	1404	Kab. Pelalawan	1404	Kab. Pelalawan
1406	Kab. Kampar	1406	Kab. Kampar	1406	Kab. Kampar	1406	Kab. Kampar
1407	Kab. Rokan Hulu	1407	Kab. Rokan Hulu	1407	Kab. Rokan Hulu	1407	Kab. Rokan Hulu
1405	Kab. Siak	1405	Kab. Siak	1405	Kab. Siak	1405	Kab. Siak
1408	Kab. Bengkalis	1408	Kab. Bengkalis	1408	Kab. Bengkalis	1408	Kab. Bengkalis
1408	Kab. Bengkalis	1408	Kab. Bengkalis	1408	Kab. Bengkalis	1408	Kab. Bengkalis

Susenas 2007 Code9	Name	Susenas 2008 Code10	Name	Susenas 2009 Code11	Name
1100 Prov. Nanggroe Aceh Darussalam		1100 Prov. Nanggroe Aceh Darussalam		1100 Prov. Nanggroe Aceh Darussalam	
1102 Kab. Aceh Singkil		1102 Kab. Aceh Singkil		1102 Kab. Aceh Singkil	
1175 Kota Subulussalam		1175 Kota Subulussalam		1175 Kota Subulussalam	
1103 Kab. Aceh Selatan		1103 Kab. Aceh Selatan		1103 Kab. Aceh Selatan	
1112 Kab. Aceh Barat Daya		1112 Kab. Aceh Barat Daya		1112 Kab. Aceh Barat Daya	
1104 Kab. Aceh Tenggara		1104 Kab. Aceh Tenggara		1104 Kab. Aceh Tenggara	
1113 Kab. Gayo Lues		1113 Kab. Gayo Lues		1113 Kab. Gayo Lues	
1105 Kab. Aceh Timur		1105 Kab. Aceh Timur		1105 Kab. Aceh Timur	
1114 Kab. Aceh Tamiang		1114 Kab. Aceh Tamiang		1114 Kab. Aceh Tamiang	
1173 Kota Langsa		1173 Kota Langsa		1173 Kota Langsa	
1106 Kab. Aceh Tengah		1106 Kab. Aceh Tengah		1106 Kab. Aceh Tengah	
1117 Kab. Bener Meriah		1117 Kab. Bener Meriah		1117 Kab. Bener Meriah	
1107 Kab. Aceh Barat		1107 Kab. Aceh Barat		1107 Kab. Aceh Barat	
1115 Kab. Nagan Raya		1115 Kab. Nagan Raya		1115 Kab. Nagan Raya	
1116 Kab. Aceh Jaya		1116 Kab. Aceh Jaya		1116 Kab. Aceh Jaya	
1101 Kab. Simeulue		1101 Kab. Simeulue		1101 Kab. Simeulue	
1108 Kab. Aceh Besar		1108 Kab. Aceh Besar		1108 Kab. Aceh Besar	
1109 Kab. Pidie		1109 Kab. Aceh Pidie		1109 Kab. Aceh Pidie	
1118 Kab. Pidie Jaya		1118 Kab. Pidie Jaya		1118 Kab. Pidie Jaya	
1110 Kab. Bireuen		1110 Kab. Bireuen		1110 Kab. Bireuen	
1111 Kab. Aceh Utara		1111 Kab. Aceh Utara		1111 Kab. Aceh Utara	
1174 Kota Lhokseumawe		1174 Kota Lhokseumawe		1174 Kota Lhokseumawe	
1171 Kota Banda Aceh		1171 Kota Banda Aceh		1171 Kota Banda Aceh	
1172 Kota Sabang		1172 Kota Sabang		1172 Kota Sabang	
1200 Prov. Sumatera Utara		1200 Prov. Sumatera Utara		1200 Prov. Sumatera Utara	
1201 Kab. Nias		1201 Kab. Nias		1201 Kab. Nias	
1201 Kab. Nias		1201 Kab. Nias		1201 Kab. Nias	
1201 Kab. Nias		1201 Kab. Nias		1201 Kab. Nias	
1214 Kab. Nias Selatan		1214 Kab. Nias Selatan		1214 Kab. Nias Selatan	
1202 Kab. Mandailing Natal		1202 Kab. Mandailing Natal		1202 Kab. Mandailing Natal	
1203 Kab. Tapanuli Selatan		1203 Kab. Tapanuli Selatan		1203 Kab. Tapanuli Selatan	
1203 Kab. Tapanuli Selatan		1203 Kab. Tapanuli Selatan		1220 Kab. Padang Lawas Utara	
1203 Kab. Tapanuli Selatan		1203 Kab. Tapanuli Selatan		1221 Kab. Padang Lawas	
1277 Kota Padang Sidempuan		1277 Kota Padang Sidempuan		1277 Kota Padang Sidempuan	
1204 Kab. Tapanuli Tengah		1204 Kab. Tapanuli Tengah		1204 Kab. Tapanuli Tengah	
1205 Kab. Tapanuli Utara		1205 Kab. Tapanuli Utara		1205 Kab. Tapanuli Utara	
1215 Kab. Humbang Hasundutan		1215 Kab. Humbang Hasundutan		1215 Kab. Humbang Hasundutan	
1206 Kab. Toba Samosir		1206 Kab. Toba Samosir		1206 Kab. Toba Samosir	
1217 Kab. Samosir		1217 Kab. Samosir		1217 Kab. Samosir	
1207 Kab. Labuhan Batu		1207 Kab. Labuhan Batu		1207 Kab. Labuhan Batu	
1207 Kab. Labuhan Batu		1207 Kab. Labuhan Batu		1207 Kab. Labuhan Batu	
1207 Kab. Labuhan Batu		1207 Kab. Labuhan Batu		1207 Kab. Labuhan Batu	
1208 Kab. Asahan		1208 Kab. Asahan		1208 Kab. Asahan	
1219 Kab. Batu Bara		1219 Kab. Batu Bara		1219 Kab. Batu Bara	
1209 Kab. Simalungun		1209 Kab. Simalungun		1209 Kab. Simalungun	
1210 Kab. Dairi		1210 Kab. Dairi		1210 Kab. Dairi	
1216 Kab. Pakpak Bharat		1216 Kab. Pakpak Bharat		1216 Kab. Pakpak Bharat	
1211 Kab. Karo		1211 Kab. Tanah Karo		1211 Kab. Tanah Karo	
1212 Kab. Deli Serdang		1212 Kab. Deli Serdang		1212 Kab. Deli Serdang	
1218 Kab. Serdang Bedagai		1218 Kab. Serdang Bedagai		1218 Kab. Serdang Bedagai	
1213 Kab. Langkat		1213 Kab. Langkat		1213 Kab. Langkat	
1271 Kota Sibolga		1271 Kota Sibolga		1271 Kota Sibolga	
1272 Kota Tanjung Balai		1272 Kota Tanjung Balai		1272 Kota Tanjung Balai	
1273 Kota Pematang Siantar		1273 Kota Pematang Siantar		1273 Kota Pematang Siantar	
1274 Kota Tebing Tinggi		1274 Kota Tebing Tinggi		1274 Kota Tebing Tinggi	
1275 Kota Medan		1275 Kota Medan		1275 Kota Medan	
1276 Kota Binjai		1276 Kota Binjai		1276 Kota Binjai	
1300 Prov. Sumatera Barat		1300 Prov. Sumatera Barat		1300 Prov. Sumatera Barat	
1302 Kab. Pesisir Selatan		1302 Kab. Pesisir Selatan		1302 Kab. Pesisir Selatan	
1303 Kab. Solok		1303 Kab. Solok		1303 Kab. Solok	
1310 Kab. Solok Selatan		1310 Kab. Solok Selatan		1310 Kab. Solok Selatan	
1304 Kab. Sawahlunto/Sijunjung		1304 Kab. Sawahlunto/Sijunjung		1304 Kab. Sawahlunto Sijunjung	
1311 Kab. Dharmas Raya		1311 Kab. Dharmas Raya		1311 Kab. Dharmas Raya	
1305 Kab. Tanah Datar		1305 Kab. Tanah Datar		1305 Kab. Tanah Datar	
1301 Kab. Kepulauan Mentawai		1301 Kab. Kepulauan Mentawai		1301 Kab. Kepulauan Mentawai	
1306 Kab. Padang Pariaman		1306 Kab. Padang Pariaman		1306 Kab. Padang Pariaman	
1377 Kota Pariaman		1377 Kota Pariaman		1377 Kota Pariaman	
1307 Kab. Agam		1307 Kab. Agam		1307 Kab. Agam	
1308 Kab. Lima Puluh Koto		1308 Kab. Limapuluh Koto		1308 Kab. Limapuluh Koto	
1309 Kab. Pasaman		1309 Kab. Pasaman		1309 Kab. Pasaman	
1312 Kab. Pasaman Barat		1312 Kab. Pasaman Barat		1312 Kab. Pasaman Barat	
1371 Kota Padang		1371 Kota Padang		1371 Kota Padang	
1372 Kota Solok		1372 Kota Solok		1372 Kota Solok	
1373 Kota Sawahlunto		1373 Kota Sawahlunto		1373 Kota Sawahlunto	
1374 Kota Padang Panjang		1374 Kota Padang Panjang		1374 Kota Padang Panjang	
1375 Kota Bukittinggi		1375 Kota Bukittinggi		1375 Kota Bukittinggi	
1376 Kota Payakumbuh		1376 Kota Payakumbuh		1376 Kota Payakumbuh	
1400 Prov. Riau		1400 Prov. Riau		1400 Prov. Riau	
2100 Prov. Kepulauan Riau		2100 Prov. Kepulauan Riau		2100 Prov. Kepulauan Riau	
1401 Kab. Kuantan Singingi		1401 Kab. Kuantan Singingi		1401 Kab. Kuantan Singingi	
1402 Kab. Indragiri Hulu		1402 Kab. Indragiri Hulu		1402 Kab. Indragiri Hulu	
1403 Kab. Indragiri Hilir		1403 Kab. Indragiri Hilir		1403 Kab. Indragiri Hilir	
2102 Kab. Kepulauan Riau		2102 Kab. Bintan		2102 Kab. Bintan	
2104 Kab. Lingga		2104 Kab. Lingga		2104 Kab. Lingga	
2101 Kab. Karimun		2101 Kab. Karimun		2101 Kab. Karimun	
2103 Kab. Natuna		2103 Kab. Natuna		2103 Kab. Natuna	
2103 Kab. Natuna		2103 Kab. Natuna		2103 Kab. Natuna	
2172 Kota Tanjung Pinang		2172 Kota Tanjung Pinang		2172 Kota Tanjung Pinang	
1404 Kab. Pelalawan		1404 Kab. Pelalawan		1404 Kab. Pelalawan	
1406 Kab. Kampar		1406 Kab. Kampar		1406 Kab. Kampar	
1407 Kab. Rokan Hulu		1407 Kab. Rokan Hulu		1407 Kab. Rokan Hulu	
1405 Kab. Siak		1405 Kab. Siak		1405 Kab. Siak	
1408 Kab. Bengkalis		1408 Kab. Bengkalis		1408 Kab. Bengkalis	
1408 Kab. Bengkalis		1408 Kab. Bengkalis		1408 Kab. Bengkalis	

Susenas 2010	Susenas 2011	Susenas 2012-2014			
Code12	Name	Code13	Name	Code14	Name
1100 Prov. Nanggroe Aceh Darussalam	1100 Prov. Nanggroe Aceh Darussalam	1100 Prov. Nanggroe Aceh Darussalam			
1102 Kab. Aceh Singkil	1102 Kab. Aceh Singkil	1102 Kab. Aceh Singkil			
1175 Kota Subulussalam	1175 Kota Subulussalam	1175 Kota Subulussalam			
1103 Kab. Aceh Selatan	1103 Kab. Aceh Selatan	1103 Kab. Aceh Selatan			
1112 Kab. Aceh Barat Daya	1112 Kab. Aceh Barat Daya	1112 Kab. Aceh Barat Daya			
1104 Kab. Aceh Tenggara	1104 Kab. Aceh Tenggara	1104 Kab. Aceh Tenggara			
1113 Kab. Gayo Lues	1113 Kab. Gayo Lues	1113 Kab. Gayo Lues			
1105 Kab. Aceh Timur	1105 Kab. Aceh Timur	1105 Kab. Aceh Timur			
1114 Kab. Aceh Tamiang	1114 Kab. Aceh Tamiang	1114 Kab. Aceh Tamiang			
1173 Kota Langsa	1173 Kota Langsa	1173 Kota Langsa			
1106 Kab. Aceh Tengah	1106 Kab. Aceh Tengah	1106 Kab. Aceh Tengah			
1117 Kab. Bener Meriah	1117 Kab. Bener Meriah	1117 Kab. Bener Meriah			
1107 Kab. Aceh Barat	1107 Kab. Aceh Barat	1107 Kab. Aceh Barat			
1115 Kab. Nagan Raya	1115 Kab. Nagan Raya	1115 Kab. Nagan Raya			
1116 Kab. Aceh Jaya	1116 Kab. Aceh Jaya	1116 Kab. Aceh Jaya			
1101 Kab. Simeulue	1101 Kab. Simeulue	1101 Kab. Simeulue			
1108 Kab. Aceh Besar	1108 Kab. Aceh Besar	1108 Kab. Aceh Besar			
1109 Kab. Aceh Pidie	1109 Kab. Aceh Pidie	1109 Kab. Aceh Pidie			
1118 Kab. Pidie Jaya	1118 Kab. Pidie Jaya	1118 Kab. Pidie Jaya			
1110 Kab. Bireuen	1110 Kab. Bireuen	1110 Kab. Bireuen			
1111 Kab. Aceh Utara	1111 Kab. Aceh Utara	1111 Kab. Aceh Utara			
1174 Kota Lhokseumawe	1174 Kota Lhokseumawe	1174 Kota Lhokseumawe			
1171 Kota Banda Aceh	1171 Kota Banda Aceh	1171 Kota Banda Aceh			
1172 Kota Sabang	1172 Kota Sabang	1172 Kota Sabang			
1200 Prov. Sumatera Utara	1200 Prov. Sumatera Utara	1200 Prov. Sumatera Utara			
1201 Kab. Nias	1201 Kab. Nias	1201 Kab. Nias			
1224 Kab. Nias Utara	1224 Kab. Nias Utara	1224 Kab. Nias Utara			
1225 Kab. Nias Barat	1225 Kab. Nias Barat	1225 Kab. Nias Barat			
1278 Kota Gunung Sitoli	1278 Kota Gunung Sitoli	1278 Kota Gunung Sitoli			
1214 Kab. Nias Selatan	1214 Kab. Nias Selatan	1214 Kab. Nias Selatan			
1202 Kab. Mandailing Natal	1202 Kab. Mandailing Natal	1202 Kab. Mandailing Natal			
1203 Kab. Tapanuli Selatan	1203 Kab. Tapanuli Selatan	1203 Kab. Tapanuli Selatan			
1220 Kab. Padang Lawas Utara	1220 Kab. Padang Lawas Utara	1220 Kab. Padang Lawas Utara			
1221 Kab. Padang Lawas	1221 Kab. Padang Lawas	1221 Kab. Padang Lawas			
1277 Kota Padang Sidempuan	1277 Kota Padang Sidempuan	1277 Kota Padang Sidempuan			
1204 Kab. Tapanuli Tengah	1204 Kab. Tapanuli Tengah	1204 Kab. Tapanuli Tengah			
1205 Kab. Tapanuli Utara	1205 Kab. Tapanuli Utara	1205 Kab. Tapanuli Utara			
1215 Kab. Humbang Hasundutan	1215 Kab. Humbang Hasundutan	1215 Kab. Humbang Hasundutan			
1206 Kab. Toba Samosir	1206 Kab. Toba Samosir	1206 Kab. Toba Samosir			
1217 Kab. Samosir	1217 Kab. Samosir	1217 Kab. Samosir			
1207 Kab. Labuhan Batu	1207 Kab. Labuhan Batu	1207 Kab. Labuhan Batu			
1222 Kab. Labuhan Batu Selatan	1222 Kab. Labuhan Batu Selatan	1222 Kab. Labuhan Batu Selatan			
1223 Kab. Labuhan Batu Utara	1223 Kab. Labuhan Batu Utara	1223 Kab. Labuhan Batu Utara			
1208 Kab. Asahan	1208 Kab. Asahan	1208 Kab. Asahan			
1219 Kab. Batu Bara	1219 Kab. Batu Bara	1219 Kab. Batu Bara			
1209 Kab. Simalungun	1209 Kab. Simalungun	1209 Kab. Simalungun			
1210 Kab. Dairi	1210 Kab. Dairi	1210 Kab. Dairi			
1216 Kab. Pakpak Bharat	1216 Kab. Pakpak Bharat	1216 Kab. Pakpak Bharat			
1211 Kab. Tanah Karo	1211 Kab. Tanah Karo	1211 Kab. Tanah Karo			
1212 Kab. Deli Serdang	1212 Kab. Deli Serdang	1212 Kab. Deli Serdang			
1218 Kab. Serdang Bedagai	1218 Kab. Serdang Bedagai	1218 Kab. Serdang Bedagai			
1213 Kab. Langkat	1213 Kab. Langkat	1213 Kab. Langkat			
1271 Kota Sibolga	1271 Kota Sibolga	1271 Kota Sibolga			
1272 Kota Tanjung Balai	1272 Kota Tanjung Balai	1272 Kota Tanjung Balai			
1273 Kota Pematang Siantar	1273 Kota Pematang Siantar	1273 Kota Pematang Siantar			
1274 Kota Tebing Tinggi	1274 Kota Tebing Tinggi	1274 Kota Tebing Tinggi			
1275 Kota Medan	1275 Kota Medan	1275 Kota Medan			
1276 Kota Binjai	1276 Kota Binjai	1276 Kota Binjai			
1300 Prov. Sumatera Barat	1300 Prov. Sumatera Barat	1300 Prov. Sumatera Barat			
1302 Kab. Pesisir Selatan	1302 Kab. Pesisir Selatan	1302 Kab. Pesisir Selatan			
1303 Kab. Solok	1303 Kab. Solok	1303 Kab. Solok			
1310 Kab. Solok Selatan	1310 Kab. Solok Selatan	1310 Kab. Solok Selatan			
1304 Kab. Sawahlunto Sijunjung	1304 Kab. Sawahlunto Sijunjung	1304 Kab. Sawahlunto Sijunjung			
1311 Kab. Dharmas Raya	1311 Kab. Dharmas Raya	1311 Kab. Dharmas Raya			
1305 Kab. Tanah Datar	1305 Kab. Tanah Datar	1305 Kab. Tanah Datar			
1301 Kab. Kepulauan Mentawai	1301 Kab. Kepulauan Mentawai	1301 Kab. Kepulauan Mentawai			
1306 Kab. Padang Pariaman	1306 Kab. Padang Pariaman	1306 Kab. Padang Pariaman			
1377 Kota Pariaman	1377 Kota Pariaman	1377 Kota Pariaman			
1307 Kab. Agam	1307 Kab. Agam	1307 Kab. Agam			
1308 Kab. Limapuluh Kota	1308 Kab. Limapuluh Kota	1308 Kab. Limapuluh Kota			
1309 Kab. Pasaman	1309 Kab. Pasaman	1309 Kab. Pasaman			
1312 Kab. Pasaman Barat	1312 Kab. Pasaman Barat	1312 Kab. Pasaman Barat			
1371 Kota Padang	1371 Kota Padang	1371 Kota Padang			
1372 Kota Solok	1372 Kota Solok	1372 Kota Solok			
1373 Kota Sawahlunto	1373 Kota Sawahlunto	1373 Kota Sawahlunto			
1374 Kota Padang Panjang	1374 Kota Padang Panjang	1374 Kota Padang Panjang			
1375 Kota Bukittinggi	1375 Kota Bukittinggi	1375 Kota Bukittinggi			
1376 Kota Payakumbuh	1376 Kota Payakumbuh	1376 Kota Payakumbuh			
1400 Prov. Riau	1400 Prov. Riau	1400 Prov. Riau			
2100 Prov. Kepulauan Riau	2100 Prov. Kepulauan Riau	2100 Prov. Kepulauan Riau			
1401 Kab. Kuantan Singingi	1401 Kab. Kuantan Singingi	1401 Kab. Kuantan Singingi			
1402 Kab. Indragiri Hulu	1402 Kab. Indragiri Hulu	1402 Kab. Indragiri Hulu			
1403 Kab. Indragiri Hilir	1403 Kab. Indragiri Hilir	1403 Kab. Indragiri Hilir			
2102 Kab. Bintan	2102 Kab. Bintan	2102 Kab. Bintan			
2104 Kab. Lingga	2104 Kab. Lingga	2104 Kab. Lingga			
2101 Kab. Karimun	2101 Kab. Karimun	2101 Kab. Karimun			
2103 Kab. Natuna	2103 Kab. Natuna	2103 Kab. Natuna			
2105 Kab. Kepulauan Anambas	2105 Kab. Kepulauan Anambas	2105 Kab. Kepulauan Anambas			
2172 Kota Tanjung Pinang	2172 Kota Tanjung Pinang	2172 Kota Tanjung Pinang			
1404 Kab. Pelalawan	1404 Kab. Pelalawan	1404 Kab. Pelalawan			
1406 Kab. Kampar	1406 Kab. Kampar	1406 Kab. Kampar			
1407 Kab. Rokan Hulu	1407 Kab. Rokan Hulu	1407 Kab. Rokan Hulu			
1405 Kab. Siak	1405 Kab. Siak	1405 Kab. Siak			
1408 Kab. Bengkalis	1408 Kab. Bengkalis	1408 Kab. Bengkalis			
1410 Kab. Kepulauan Meranti	1410 Kab. Kepulauan Meranti	1410 Kab. Kepulauan Meranti			

Susenus 2001-2003		Susenas 2004		Susenus 2005		Susenus 2006	
Code5	Name	Code6	Name	Code7	Name	Code8	Name
1409	Kab. Rokan Hilir	1409	Kab. Rokan Hilir	1409	Kab. Rokan Hilir	1409	Kab. Rokan Hilir
1473	Kota Dumai	1473	Kota Dumai	1473	Kota Dumai	1473	Kota Dumai
1471	Kota Pekan Baru	1471	Kota Pekan Baru	1471	Kota Pekan Baru	1471	Kota Pekan Baru
1472	Kota Batam	1472	Kota Batam	2071	Kota Batam	2071	Kota Batam
1500	Prov. Jambi	1500	Prov. Jambi	1500	Prov. Jambi	1500	Prov. Jambi
1501	Kab. Kerinci	1501	Kab. Kerinci	1501	Kab. Kerinci	1501	Kab. Kerinci
1501	Kab. Kerinci	1501	Kab. Kerinci	1501	Kab. Kerinci	1501	Kab. Kerinci
1508	Kab. Tebo	1508	Kab. Tebo	1508	Kab. Tebo	1508	Kab. Tebo
1509	Kab. Bungo	1509	Kab. Bungo	1509	Kab. Bungo	1509	Kab. Bungo
1502	Kab. Merangin	1502	Kab. Merangin	1502	Kab. Merangin	1502	Kab. Merangin
1503	Kab. Sarolangun	1503	Kab. Sarolangun	1503	Kab. Sarolangun	1503	Kab. Sarolangun
1504	Kab. Batang Hari	1504	Kab. Batang Hari	1504	Kab. Batang Hari	1504	Kab. Batang Hari
1505	Kab. Muaro Jambi	1505	Kab. Muaro Jambi	1505	Kab. Muaro Jambi	1505	Kab. Muaro Jambi
1506	Kab. Tanjung Jabung Timur	1506	Kab. Tanjung Jabung Timur	1506	Kab. Tanjung Jabung Timur	1506	Kab. Tanjung Jabung Timur
1507	Kab. Tanjung Jabung Barat	1507	Kab. Tanjung Jabung Barat	1507	Kab. Tanjung Jabung Barat	1507	Kab. Tanjung Jabung Barat
1571	Kota Jambi	1571	Kota Jambi	1571	Kota Jambi	1571	Kota Jambi
1600	Prov. Sumatera Selatan	1600	Prov. Sumatera Selatan	1600	Prov. Sumatera Selatan	1600	Prov. Sumatera Selatan
1900	Prov. Kep. Bangka Belitung	1900	Prov. Kep. Bangka Belitung	1900	Prov. Kep. Bangka Belitung	1900	Prov. Kep. Bangka Belitung
1601	Kab. Ogan Komering Ulu	1601	Kab. Ogan Komering Ulu	1601	Kab. Ogan Komering Ulu	1601	Kab. Ogan Komering Ulu
1601	Kab. Ogan Komering Ulu	1601	Kab. Ogan Komering Ulu	1608	Kab. Ogan Komering Ulu Selatan	1608	Kab. Ogan Komering Ulu Selatan
1601	Kab. Ogan Komering Ulu	1601	Kab. Ogan Komering Ulu	1609	Kab. Ogan Komering Ulu Timur	1609	Kab. Ogan Komering Ulu Timur
1602	Kab. Ogan Komering Ilir	1602	Kab. Ogan Komering Ilir	1602	Kab. Ogan Komering Ilir	1602	Kab. Ogan Komering Ilir
1602	Kab. Ogan Komering Ilir	1602	Kab. Ogan Komering Ilir	1610	Kab. Ogan Ilir	1610	Kab. Ogan Ilir
1603	Kab. Muara Enim	1603	Kab. Muara Enim	1603	Kab. Muara Enim	1603	Kab. Muara Enim
1672	Kota Prabumulih	1672	Kota Prabumulih	1672	Kota Prabumulih	1672	Kota Prabumulih
1604	Kab. Lahat	1604	Kab. Lahat	1604	Kab. Lahat	1604	Kab. Lahat
1604	Kab. Lahat	1604	Kab. Lahat	1604	Kab. Lahat	1604	Kab. Lahat
1673	Kota Pagar Alam	1673	Kota Pagar Alam	1673	Kota Pagar Alam	1673	Kota Pagar Alam
1605	Kab. Musi Rawas	1605	Kab. Musi Rawas	1605	Kab. Musi Rawas	1605	Kab. Musi Rawas
1674	Kota Lubuk Linggau	1674	Kota Lubuk Linggau	1674	Kota Lubuk Linggau	1674	Kota Lubuk Linggau
1606	Kab. Musi Banyuasin	1606	Kab. Musi Banyuasin	1606	Kab. Musi Banyuasin	1606	Kab. Musi Banyuasin
1606	Kab. Musi Banyuasin	1607	Kab. Banyuasin	1607	Kab. Banyuasin	1607	Kab. Banyuasin
1901	Kab. Bangka	1901	Kab. Bangka	1901	Kab. Bangka	1901	Kab. Bangka
1901	Kab. Bangka	1901	Kab. Bangka	1903	Kab. Bangka Barat	1903	Kab. Bangka Barat
1901	Kab. Bangka	1901	Kab. Bangka	1904	Kab. Bangka Tengah	1904	Kab. Bangka Tengah
1901	Kab. Bangka	1901	Kab. Bangka	1905	Kab. Bangka Selatan	1905	Kab. Bangka Selatan
1902	Kab. Belitung	1902	Kab. Belitung	1902	Kab. Belitung	1902	Kab. Belitung
1902	Kab. Belitung	1902	Kab. Belitung	1906	Kab. Belitung Timur	1906	Kab. Belitung Timur
1671	Kota Palembang	1671	Kota Palembang	1671	Kota Palembang	1671	Kota Palembang
1971	Kota Pangkal Pinang	1971	Kota Pangkal Pinang	1971	Kota Pangkal Pinang	1971	Kota Pangkal Pinang
1700	Prov. Bengkulu	1700	Prov. Bengkulu	1700	Prov. Bengkulu	1700	Prov. Bengkulu
1701	Kab. Bengkulu Selatan	1701	Kab. Bengkulu Selatan	1701	Kab. Bengkulu Selatan	1701	Kab. Bengkulu Selatan
1701	Kab. Bengkulu Selatan	1701	Kab. Bengkulu Selatan	1704	Kab. Kaur	1704	Kab. Kaur
1701	Kab. Bengkulu Selatan	1701	Kab. Bengkulu Selatan	1705	Kab. Seluma	1705	Kab. Seluma
1702	Kab. Rejang Lebong	1702	Kab. Rejang Lebong	1702	Kab. Rejang Lebong	1702	Kab. Rejang Lebong
1702	Kab. Rejang Lebong	1702	Kab. Rejang Lebong	1707	Kab. Lebong	1707	Kab. Lebong
1702	Kab. Rejang Lebong	1702	Kab. Rejang Lebong	1708	Kab. Kepahiang	1708	Kab. Kepahiang
1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara
1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara
1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara	1706	Kab. Mukomuko	1706	Kab. Mukomuko
1771	Kota Bengkulu	1771	Kota Bengkulu	1771	Kota Bengkulu	1771	Kota Bengkulu
1800	Prov. Lampung	1800	Prov. Lampung	1800	Prov. Lampung	1800	Prov. Lampung
1803	Kab. Lampung Selatan	1803	Kab. Lampung Selatan	1803	Kab. Lampung Selatan	1803	Kab. Lampung Selatan
1802	Kab. Lampung Selatan	1802	Kab. Lampung Selatan	1802	Kab. Lampung Selatan	1802	Kab. Lampung Selatan
1802	Kab. Tanggamus	1802	Kab. Tanggamus	1802	Kab. Tanggamus	1802	Kab. Tanggamus
1804	Kab. Lampung Timur	1804	Kab. Lampung Timur	1804	Kab. Lampung Timur	1804	Kab. Lampung Timur
1805	Kab. Lampung Tengah	1805	Kab. Lampung Tengah	1805	Kab. Lampung Tengah	1805	Kab. Lampung Tengah
1872	Kota Metro	1872	Kota Metro	1872	Kota Metro	1872	Kota Metro
1806	Kab. Lampung Utara	1806	Kab. Lampung Utara	1806	Kab. Lampung Utara	1806	Kab. Lampung Utara
1807	Kab. Way Kanan	1807	Kab. Way Kanan	1807	Kab. Way Kanan	1807	Kab. Way Kanan
1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang
1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang
1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang
1801	Kab. Lampung Barat	1801	Kab. Lampung Barat	1801	Kab. Lampung Barat	1801	Kab. Lampung Barat
1871	Kota Bandar Lampung	1871	Kota Bandar Lampung	1871	Kota Bandar Lampung	1871	Kota Bandar Lampung
3100	Prov. D K I Jakarta	3100	Prov. D K I Jakarta	3100	Prov. D K I Jakarta	3100	Prov. D K I Jakarta
3171	Kota Jakarta Selatan	3171	Kota Jakarta Selatan	3171	Kota Jakarta Selatan	3171	Kota Jakarta Selatan
3172	Kota Jakarta Timur	3172	Kota Jakarta Timur	3172	Kota Jakarta Timur	3172	Kota Jakarta Timur
3173	Kota Jakarta Pusat	3173	Kota Jakarta Pusat	3173	Kota Jakarta Pusat	3173	Kota Jakarta Pusat
3174	Kota Jakarta Barat	3174	Kota Jakarta Barat	3174	Kota Jakarta Barat	3174	Kota Jakarta Barat
3101	Kab. Adm. Kepulauan Seribu	3101	Kab. Adm. Kepulauan Seribu	3101	Kab. Adm. Kepulauan Seribu	3101	Kab. Adm. Kepulauan Seribu
3175	Kota Jakarta Utara	3175	Kota Jakarta Utara	3175	Kota Jakarta Utara	3175	Kota Jakarta Utara
3200	Prov. Java Barat	3200	Prov. Java Barat	3200	Prov. Java Barat	3200	Prov. Java Barat
3600	Prov. Banten	3600	Prov. Banten	3600	Prov. Banten	3600	Prov. Banten
3601	Kab. Pandeglang	3601	Kab. Pandeglang	3601	Kab. Pandeglang	3601	Kab. Pandeglang
3602	Kab. Lebak	3602	Kab. Lebak	3602	Kab. Lebak	3602	Kab. Lebak
3201	Kab. Bogor	3201	Kab. Bogor	3201	Kab. Bogor	3201	Kab. Bogor
3276	Kota Depok	3276	Kota Depok	3276	Kota Depok	3276	Kota Depok
3202	Kab. Sukabumi	3202	Kab. Sukabumi	3202	Kab. Sukabumi	3202	Kab. Sukabumi
3203	Kab. Cianjur	3203	Kab. Cianjur	3203	Kab. Cianjur	3203	Kab. Cianjur
3204	Kab. Bandung	3204	Kab. Bandung	3204	Kab. Bandung	3204	Kab. Bandung
3204	Kab. Bandung	3204	Kab. Bandung	3204	Kab. Bandung	3204	Kab. Bandung
3277	Kota Cimahi	3277	Kota Cimahi	3277	Kota Cimahi	3277	Kota Cimahi
3205	Kab. Garut	3205	Kab. Garut	3205	Kab. Garut	3205	Kab. Garut
3206	Kab. Tasikmalaya	3206	Kab. Tasikmalaya	3206	Kab. Tasikmalaya	3206	Kab. Tasikmalaya
3278	Kota Tasikmalaya	3278	Kota Tasikmalaya	3278	Kota Tasikmalaya	3278	Kota Tasikmalaya
3207	Kab. Ciamis	3207	Kab. Ciamis	3207	Kab. Ciamis	3207	Kab. Ciamis
3207	Kota Banjar	3207	Kota Banjar	3207	Kota Banjar	3207	Kota Banjar
3208	Kab. Kuningan	3208	Kab. Kuningan	3208	Kab. Kuningan	3208	Kab. Kuningan
3209	Kab. Cirebon	3209	Kab. Cirebon	3209	Kab. Cirebon	3209	Kab. Cirebon
3210	Kab. Majalengka	3210	Kab. Majalengka	3210	Kab. Majalengka	3210	Kab. Majalengka
3211	Kab. Sumedang	3211	Kab. Sumedang	3211	Kab. Sumedang	3211	Kab. Sumedang
3212	Kab. Indramayu	3212	Kab. Indramayu	3212	Kab. Indramayu	3212	Kab. Indramayu
3213	Kab. Subang	3213	Kab. Subang	3213	Kab. Subang	3213	Kab. Subang
3214	Kab. Purwakarta	3214	Kab. Purwakarta	3214	Kab. Purwakarta	3214	Kab. Purwakarta
3215	Kab. Karawang	3215	Kab. Karawang	3215	Kab. Karawang	3215	Kab. Karawang

Susenus 2007		Susenus 2008		Susenus 2009	
Code9	Name	Code10	Name	Code11	Name
1409	Kab. Rokan Hilir	1409	Kab. Rokan Hilir	1409	Kab. Rokan Hilir
1473	Kota Dumai	1473	Kota Dumai	1473	Kota Dumai
1471	Kota Pekan Baru	1471	Kota Pekan Baru	1471	Kota Pekan Baru
2171	Kota Batam	2171	Kota Batam	2171	Kota Batam
1500	Prov. Jambi	1500	Prov. Jambi	1500	Prov. Jambi
1501	Kab. Kerinci	1501	Kab. Kerinci	1501	Kab. Kerinci
1501	Kab. Kerinci	1501	Kab. Kerinci	1501	Kab. Kerinci
1508	Kab. Tebo	1508	Kab. Tebo	1508	Kab. Tebo
1509	Kab. Bungo	1509	Kab. Bungo	1509	Kab. Bungo
1502	Kab. Merangin	1502	Kab. Merangin	1502	Kab. Merangin
1503	Kab. Sarolangun	1503	Kab. Sarolangun	1503	Kab. Sarolangun
1504	Kab. Batang Hari	1504	Kab. Batanghari	1504	Kab. Batanghari
1505	Kab. Muaro Jambi	1505	Kab. Muaro Jambi	1505	Kab. Muaro Jambi
1506	Kab. Tanjung Jabung Timur	1506	Kab. Tanjung Jabung Timur	1506	Kab. Tanjung Jabung Timur
1507	Kab. Tanjung Jabung Barat	1507	Kab. Tanjung Jabung Barat	1507	Kab. Tanjung Jabung Barat
1571	Kota Jambi	1571	Kota Jambi	1571	Kota Jambi
1600	Prov. Sumatera Selatan	1600	Prov. Sumatera Selatan	1600	Prov. Sumatera Selatan
1900	Prov. Kep. Bangka Belitung	1900	Prov. Kep. Bangka Belitung	1900	Prov. Kep. Bangka Belitung
1601	Kab. Ogan Komering Ulu	1601	Kab. Ogan Komering Ulu	1601	Kab. Ogan Komering Ulu
1608	Kab. Ogan Komering Ulu Selatan	1608	Kab. Ogan Komering Ulu Selatan	1608	Kab. Ogan Komering Ulu Selatan
1609	Kab. Ogan Komering Ulu Timur	1609	Kab. Ogan Komering Ulu Timur	1609	Kab. Ogan Komering Ulu Timur
1602	Kab. Ogan Komering Ilir	1602	Kab. Ogan Komering Ilir	1602	Kab. Ogan Komering Ilir
1610	Kab. Ogan Ilir	1610	Kab. Ogan Ilir	1610	Kab. Ogan Ilir
1603	Kab. Muara Enim	1603	Kab. Muara Enim	1603	Kab. Muara Enim
1672	Kota Prabumulih	1672	Kota Prabumulih	1672	Kota Prabumulih
1604	Kab. Lahat	1604	Kab. Lahat	1604	Kab. Lahat
1611	Kab. Empat Lawang	1611	Kab. Empat Lawang	1611	Kab. Empat Lawang
1673	Kota Pagar Alam	1673	Kota Pagar Alam	1673	Kota Pagar Alam
1605	Kab. Musi Rawas	1605	Kab. Musi Rawas	1605	Kab. Musi Rawas
1674	Kota Lubuk Linggau	1674	Kota Lubuk Linggau	1674	Kota Lubuk Linggau
1606	Kab. Musi Banyuasin	1606	Kab. Musi Banyuasin	1606	Kab. Musi Banyuasin
1607	Kab. Banyuasin	1607	Kab. Banyuasin	1607	Kab. Banyuasin
1901	Kab. Bangka	1901	Kab. Bangka	1901	Kab. Bangka
1903	Kab. Bangka Barat	1903	Kab. Bangka Barat	1903	Kab. Bangka Barat
1904	Kab. Bangka Tengah	1904	Kab. Bangka Tengah	1904	Kab. Bangka Tengah
1905	Kab. Bangka Selatan	1905	Kab. Bangka Selatan	1905	Kab. Bangka Selatan
1902	Kab. Belitung	1902	Kab. Belitung	1902	Kab. Belitung
1906	Kab. Belitung Timur	1906	Kab. Belitung Timur	1906	Kab. Belitung Timur
1671	Kota Palembang	1671	Kota Palembang	1671	Kota Palembang
1971	Kota Pangkal Pinang	1971	Kota Pangkal Pinang	1971	Kota Pangkal Pinang
1700	Prov. Bengkulu	1700	Prov. Bengkulu	1700	Prov. Bengkulu
1701	Kab. Bengkulu Selatan	1701	Kab. Bengkulu Selatan	1701	Kab. Bengkulu Selatan
1704	Kab. Kaur	1704	Kab. Kaur	1704	Kab. Kaur
1705	Kab. Seluma	1705	Kab. Seluma	1705	Kab. Seluma
1702	Kab. Rejang Lebong	1702	Kab. Rejang Lebong	1702	Kab. Rejang Lebong
1707	Kab. Lebong	1707	Kab. Lebong	1707	Kab. Lebong
1708	Kab. Kepahiang	1708	Kab. Kepahiang	1708	Kab. Kepahiang
1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara
1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara	1703	Kab. Bengkulu Utara
1706	Kab. Mukomuko	1706	Kab. Mukomuko	1706	Kab. Mukomuko
1771	Kota Bengkulu	1771	Kota Bengkulu	1771	Kota Bengkulu
1800	Prov. Lampung	1800	Prov. Lampung	1800	Prov. Lampung
1803	Kab. Lampung Selatan	1803	Kab. Lampung Selatan	1803	Kab. Lampung Selatan
1803	Kab. Lampung Selatan	1803	Kab. Lampung Selatan	1809	Kab. Pesawaran
1802	Kab. Tanggamus	1802	Kab. Tanggamus	1802	Kab. Tanggamus
1802	Kab. Tanggamus	1802	Kab. Tanggamus	1802	Kab. Tanggamus
1804	Kab. Lampung Timur	1804	Kab. Lampung Timur	1804	Kab. Lampung Timur
1805	Kab. Lampung Tengah	1805	Kab. Lampung Tengah	1805	Kab. Lampung Tengah
1872	Kota Metro	1872	Kota Metro	1872	Kota Metro
1806	Kab. Lampung Utara	1806	Kab. Lampung Utara	1806	Kab. Lampung Utara
1807	Kab. Way Kanan	1807	Kab. Way Kanan	1807	Kab. Way Kanan
1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang
1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang
1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang	1808	Kab. Tulang Bawang
1801	Kab. Lampung Barat	1801	Kab. Lampung Barat	1801	Kab. Lampung Barat
1871	Kota Bandar Lampung	1871	Kota Bandar Lampung	1871	Kota Bandar Lampung
3100	Prov. D K I Jakarta	3100	Prov. D K I Jakarta	3100	Prov. D K I Jakarta
3171	Kota Jakarta Selatan	3171	Kota Jakarta Selatan	3171	Kota Jakarta Selatan
3172	Kota Jakarta Timur	3172	Kota Jakarta Timur	3172	Kota Jakarta Timur
3173	Kota Jakarta Pusat	3173	Kota Jakarta Pusat	3173	Kota Jakarta Pusat
3174	Kota Jakarta Barat	3174	Kota Jakarta Barat	3174	Kota Jakarta Barat
3101	Kab. Adm. Kepulauan Seribu	3101	Kab. Adm. Kepulauan Seribu	3101	Kab. Adm. Kepulauan Seribu
3175	Kota Jakarta Utara	3175	Kota Jakarta Utara	3175	Kota Jakarta Utara
3200	Prov. Jawa Barat	3200	Prov. Jawa Barat	3200	Prov. Jawa Barat
3600	Prov. Banten	3600	Prov. Banten	3600	Prov. Banten
3601	Kab. Pandeglang	3601	Kab. Pandeglang	3601	Kab. Pandeglang
3602	Kab. Lebak	3602	Kab. Lebak	3602	Kab. Lebak
3201	Kab. Bogor	3201	Kab. Bogor	3201	Kab. Bogor
3276	Kota Depok	3276	Kota Depok	3276	Kota Depok
3202	Kab. Sukabumi	3202	Kab. Sukabumi	3202	Kab. Sukabumi
3203	Kab. Cianjur	3203	Kab. Cianjur	3203	Kab. Cianjur
3204	Kab. Bandung	3204	Kab. Bandung	3204	Kab. Bandung
3217	Kab. Bandung Barat	3217	Kab. Bandung Barat	3217	Kab. Bandung Barat
3277	Kota Cimahi	3277	Kota Cimahi	3277	Kota Cimahi
3205	Kab. Garut	3205	Kab. Garut	3205	Kab. Garut
3206	Kab. Tasikmalaya	3206	Kab. Tasikmalaya	3206	Kab. Tasikmalaya
3278	Kota Tasikmalaya	3278	Kota Tasikmalaya	3278	Kota Tasikmalaya
3207	Kab. Clamis	3207	Kab. Clamis	3207	Kab. Clamis
3279	Kota Banjar	3279	Kota Banjar	3279	Kota Banjar
3208	Kab. Kuningan	3208	Kab. Kuningan	3208	Kab. Kuningan
3209	Kab. Cirebon	3209	Kab. Cirebon	3209	Kab. Cirebon
3210	Kab. Majalengka	3210	Kab. Majalengka	3210	Kab. Majalengka
3211	Kab. Sumedang	3211	Kab. Sumedang	3211	Kab. Sumedang
3212	Kab. Indramayu	3212	Kab. Indramayu	3212	Kab. Indramayu
3213	Kab. Subang	3213	Kab. Subang	3213	Kab. Subang
3214	Kab. Purwakarta	3214	Kab. Purwakarta	3214	Kab. Purwakarta
3215	Kab. Karawang	3215	Kab. Karawang	3215	Kab. Karawang

Susenus 2010	Susenus 2011	Susenus 2012-2014			
Code12	Name	Code13	Name	Code14	Name
1409 Kab. Rokan Hilir	1409 Kab. Rokan Hilir	1409 Kab. Rokan Hilir			
1473 Kota Dumai	1473 Kota Dumai	1473 Kota Dumai			
1471 Kota Pekan Baru	1471 Kota Pekan Baru	1471 Kota Pekan Baru			
2171 Kota Batam	2171 Kota Batam	2171 Kota Batam			
1500 Prov. Jambi	1500 Prov. Jambi	1500 Prov. Jambi			
1501 Kab. Kerinci	1501 Kab. Kerinci	1501 Kab. Kerinci			
1572 Kota Sungai Penuh	1572 Kota Sungai Penuh	1572 Kota Sungai Penuh			
1508 Kab. Tebo	1508 Kab. Tebo	1508 Kab. Tebo			
1509 Kab. Bungo	1509 Kab. Bungo	1509 Kab. Bungo			
1502 Kab. Merangin	1502 Kab. Merangin	1502 Kab. Merangin			
1503 Kab. Sarolangun	1503 Kab. Sarolangun	1503 Kab. Sarolangun			
1504 Kab. Batanghari	1504 Kab. Batanghari	1504 Kab. Batanghari			
1505 Kab. Muaro Jambi	1505 Kab. Muaro Jambi	1505 Kab. Muaro Jambi			
1506 Kab. Tanjung Jabung Timur	1506 Kab. Tanjung Jabung Timur	1506 Kab. Tanjung Jabung Timur			
1507 Kab. Tanjung Jabung Barat	1507 Kab. Tanjung Jabung Barat	1507 Kab. Tanjung Jabung Barat			
1571 Kota Jambi	1571 Kota Jambi	1571 Kota Jambi			
1600 Prov. Sumatera Selatan	1600 Prov. Sumatera Selatan	1600 Prov. Sumatera Selatan			
1900 Prov. Kep. Bangka Belitung	1900 Prov. Kep. Bangka Belitung	1900 Prov. Kep. Bangka Belitung			
1601 Kab. Ogan Komering Ulu	1601 Kab. Ogan Komering Ulu	1601 Kab. Ogan Komering Ulu			
1608 Kab. Ogan Komering Ulu Selatan	1608 Kab. Ogan Komering Ulu Selatan	1608 Kab. Ogan Komering Ulu Selatan			
1609 Kab. Ogan Komering Ulu Timur	1609 Kab. Ogan Komering Ulu Timur	1609 Kab. Ogan Komering Ulu Timur			
1602 Kab. Ogan Komering Ilir	1602 Kab. Ogan Komering Ilir	1602 Kab. Ogan Komering Ilir			
1610 Kab. Ogan Ilir	1610 Kab. Ogan Ilir	1610 Kab. Ogan Ilir			
1603 Kab. Muara Enim	1603 Kab. Muara Enim	1603 Kab. Muara Enim			
1672 Kota Prabumulih	1672 Kota Prabumulih	1672 Kota Prabumulih			
1604 Kab. Lahat	1604 Kab. Lahat	1604 Kab. Lahat			
1611 Kab. Empat Lawang	1611 Kab. Empat Lawang	1611 Kab. Empat Lawang			
1673 Kota Pagar Alam	1673 Kota Pagar Alam	1673 Kota Pagar Alam			
1605 Kab. Musi Rawas	1605 Kab. Musi Rawas	1605 Kab. Musi Rawas			
1674 Kota Lubuk Linggau	1674 Kota Lubuk Linggau	1674 Kota Lubuk Linggau			
1606 Kab. Musi Banyuasin	1606 Kab. Musi Banyuasin	1606 Kab. Musi Banyuasin			
1607 Kab. Banyuasin	1607 Kab. Banyuasin	1607 Kab. Banyuasin			
1901 Kab. Bangka	1901 Kab. Bangka	1901 Kab. Bangka			
1903 Kab. Bangka Barat	1903 Kab. Bangka Barat	1903 Kab. Bangka Barat			
1904 Kab. Bangka Tengah	1904 Kab. Bangka Tengah	1904 Kab. Bangka Tengah			
1905 Kab. Bangka Selatan	1905 Kab. Bangka Selatan	1905 Kab. Bangka Selatan			
1902 Kab. Belitung	1902 Kab. Belitung	1902 Kab. Belitung			
1906 Kab. Belitung Timur	1906 Kab. Belitung Timur	1906 Kab. Belitung Timur			
1671 Kota Palembang	1671 Kota Palembang	1671 Kota Palembang			
1791 Kota Pangkal Pinang	1791 Kota Pangkal Pinang	1791 Kota Pangkal Pinang			
1700 Prov. Bengkulu	1700 Prov. Bengkulu	1700 Prov. Bengkulu			
1701 Kab. Bengkulu Selatan	1701 Kab. Bengkulu Selatan	1701 Kab. Bengkulu Selatan			
1704 Kab. Kaur	1704 Kab. Kaur	1704 Kab. Kaur			
1705 Kab. Seluma	1705 Kab. Seluma	1705 Kab. Seluma			
1702 Kab. Rejang Lebong	1702 Kab. Rejang Lebong	1702 Kab. Rejang Lebong			
1707 Kab. Lebong	1707 Kab. Lebong	1707 Kab. Lebong			
1708 Kab. Kepahiang	1708 Kab. Kepahiang	1708 Kab. Kepahiang			
1703 Kab. Bengkulu Utara	1703 Kab. Bengkulu Utara	1703 Kab. Bengkulu Utara			
1709 Kab. Bengkulu Tengah	1709 Kab. Bengkulu Tengah	1709 Kab. Bengkulu Tengah			
1706 Kab. Mukomuko	1706 Kab. Mukomuko	1706 Kab. Mukomuko			
1771 Kota Bengkulu	1771 Kota Bengkulu	1771 Kota Bengkulu			
1800 Prov. Lampung	1800 Prov. Lampung	1800 Prov. Lampung			
1803 Kab. Lampung Selatan	1803 Kab. Lampung Selatan	1803 Kab. Lampung Selatan			
1809 Kab. Pesawaran	1809 Kab. Pesawaran	1809 Kab. Pesawaran			
1802 Kab. Tanggamus	1802 Kab. Tanggamus	1802 Kab. Tanggamus			
1810 Kab. Pringsewu	1810 Kab. Pringsewu	1810 Kab. Pringsewu			
1804 Kab. Lampung Timur	1804 Kab. Lampung Timur	1804 Kab. Lampung Timur			
1805 Kab. Lampung Tengah	1805 Kab. Lampung Tengah	1805 Kab. Lampung Tengah			
1872 Kota Metro	1872 Kota Metro	1872 Kota Metro			
1806 Kab. Lampung Utara	1806 Kab. Lampung Utara	1806 Kab. Lampung Utara			
1807 Kab. Way Kanan	1807 Kab. Way Kanan	1807 Kab. Way Kanan			
1808 Kab. Tulang Bawang	1808 Kab. Tulang Bawang	1808 Kab. Tulang Bawang			
1811 Kab. Mesuji	1811 Kab. Mesuji	1811 Kab. Mesuji			
1812 Kab. Tulang Bawang Barat	1812 Kab. Tulang Bawang Barat	1812 Kab. Tulang Bawang Barat			
1801 Kab. Lampung Barat	1801 Kab. Lampung Barat	1801 Kab. Lampung Barat			
1871 Kota Bandar Lampung	1871 Kota Bandar Lampung	1871 Kota Bandar Lampung			
3100 Prov. D K I Jakarta	3100 Prov. D K I Jakarta	3100 Prov. D K I Jakarta			
3171 Kota Jakarta Selatan	3171 Kota Jakarta Selatan	3171 Kota Jakarta Selatan			
3172 Kota Jakarta Timur	3172 Kota Jakarta Timur	3172 Kota Jakarta Timur			
3173 Kota Jakarta Pusat	3173 Kota Jakarta Pusat	3173 Kota Jakarta Pusat			
3174 Kota Jakarta Barat	3174 Kota Jakarta Barat	3174 Kota Jakarta Barat			
3101 Kab. Adm. Kepulauan Seribu	3101 Kab. Adm. Kepulauan Seribu	3101 Kab. Adm. Kepulauan Seribu			
3175 Kota Jakarta Utara	3175 Kota Jakarta Utara	3175 Kota Jakarta Utara			
3200 Prov. Jawa Barat	3200 Prov. Jawa Barat	3200 Prov. Jawa Barat			
3600 Prov. Banten	3600 Prov. Banten	3600 Prov. Banten			
3601 Kab. Pandeglang	3601 Kab. Pandeglang	3601 Kab. Pandeglang			
3602 Kab. Lebak	3602 Kab. Lebak	3602 Kab. Lebak			
3201 Kab. Bogor	3201 Kab. Bogor	3201 Kab. Bogor			
3276 Kota Depok	3276 Kota Depok	3276 Kota Depok			
3202 Kab. Sukabumi	3202 Kab. Sukabumi	3202 Kab. Sukabumi			
3203 Kab. Cianjur	3203 Kab. Cianjur	3203 Kab. Cianjur			
3204 Kab. Bandung	3204 Kab. Bandung	3204 Kab. Bandung			
3217 Kab. Bandung Barat	3217 Kab. Bandung Barat	3217 Kab. Bandung Barat			
3277 Kota Cimahi	3277 Kota Cimahi	3277 Kota Cimahi			
3205 Kab. Garut	3205 Kab. Garut	3205 Kab. Garut			
3206 Kab. Tasikmalaya	3206 Kab. Tasikmalaya	3206 Kab. Tasikmalaya			
3278 Kota Tasikmalaya	3278 Kota Tasikmalaya	3278 Kota Tasikmalaya			
3207 Kab. Ciamis	3207 Kab. Ciamis	3207 Kab. Ciamis			
3279 Kota Banjar	3279 Kota Banjar	3279 Kota Banjar			
3208 Kab. Kuningan	3208 Kab. Kuningan	3208 Kab. Kuningan			
3209 Kab. Cirebon	3209 Kab. Cirebon	3209 Kab. Cirebon			
3210 Kab. Majalengka	3210 Kab. Majalengka	3210 Kab. Majalengka			
3211 Kab. Sumedang	3211 Kab. Sumedang	3211 Kab. Sumedang			
3212 Kab. Indramayu	3212 Kab. Indramayu	3212 Kab. Indramayu			
3213 Kab. Subang	3213 Kab. Subang	3213 Kab. Subang			
3214 Kab. Purwakarta	3214 Kab. Purwakarta	3214 Kab. Purwakarta			
3215 Kab. Karawang	3215 Kab. Karawang	3215 Kab. Karawang			

Susenus 1994		Susenus 1995		Susenus 1996		Susenus 1997-2000	
Code1	Name	Code2	Name	Code3	Name	Code4	Name
3218	Kab. Bekasi	3218	Kab. Bekasi	3218	Kab. Bekasi	3218	Kab. Bekasi
3218	Kab. Bekasi	3218	Kab. Bekasi	3276	Kota Bekasi	3276	Kota Bekasi
3219	Kab. Tangerang	3219	Kab. Tangerang	3219	Kab. Tangerang	3219	Kab. Tangerang
3219	Kab. Tangerang	3219	Kab. Tangerang	3219	Kab. Tangerang	3219	Kab. Tangerang
3220	Kab. Serang	3220	Kab. Serang	3220	Kab. Serang	3220	Kab. Serang
3220	Kab. Serang	3220	Kab. Serang	3220	Kab. Serang	3220	Kab. Serang
3220	Kab. Serang	3220	Kab. Serang	3220	Kab. Serang	3220	Kab. Serang
3271	Kota Bogor	3271	Kota Bogor	3271	Kota Bogor	3271	Kota Bogor
3272	Kota Sukabumi	3272	Kota Sukabumi	3272	Kota Sukabumi	3272	Kota Sukabumi
3273	Kota Bandung	3273	Kota Bandung	3273	Kota Bandung	3273	Kota Bandung
3274	Kota Cirebon	3274	Kota Cirebon	3274	Kota Cirebon	3274	Kota Cirebon
3275	Kota Tangerang	3275	Kota Tangerang	3275	Kota Tangerang	3275	Kota Tangerang
3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah
3301	Kab. Cilacap	3301	Kab. Cilacap	3301	Kab. Cilacap	3301	Kab. Cilacap
3302	Kab. Banyumas	3302	Kab. Banyumas	3302	Kab. Banyumas	3302	Kab. Banyumas
3303	Kab. Purbalingga	3303	Kab. Purbalingga	3303	Kab. Purbalingga	3303	Kab. Purbalingga
3304	Kab. Banjarnegara	3304	Kab. Banjarnegara	3304	Kab. Banjarnegara	3304	Kab. Banjarnegara
3305	Kab. Kebumen	3305	Kab. Kebumen	3305	Kab. Kebumen	3305	Kab. Kebumen
3306	Kab. Purworejo	3306	Kab. Purworejo	3306	Kab. Purworejo	3306	Kab. Purworejo
3307	Kab. Wonosobo	3307	Kab. Wonosobo	3307	Kab. Wonosobo	3307	Kab. Wonosobo
3308	Kab. Magelang	3308	Kab. Magelang	3308	Kab. Magelang	3308	Kab. Magelang
3309	Kab. Boyolali	3309	Kab. Boyolali	3309	Kab. Boyolali	3309	Kab. Boyolali
3310	Kab. Klaten	3310	Kab. Klaten	3310	Kab. Klaten	3310	Kab. Klaten
3311	Kab. Sukoharjo	3311	Kab. Sukoharjo	3311	Kab. Sukoharjo	3311	Kab. Sukoharjo
3312	Kab. Wongorji	3312	Kab. Wongorji	3312	Kab. Wongorji	3312	Kab. Wongorji
3313	Kab. Karanganyar	3313	Kab. Karanganyar	3313	Kab. Karanganyar	3313	Kab. Karanganyar
3314	Kab. Slragen	3314	Kab. Slragen	3314	Kab. Slragen	3314	Kab. Slragen
3315	Kab. Grobogan	3315	Kab. Grobogan	3315	Kab. Grobogan	3315	Kab. Grobogan
3316	Kab. Blora	3316	Kab. Blora	3316	Kab. Blora	3316	Kab. Blora
3317	Kab. Rembang	3317	Kab. Rembang	3317	Kab. Rembang	3317	Kab. Rembang
3318	Kab. Pati	3318	Kab. Pati	3318	Kab. Pati	3318	Kab. Pati
3319	Kab. Kudus	3319	Kab. Kudus	3319	Kab. Kudus	3319	Kab. Kudus
3320	Kab. Jepara	3320	Kab. Jepara	3320	Kab. Jepara	3320	Kab. Jepara
3321	Kab. Demak	3321	Kab. Demak	3321	Kab. Demak	3321	Kab. Demak
3322	Kab. Semarang	3322	Kab. Semarang	3322	Kab. Semarang	3322	Kab. Semarang
3323	Kab. Temanggung	3323	Kab. Temanggung	3323	Kab. Temanggung	3323	Kab. Temanggung
3324	Kab. Kendal	3324	Kab. Kendal	3324	Kab. Kendal	3324	Kab. Kendal
3325	Kab. Batang	3325	Kab. Batang	3325	Kab. Batang	3325	Kab. Batang
3326	Kab. Pekalongan	3326	Kab. Pekalongan	3326	Kab. Pekalongan	3326	Kab. Pekalongan
3327	Kab. Pemalang	3327	Kab. Pemalang	3327	Kab. Pemalang	3327	Kab. Pemalang
3328	Kab. Tegal	3328	Kab. Tegal	3328	Kab. Tegal	3328	Kab. Tegal
3329	Kab. Brebes	3329	Kab. Brebes	3329	Kab. Brebes	3329	Kab. Brebes
3371	Kota Magelang	3371	Kota Magelang	3371	Kota Magelang	3371	Kota Magelang
3372	Kota Surakarta	3372	Kota Surakarta	3372	Kota Surakarta	3372	Kota Surakarta
3373	Kota Salatiga	3373	Kota Salatiga	3373	Kota Salatiga	3373	Kota Salatiga
3374	Kota Semarang	3374	Kota Semarang	3374	Kota Semarang	3374	Kota Semarang
3375	Kota Pekalongan	3375	Kota Pekalongan	3375	Kota Pekalongan	3375	Kota Pekalongan
3376	Kota Tegal	3376	Kota Tegal	3376	Kota Tegal	3376	Kota Tegal
3400	Prov. D I Yogyakarta	3400	Prov. D I Yogyakarta	3400	Prov. D I Yogyakarta	3400	Prov. D I Yogyakarta
3401	Kab. Kulon Progo	3401	Kab. Kulon Progo	3401	Kab. Kulon Progo	3401	Kab. Kulon Progo
3402	Kab. Bantul	3402	Kab. Bantul	3402	Kab. Bantul	3402	Kab. Bantul
3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul
3404	Kab. Sleman	3404	Kab. Sleman	3404	Kab. Sleman	3404	Kab. Sleman
3471	Kota Yogyakarta	3471	Kota Yogyakarta	3471	Kota Yogyakarta	3471	Kota Yogyakarta
3500	Prov. Jawa Timur	3500	Prov. Jawa Timur	3500	Prov. Jawa Timur	3500	Prov. Jawa Timur
3501	Kab. Pacitan	3501	Kab. Pacitan	3501	Kab. Pacitan	3501	Kab. Pacitan
3502	Kab. Ponorogo	3502	Kab. Ponorogo	3502	Kab. Ponorogo	3502	Kab. Ponorogo
3503	Kab. Trenggalek	3503	Kab. Trenggalek	3503	Kab. Trenggalek	3503	Kab. Trenggalek
3504	Kab. Tulungagung	3504	Kab. Tulungagung	3504	Kab. Tulungagung	3504	Kab. Tulungagung
3505	Kab. Blitar	3505	Kab. Blitar	3505	Kab. Blitar	3505	Kab. Blitar
3506	Kab. Kediri	3506	Kab. Kediri	3506	Kab. Kediri	3506	Kab. Kediri
3507	Kab. Malang	3507	Kab. Malang	3507	Kab. Malang	3507	Kab. Malang
3507	Kab. Malang	3507	Kab. Malang	3507	Kab. Malang	3507	Kab. Malang
3508	Kab. Lumajang	3508	Kab. Lumajang	3508	Kab. Lumajang	3508	Kab. Lumajang
3509	Kab. Jember	3509	Kab. Jember	3509	Kab. Jember	3509	Kab. Jember
3510	Kab. Banyuwangi	3510	Kab. Banyuwangi	3510	Kab. Banyuwangi	3510	Kab. Banyuwangi
3511	Kab. Bondowoso	3511	Kab. Bondowoso	3511	Kab. Bondowoso	3511	Kab. Bondowoso
3512	Kab. Situbondo	3512	Kab. Situbondo	3512	Kab. Situbondo	3512	Kab. Situbondo
3513	Kab. Probolinggo	3513	Kab. Probolinggo	3513	Kab. Probolinggo	3513	Kab. Probolinggo
3514	Kab. Pasuruan	3514	Kab. Pasuruan	3514	Kab. Pasuruan	3514	Kab. Pasuruan
3515	Kab. Sidoarjo	3515	Kab. Sidoarjo	3515	Kab. Sidoarjo	3515	Kab. Sidoarjo
3516	Kab. Mojokerto	3516	Kab. Mojokerto	3516	Kab. Mojokerto	3516	Kab. Mojokerto
3517	Kab. Jombang	3517	Kab. Jombang	3517	Kab. Jombang	3517	Kab. Jombang
3518	Kab. Nganjuk	3518	Kab. Nganjuk	3518	Kab. Nganjuk	3518	Kab. Nganjuk
3519	Kab. Madiun	3519	Kab. Madiun	3519	Kab. Madiun	3519	Kab. Madiun
3520	Kab. Magetan	3520	Kab. Magetan	3520	Kab. Magetan	3520	Kab. Magetan
3521	Kab. Ngawi	3521	Kab. Ngawi	3521	Kab. Ngawi	3521	Kab. Ngawi
3522	Kab. Bojonegoro	3522	Kab. Bojonegoro	3522	Kab. Bojonegoro	3522	Kab. Bojonegoro
3523	Kab. Tuban	3523	Kab. Tuban	3523	Kab. Tuban	3523	Kab. Tuban
3524	Kab. Lamongan	3524	Kab. Lamongan	3524	Kab. Lamongan	3524	Kab. Lamongan
3525	Kab. Gresik	3525	Kab. Gresik	3525	Kab. Gresik	3525	Kab. Gresik
3526	Kab. Bangkalan	3526	Kab. Bangkalan	3526	Kab. Bangkalan	3526	Kab. Bangkalan
3527	Kab. Sampang	3527	Kab. Sampang	3527	Kab. Sampang	3527	Kab. Sampang
3528	Kab. Pamekasan	3528	Kab. Pamekasan	3528	Kab. Pamekasan	3528	Kab. Pamekasan
3529	Kab. Sumenep	3529	Kab. Sumenep	3529	Kab. Sumenep	3529	Kab. Sumenep
3571	Kota Kediri	3571	Kota Kediri	3571	Kota Kediri	3571	Kota Kediri
3572	Kota Blitar	3572	Kota Blitar	3572	Kota Blitar	3572	Kota Blitar
3573	Kota Malang	3573	Kota Malang	3573	Kota Malang	3573	Kota Malang
3574	Kota Probolinggo	3574	Kota Probolinggo	3574	Kota Probolinggo	3574	Kota Probolinggo
3575	Kota Pasuruan	3575	Kota Pasuruan	3575	Kota Pasuruan	3575	Kota Pasuruan
3576	Kota Mojokerto	3576	Kota Mojokerto	3576	Kota Mojokerto	3576	Kota Mojokerto
3577	Kota Madiun	3577	Kota Madiun	3577	Kota Madiun	3577	Kota Madiun
3578	Kota Surabaya	3578	Kota Surabaya	3578	Kota Surabaya	3578	Kota Surabaya
5100	Prov. Bali	5100	Prov. Bali	5100	Prov. Bali	5100	Prov. Bali
5101	Kab. Jembrana	5101	Kab. Jembrana	5101	Kab. Jembrana	5101	Kab. Jembrana
5102	Kab. Tabanan	5102	Kab. Tabanan	5102	Kab. Tabanan	5102	Kab. Tabanan
5103	Kab. Badung	5103	Kab. Badung	5103	Kab. Badung	5103	Kab. Badung

Susenas 2001-2003		Susenas 2004		Susenas 2005		Susenas 2006	
Code5	Name	Code6	Name	Code7	Name	Code8	Name
3216	Kab. Bekasi	3216	Kab. Bekasi	3216	Kab. Bekasi	3216	Kab. Bekasi
3275	Kota Bekasi	3275	Kota Bekasi	3275	Kota Bekasi	3275	Kota Bekasi
3603	Kab. Tangerang	3603	Kab. Tangerang	3603	Kab. Tangerang	3603	Kab. Tangerang
3603	Kab. Tangerang	3603	Kab. Tangerang	3603	Kab. Tangerang	3603	Kab. Tangerang
3604	Kab. Serang	3604	Kab. Serang	3604	Kab. Serang	3604	Kab. Serang
3604	Kab. Serang	3604	Kab. Serang	3604	Kab. Serang	3604	Kab. Serang
3672	Kota Cilegon	3672	Kota Cilegon	3672	Kota Cilegon	3672	Kota Cilegon
3271	Kota Bogor	3271	Kota Bogor	3271	Kota Bogor	3271	Kota Bogor
3272	Kota Sukabumi	3272	Kota Sukabumi	3272	Kota Sukabumi	3272	Kota Sukabumi
3273	Kota Bandung	3273	Kota Bandung	3273	Kota Bandung	3273	Kota Bandung
3274	Kota Cirebon	3274	Kota Cirebon	3274	Kota Cirebon	3274	Kota Cirebon
3671	Kota Tangerang	3671	Kota Tangerang	3671	Kota Tangerang	3671	Kota Tangerang
3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah
3301	Kab. Clacap	3301	Kab. Clacap	3301	Kab. Clacap	3301	Kab. Clacap
3302	Kab. Banyumas	3302	Kab. Banyumas	3302	Kab. Banyumas	3302	Kab. Banyumas
3303	Kab. Purbalingga	3303	Kab. Purbalingga	3303	Kab. Purbalingga	3303	Kab. Purbalingga
3304	Kab. Banjarnegara	3304	Kab. Banjarnegara	3304	Kab. Banjarnegara	3304	Kab. Banjarnegara
3305	Kab. Kebumen	3305	Kab. Kebumen	3305	Kab. Kebumen	3305	Kab. Kebumen
3306	Kab. Purworejo	3306	Kab. Purworejo	3306	Kab. Purworejo	3306	Kab. Purworejo
3307	Kab. Wonosobo	3307	Kab. Wonosobo	3307	Kab. Wonosobo	3307	Kab. Wonosobo
3308	Kab. Magelang	3308	Kab. Magelang	3308	Kab. Magelang	3308	Kab. Magelang
3309	Kab. Boyolali	3309	Kab. Boyolali	3309	Kab. Boyolali	3309	Kab. Boyolali
3310	Kab. Klaten	3310	Kab. Klaten	3310	Kab. Klaten	3310	Kab. Klaten
3311	Kab. Sukoharjo	3311	Kab. Sukoharjo	3311	Kab. Sukoharjo	3311	Kab. Sukoharjo
3312	Kab. Wonogiri	3312	Kab. Wonogiri	3312	Kab. Wonogiri	3312	Kab. Wonogiri
3313	Kab. Karanganyar	3313	Kab. Karanganyar	3313	Kab. Karanganyar	3313	Kab. Karanganyar
3314	Kab. Slragen	3314	Kab. Slragen	3314	Kab. Slragen	3314	Kab. Slragen
3315	Kab. Grobogan	3315	Kab. Grobogan	3315	Kab. Grobogan	3315	Kab. Grobogan
3316	Kab. Blora	3316	Kab. Blora	3316	Kab. Blora	3316	Kab. Blora
3317	Kab. Rembang	3317	Kab. Rembang	3317	Kab. Rembang	3317	Kab. Rembang
3318	Kab. Pati	3318	Kab. Pati	3318	Kab. Pati	3318	Kab. Pati
3319	Kab. Kudus	3319	Kab. Kudus	3319	Kab. Kudus	3319	Kab. Kudus
3320	Kab. Jepara	3320	Kab. Jepara	3320	Kab. Jepara	3320	Kab. Jepara
3321	Kab. Demak	3321	Kab. Demak	3321	Kab. Demak	3321	Kab. Demak
3322	Kab. Semarang	3322	Kab. Semarang	3322	Kab. Semarang	3322	Kab. Semarang
3323	Kab. Temanggung	3323	Kab. Temanggung	3323	Kab. Temanggung	3323	Kab. Temanggung
3324	Kab. Kendal	3324	Kab. Kendal	3324	Kab. Kendal	3324	Kab. Kendal
3325	Kab. Batang	3325	Kab. Batang	3325	Kab. Batang	3325	Kab. Batang
3326	Kab. Pekalongan	3326	Kab. Pekalongan	3326	Kab. Pekalongan	3326	Kab. Pekalongan
3327	Kab. Pemalang	3327	Kab. Pemalang	3327	Kab. Pemalang	3327	Kab. Pemalang
3328	Kab. Tegal	3328	Kab. Tegal	3328	Kab. Tegal	3328	Kab. Tegal
3329	Kab. Brebes	3329	Kab. Brebes	3329	Kab. Brebes	3329	Kab. Brebes
3371	Kota Magelang	3371	Kota Magelang	3371	Kota Magelang	3371	Kota Magelang
3372	Kota Surakarta	3372	Kota Surakarta	3372	Kota Surakarta	3372	Kota Surakarta
3373	Kota Salatiga	3373	Kota Salatiga	3373	Kota Salatiga	3373	Kota Salatiga
3374	Kota Semarang	3374	Kota Semarang	3374	Kota Semarang	3374	Kota Semarang
3375	Kota Pekalongan	3375	Kota Pekalongan	3375	Kota Pekalongan	3375	Kota Pekalongan
3376	Kota Tegal	3376	Kota Tegal	3376	Kota Tegal	3376	Kota Tegal
3400	Prov. D.I Yogyakarta	3400	Prov. D.I Yogyakarta	3400	Prov. D.I Yogyakarta	3400	Prov. D.I Yogyakarta
3401	Kab. Kulon Progo	3401	Kab. Kulon Progo	3401	Kab. Kulon Progo	3401	Kab. Kulon Progo
3402	Kab. Bantul	3402	Kab. Bantul	3402	Kab. Bantul	3402	Kab. Bantul
3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul
3404	Kab. Sleman	3404	Kab. Sleman	3404	Kab. Sleman	3404	Kab. Sleman
3471	Kota Yogyakarta	3471	Kota Yogyakarta	3471	Kota Yogyakarta	3471	Kota Yogyakarta
3500	Prov. Jawa Timur	3500	Prov. Jawa Timur	3500	Prov. Jawa Timur	3500	Prov. Jawa Timur
3501	Kab. Pacitan	3501	Kab. Pacitan	3501	Kab. Pacitan	3501	Kab. Pacitan
3502	Kab. Ponorogo	3502	Kab. Ponorogo	3502	Kab. Ponorogo	3502	Kab. Ponorogo
3503	Kab. Trenggalek	3503	Kab. Trenggalek	3503	Kab. Trenggalek	3503	Kab. Trenggalek
3504	Kab. Tulungagung	3504	Kab. Tulungagung	3504	Kab. Tulungagung	3504	Kab. Tulungagung
3505	Kab. Blitar	3505	Kab. Blitar	3505	Kab. Blitar	3505	Kab. Blitar
3506	Kab. Kediri	3506	Kab. Kediri	3506	Kab. Kediri	3506	Kab. Kediri
3507	Kab. Malang	3507	Kab. Malang	3507	Kab. Malang	3507	Kab. Malang
3579	Kota Batu	3579	Kota Batu	3579	Kota Batu	3579	Kota Batu
3508	Kab. Lumajang	3508	Kab. Lumajang	3508	Kab. Lumajang	3508	Kab. Lumajang
3509	Kab. Jember	3509	Kab. Jember	3509	Kab. Jember	3509	Kab. Jember
3510	Kab. Banyuwangi	3510	Kab. Banyuwangi	3510	Kab. Banyuwangi	3510	Kab. Banyuwangi
3511	Kab. Bondowoso	3511	Kab. Bondowoso	3511	Kab. Bondowoso	3511	Kab. Bondowoso
3512	Kab. Situbondo	3512	Kab. Situbondo	3512	Kab. Situbondo	3512	Kab. Situbondo
3513	Kab. Probolinggo	3513	Kab. Probolinggo	3513	Kab. Probolinggo	3513	Kab. Probolinggo
3514	Kab. Pasuruan	3514	Kab. Pasuruan	3514	Kab. Pasuruan	3514	Kab. Pasuruan
3515	Kab. Sidoarjo	3515	Kab. Sidoarjo	3515	Kab. Sidoarjo	3515	Kab. Sidoarjo
3516	Kab. Mojokerto	3516	Kab. Mojokerto	3516	Kab. Mojokerto	3516	Kab. Mojokerto
3517	Kab. Jombang	3517	Kab. Jombang	3517	Kab. Jombang	3517	Kab. Jombang
3518	Kab. Nganjuk	3518	Kab. Nganjuk	3518	Kab. Nganjuk	3518	Kab. Nganjuk
3519	Kab. Madiun	3519	Kab. Madiun	3519	Kab. Madiun	3519	Kab. Madiun
3520	Kab. Magetan	3520	Kab. Magetan	3520	Kab. Magetan	3520	Kab. Magetan
3521	Kab. Ngawi	3521	Kab. Ngawi	3521	Kab. Ngawi	3521	Kab. Ngawi
3522	Kab. Bojonegoro	3522	Kab. Bojonegoro	3522	Kab. Bojonegoro	3522	Kab. Bojonegoro
3523	Kab. Tuban	3523	Kab. Tuban	3523	Kab. Tuban	3523	Kab. Tuban
3524	Kab. Lamongan	3524	Kab. Lamongan	3524	Kab. Lamongan	3524	Kab. Lamongan
3525	Kab. Gresik	3525	Kab. Gresik	3525	Kab. Gresik	3525	Kab. Gresik
3526	Kab. Bangkalan	3526	Kab. Bangkalan	3526	Kab. Bangkalan	3526	Kab. Bangkalan
3527	Kab. Sampang	3527	Kab. Sampang	3527	Kab. Sampang	3527	Kab. Sampang
3528	Kab. Pamekasan	3528	Kab. Pamekasan	3528	Kab. Pamekasan	3528	Kab. Pamekasan
3529	Kab. Sumenep	3529	Kab. Sumenep	3529	Kab. Sumenep	3529	Kab. Sumenep
3571	Kota Kediri	3571	Kota Kediri	3571	Kota Kediri	3571	Kota Kediri
3572	Kota Blitar	3572	Kota Blitar	3572	Kota Blitar	3572	Kota Blitar
3573	Kota Malang	3573	Kota Malang	3573	Kota Malang	3573	Kota Malang
3574	Kota Probolinggo	3574	Kota Probolinggo	3574	Kota Probolinggo	3574	Kota Probolinggo
3575	Kota Pasuruan	3575	Kota Pasuruan	3575	Kota Pasuruan	3575	Kota Pasuruan
3576	Kota Mojokerto	3576	Kota Mojokerto	3576	Kota Mojokerto	3576	Kota Mojokerto
3577	Kota Madiun	3577	Kota Madiun	3577	Kota Madiun	3577	Kota Madiun
3578	Kota Surabaya	3578	Kota Surabaya	3578	Kota Surabaya	3578	Kota Surabaya
5100	Prov. Bali	5100	Prov. Bali	5100	Prov. Bali	5100	Prov. Bali
5101	Kab. Jembrana	5101	Kab. Jembrana	5101	Kab. Jembrana	5101	Kab. Jembrana
5102	Kab. Tabanan	5102	Kab. Tabanan	5102	Kab. Tabanan	5102	Kab. Tabanan
5103	Kab. Badung	5103	Kab. Badung	5103	Kab. Badung	5103	Kab. Badung

Susenas 2007		Susenas 2008		Susenas 2009	
Code9	Name	Code10	Name	Code11	Name
3216	Kab. Bekasi	3216	Kab. Bekasi	3216	Kab. Bekasi
3275	Kota Bekasi	3275	Kota Bekasi	3275	Kota Bekasi
3603	Kab. Tangerang	3603	Kab. Tangerang	3603	Kab. Tangerang
3603	Kab. Tangerang	3603	Kab. Tangerang	3603	Kab. Tangerang
3604	Kab. Serang	3604	Kab. Serang	3604	Kab. Serang
3604	Kab. Serang	3604	Kab. Serang	3673	Kota Serang
3672	Kota Cilegon	3672	Kota Cilegon	3672	Kota Cilegon
3271	Kota Bogor	3271	Kota Bogor	3271	Kota Bogor
3272	Kota Sukabumi	3272	Kota Sukabumi	3272	Kota Sukabumi
3273	Kota Bandung	3273	Kota Bandung	3273	Kota Bandung
3274	Kota Cirebon	3274	Kota Cirebon	3274	Kota Cirebon
3671	Kota Tangerang	3671	Kota Tangerang	3671	Kota Tangerang
3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah
3301	Kab. Cilacap	3301	Kab. Cilacap	3301	Kab. Cilacap
3302	Kab. Banjumas	3302	Kab. Banjumas	3302	Kab. Banjumas
3303	Kab. Purbalingga	3303	Kab. Purbalingga	3303	Kab. Purbalingga
3304	Kab. Banjarnegara	3304	Kab. Banjarnegara	3304	Kab. Banjarnegara
3305	Kab. Kebumen	3305	Kab. Kebumen	3305	Kab. Kebumen
3306	Kab. Purworejo	3306	Kab. Purworejo	3306	Kab. Purworejo
3307	Kab. Wonosobo	3307	Kab. Wonosobo	3307	Kab. Wonosobo
3308	Kab. Magelang	3308	Kab. Magelang	3308	Kab. Magelang
3309	Kab. Boyolali	3309	Kab. Boyolali	3309	Kab. Boyolali
3310	Kab. Klaten	3310	Kab. Klaten	3310	Kab. Klaten
3311	Kab. Sukoharjo	3311	Kab. Sukoharjo	3311	Kab. Sukoharjo
3312	Kab. Wonogiri	3312	Kab. Wonogiri	3312	Kab. Wonogiri
3313	Kab. Karanganyar	3313	Kab. Karanganyar	3313	Kab. Karanganyar
3314	Kab. Sragen	3314	Kab. Sragen	3314	Kab. Sragen
3315	Kab. Grobogan	3315	Kab. Grobogan	3315	Kab. Grobogan
3316	Kab. Blora	3316	Kab. Blora	3316	Kab. Blora
3317	Kab. Rembang	3317	Kab. Rembang	3317	Kab. Rembang
3318	Kab. Pati	3318	Kab. Pati	3318	Kab. Pati
3319	Kab. Kudus	3319	Kab. Kudus	3319	Kab. Kudus
3320	Kab. Jepara	3320	Kab. Jepara	3320	Kab. Jepara
3321	Kab. Demak	3321	Kab. Demak	3321	Kab. Demak
3322	Kab. Semarang	3322	Kab. Semarang	3322	Kab. Semarang
3323	Kab. Temanggung	3323	Kab. Temanggung	3323	Kab. Temanggung
3324	Kab. Kendal	3324	Kab. Kendal	3324	Kab. Kendal
3325	Kab. Batang	3325	Kab. Batang	3325	Kab. Batang
3326	Kab. Pekalongan	3326	Kab. Pekalongan	3326	Kab. Pekalongan
3327	Kab. Pemalang	3327	Kab. Pemalang	3327	Kab. Pemalang
3328	Kab. Tegal	3328	Kab. Tegal	3328	Kab. Tegal
3329	Kab. Brebes	3329	Kab. Brebes	3329	Kab. Brebes
3371	Kota Magelang	3371	Kota Magelang	3371	Kota Magelang
3372	Kota Surakarta	3372	Kota Surakarta	3372	Kota Surakarta
3373	Kota Salatiga	3373	Kota Salatiga	3373	Kota Salatiga
3374	Kota Semarang	3374	Kota Semarang	3374	Kota Semarang
3375	Kota Pekalongan	3375	Kota Pekalongan	3375	Kota Pekalongan
3376	Kota Tegal	3376	Kota Tegal	3376	Kota Tegal
3400	Prov. D I Yogyakarta	3400	Prov. D I Yogyakarta	3400	Prov. D I Yogyakarta
3401	Kab. Kulon Progo	3401	Kab. Kulon Progo	3401	Kab. Kulon Progo
3402	Kab. Bantul	3402	Kab. Bantul	3402	Kab. Bantul
3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul
3404	Kab. Sleman	3404	Kab. Sleman	3404	Kab. Sleman
3471	Kota Yogyakarta	3471	Kota Yogyakarta	3471	Kota Yogyakarta
3500	Prov. Jawa Timur	3500	Prov. Jawa Timur	3500	Prov. Jawa Timur
3501	Kab. Pacitan	3501	Kab. Pacitan	3501	Kab. Pacitan
3502	Kab. Ponorogo	3502	Kab. Ponorogo	3502	Kab. Ponorogo
3503	Kab. Trenggalek	3503	Kab. Trenggalek	3503	Kab. Trenggalek
3504	Kab. Tulungagung	3504	Kab. Tulungagung	3504	Kab. Tulungagung
3505	Kab. Blitar	3505	Kab. Blitar	3505	Kab. Blitar
3506	Kab. Kediri	3506	Kab. Kediri	3506	Kab. Kediri
3507	Kab. Malang	3507	Kab. Malang	3507	Kab. Malang
3579	Kota Batu	3579	Kota Batu	3579	Kota Batu
3508	Kab. Lumajang	3508	Kab. Lumajang	3508	Kab. Lumajang
3509	Kab. Jember	3509	Kab. Jember	3509	Kab. Jember
3510	Kab. Banyuwangi	3510	Kab. Banyuwangi	3510	Kab. Banyuwangi
3511	Kab. Bondowoso	3511	Kab. Bondowoso	3511	Kab. Bondowoso
3512	Kab. Situbondo	3512	Kab. Situbondo	3512	Kab. Situbondo
3513	Kab. Probolinggo	3513	Kab. Probolinggo	3513	Kab. Probolinggo
3514	Kab. Pasuruan	3514	Kab. Pasuruan	3514	Kab. Pasuruan
3515	Kab. Sidoarjo	3515	Kab. Sidoarjo	3515	Kab. Sidoarjo
3516	Kab. Mojokerto	3516	Kab. Mojokerto	3516	Kab. Mojokerto
3517	Kab. Jombang	3517	Kab. Jombang	3517	Kab. Jombang
3518	Kab. Nganjuk	3518	Kab. Nganjuk	3518	Kab. Nganjuk
3519	Kab. Madiun	3519	Kab. Madiun	3519	Kab. Madiun
3520	Kab. Magetan	3520	Kab. Magetan	3520	Kab. Magetan
3521	Kab. Ngawi	3521	Kab. Ngawi	3521	Kab. Ngawi
3522	Kab. Bojonegoro	3522	Kab. Bojonegoro	3522	Kab. Bojonegoro
3523	Kab. Tuban	3523	Kab. Tuban	3523	Kab. Tuban
3524	Kab. Lamongan	3524	Kab. Lamongan	3524	Kab. Lamongan
3525	Kab. Gresik	3525	Kab. Gresik	3525	Kab. Gresik
3526	Kab. Bangkalan	3526	Kab. Bangkalan	3526	Kab. Bangkalan
3527	Kab. Sampang	3527	Kab. Sampang	3527	Kab. Sampang
3528	Kab. Pamekasan	3528	Kab. Pamekasan	3528	Kab. Pamekasan
3529	Kab. Sumenep	3529	Kab. Sumenep	3529	Kab. Sumenep
3571	Kota Kediri	3571	Kota Kediri	3571	Kota Kediri
3572	Kota Blitar	3572	Kota Blitar	3572	Kota Blitar
3573	Kota Malang	3573	Kota Malang	3573	Kota Malang
3574	Kota Probolinggo	3574	Kota Probolinggo	3574	Kota Probolinggo
3575	Kota Pasuruan	3575	Kota Pasuruan	3575	Kota Pasuruan
3576	Kota Mojokerto	3576	Kota Mojokerto	3576	Kota Mojokerto
3577	Kota Madiun	3577	Kota Madiun	3577	Kota Madiun
3578	Kota Surabaya	3578	Kota Surabaya	3578	Kota Surabaya
5100	Prov. Bali	5100	Prov. Bali	5100	Prov. Bali
5101	Kab. Jembrana	5101	Kab. Jembrana	5101	Kab. Jembrana
5102	Kab. Tabanan	5102	Kab. Tabanan	5102	Kab. Tabanan
5103	Kab. Badung	5103	Kab. Badung	5103	Kab. Badung

Susenus 2010		Susenus 2011		Susenus 2012-2014	
Code12	Name	Code13	Name	Code14	Name
3216	Kab. Bekasi	3216	Kab. Bekasi	3216	Kab. Bekasi
3275	Kota Bekasi	3275	Kota Bekasi	3275	Kota Bekasi
3603	Kab. Tangerang	3603	Kab. Tangerang	3603	Kab. Tangerang
3674	Kota Tangerang Selatan	3674	Kota Tangerang Selatan	3674	Kota Tangerang Selatan
3604	Kab. Serang	3604	Kab. Serang	3604	Kab. Serang
3673	Kota Serang	3673	Kota Serang	3673	Kota Serang
3672	Kota Cilegon	3672	Kota Cilegon	3672	Kota Cilegon
3271	Kota Bogor	3271	Kota Bogor	3271	Kota Bogor
3272	Kota Sukabumi	3272	Kota Sukabumi	3272	Kota Sukabumi
3273	Kota Bandung	3273	Kota Bandung	3273	Kota Bandung
3274	Kota Cirebon	3274	Kota Cirebon	3274	Kota Cirebon
3671	Kota Tangerang	3671	Kota Tangerang	3671	Kota Tangerang
3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah	3300	Prov. Jawa Tengah
3301	Kab. Cilacap	3301	Kab. Cilacap	3301	Kab. Cilacap
3302	Kab. Banjumas	3302	Kab. Banjumas	3302	Kab. Banjumas
3303	Kab. Purbalingga	3303	Kab. Purbalingga	3303	Kab. Purbalingga
3304	Kab. Banjarnegara	3304	Kab. Banjarnegara	3304	Kab. Banjarnegara
3305	Kab. Kebumen	3305	Kab. Kebumen	3305	Kab. Kebumen
3306	Kab. Purworejo	3306	Kab. Purworejo	3306	Kab. Purworejo
3307	Kab. Wonosobo	3307	Kab. Wonosobo	3307	Kab. Wonosobo
3308	Kab. Magelang	3308	Kab. Magelang	3308	Kab. Magelang
3309	Kab. Boyolali	3309	Kab. Boyolali	3309	Kab. Boyolali
3310	Kab. Klaten	3310	Kab. Klaten	3310	Kab. Klaten
3311	Kab. Sukoharjo	3311	Kab. Sukoharjo	3311	Kab. Sukoharjo
3312	Kab. Wonogiri	3312	Kab. Wonogiri	3312	Kab. Wonogiri
3313	Kab. Karanganyar	3313	Kab. Karanganyar	3313	Kab. Karanganyar
3314	Kab. Sragen	3314	Kab. Sragen	3314	Kab. Sragen
3315	Kab. Grobogan	3315	Kab. Grobogan	3315	Kab. Grobogan
3316	Kab. Blora	3316	Kab. Blora	3316	Kab. Blora
3317	Kab. Rembang	3317	Kab. Rembang	3317	Kab. Rembang
3318	Kab. Pati	3318	Kab. Pati	3318	Kab. Pati
3319	Kab. Kudus	3319	Kab. Kudus	3319	Kab. Kudus
3320	Kab. Jepara	3320	Kab. Jepara	3320	Kab. Jepara
3321	Kab. Demak	3321	Kab. Demak	3321	Kab. Demak
3322	Kab. Semarang	3322	Kab. Semarang	3322	Kab. Semarang
3323	Kab. Temanggung	3323	Kab. Temanggung	3323	Kab. Temanggung
3324	Kab. Kendal	3324	Kab. Kendal	3324	Kab. Kendal
3325	Kab. Batang	3325	Kab. Batang	3325	Kab. Batang
3326	Kab. Pekalongan	3326	Kab. Pekalongan	3326	Kab. Pekalongan
3327	Kab. Pemalang	3327	Kab. Pemalang	3327	Kab. Pemalang
3328	Kab. Tegal	3328	Kab. Tegal	3328	Kab. Tegal
3329	Kab. Brebes	3329	Kab. Brebes	3329	Kab. Brebes
3371	Kota Magelang	3371	Kota Magelang	3371	Kota Magelang
3372	Kota Surakarta	3372	Kota Surakarta	3372	Kota Surakarta
3373	Kota Salatiga	3373	Kota Salatiga	3373	Kota Salatiga
3374	Kota Semarang	3374	Kota Semarang	3374	Kota Semarang
3375	Kota Pekalongan	3375	Kota Pekalongan	3375	Kota Pekalongan
3376	Kota Tegal	3376	Kota Tegal	3376	Kota Tegal
3400	Prov. D I Yogyakarta	3400	Prov. D I Yogyakarta	3400	Prov. D I Yogyakarta
3401	Kab. Kulon Progo	3401	Kab. Kulon Progo	3401	Kab. Kulon Progo
3402	Kab. Bantul	3402	Kab. Bantul	3402	Kab. Bantul
3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul	3403	Kab. Gunung Kidul
3404	Kab. Sleman	3404	Kab. Sleman	3404	Kab. Sleman
3471	Kota Yogyakarta	3471	Kota Yogyakarta	3471	Kota Yogyakarta
3500	Prov. Jawa Timur	3500	Prov. Jawa Timur	3500	Prov. Jawa Timur
3501	Kab. Pasitan	3501	Kab. Pasitan	3501	Kab. Pasitan
3502	Kab. Ponorogo	3502	Kab. Ponorogo	3502	Kab. Ponorogo
3503	Kab. Trenggalek	3503	Kab. Trenggalek	3503	Kab. Trenggalek
3504	Kab. Tulungagung	3504	Kab. Tulungagung	3504	Kab. Tulungagung
3505	Kab. Blitar	3505	Kab. Blitar	3505	Kab. Blitar
3506	Kab. Kediri	3506	Kab. Kediri	3506	Kab. Kediri
3507	Kab. Malang	3507	Kab. Malang	3507	Kab. Malang
3579	Kota Batu	3579	Kota Batu	3579	Kota Batu
3508	Kab. Lumajang	3508	Kab. Lumajang	3508	Kab. Lumajang
3509	Kab. Jember	3509	Kab. Jember	3509	Kab. Jember
3510	Kab. Banyuwangi	3510	Kab. Banyuwangi	3510	Kab. Banyuwangi
3511	Kab. Bondowoso	3511	Kab. Bondowoso	3511	Kab. Bondowoso
3512	Kab. Situbondo	3512	Kab. Situbondo	3512	Kab. Situbondo
3513	Kab. Probolinggo	3513	Kab. Probolinggo	3513	Kab. Probolinggo
3514	Kab. Pasuruan	3514	Kab. Pasuruan	3514	Kab. Pasuruan
3515	Kab. Sidoarjo	3515	Kab. Sidoarjo	3515	Kab. Sidoarjo
3516	Kab. Mojokerto	3516	Kab. Mojokerto	3516	Kab. Mojokerto
3517	Kab. Jombang	3517	Kab. Jombang	3517	Kab. Jombang
3518	Kab. Nganjuk	3518	Kab. Nganjuk	3518	Kab. Nganjuk
3519	Kab. Madiun	3519	Kab. Madiun	3519	Kab. Madiun
3520	Kab. Magetan	3520	Kab. Magetan	3520	Kab. Magetan
3521	Kab. Ngawi	3521	Kab. Ngawi	3521	Kab. Ngawi
3522	Kab. Bojonegoro	3522	Kab. Bojonegoro	3522	Kab. Bojonegoro
3523	Kab. Tuban	3523	Kab. Tuban	3523	Kab. Tuban
3524	Kab. Lamongan	3524	Kab. Lamongan	3524	Kab. Lamongan
3525	Kab. Gresik	3525	Kab. Gresik	3525	Kab. Gresik
3526	Kab. Bangkalan	3526	Kab. Bangkalan	3526	Kab. Bangkalan
3527	Kab. Sampang	3527	Kab. Sampang	3527	Kab. Sampang
3528	Kab. Pamekasan	3528	Kab. Pamekasan	3528	Kab. Pamekasan
3529	Kab. Sumenep	3529	Kab. Sumenep	3529	Kab. Sumenep
3571	Kota Kediri	3571	Kota Kediri	3571	Kota Kediri
3572	Kota Blitar	3572	Kota Blitar	3572	Kota Blitar
3573	Kota Malang	3573	Kota Malang	3573	Kota Malang
3574	Kota Probolinggo	3574	Kota Probolinggo	3574	Kota Probolinggo
3575	Kota Pasuruan	3575	Kota Pasuruan	3575	Kota Pasuruan
3576	Kota Mojokerto	3576	Kota Mojokerto	3576	Kota Mojokerto
3577	Kota Madiun	3577	Kota Madiun	3577	Kota Madiun
3578	Kota Surabaya	3578	Kota Surabaya	3578	Kota Surabaya
5100	Prov. Bali	5100	Prov. Bali	5100	Prov. Bali
5101	Kab. Jembrana	5101	Kab. Jembrana	5101	Kab. Jembrana
5102	Kab. Tabanan	5102	Kab. Tabanan	5102	Kab. Tabanan
5103	Kab. Badung	5103	Kab. Badung	5103	Kab. Badung

Susenus 2001-2003		Susenus 2004		Susenus 2005		Susenus 2006	
Code5	Name	Code6	Name	Code7	Name	Code8	Name
5104	Kab. Gianyar	5104	Kab. Gianyar	5104	Kab. Gianyar	5104	Kab. Gianyar
5105	Kab. Klungkung	5105	Kab. Klungkung	5105	Kab. Klungkung	5105	Kab. Klungkung
5106	Kab. Bangli	5106	Kab. Bangli	5106	Kab. Bangli	5106	Kab. Bangli
5107	Kab. Karang Asem	5107	Kab. Karang Asem	5107	Kab. Karang Asem	5107	Kab. Karang Asem
5108	Kab. Buleleng	5108	Kab. Buleleng	5108	Kab. Buleleng	5108	Kab. Buleleng
5171	Kota Denpasar	5171	Kota Denpasar	5171	Kota Denpasar	5171	Kota Denpasar
5200	Prov. Nusa Tenggara Barat	5200	Prov. Nusa Tenggara Barat	5200	Prov. Nusa Tenggara Barat	5200	Prov. Nusa Tenggara Barat
5201	Kab. Lombok Barat	5201	Kab. Lombok Barat	5201	Kab. Lombok Barat	5201	Kab. Lombok Barat
5201	Kab. Lombok Barat	5201	Kab. Lombok Barat	5201	Kab. Lombok Barat	5201	Kab. Lombok Barat
5202	Kab. Lombok Tengah	5202	Kab. Lombok Tengah	5202	Kab. Lombok Tengah	5202	Kab. Lombok Tengah
5203	Kab. Lombok Timur	5203	Kab. Lombok Timur	5203	Kab. Lombok Timur	5203	Kab. Lombok Timur
5204	Kab. Sumbawa	5204	Kab. Sumbawa	5204	Kab. Sumbawa	5204	Kab. Sumbawa
5204	Kab. Sumbawa	5204	Kab. Sumbawa	5207	Kab. Sumbawa Barat	5207	Kab. Sumbawa Barat
5205	Kab. Dompu	5205	Kab. Dompu	5205	Kab. Dompu	5205	Kab. Dompu
5206	Kab. Bima	5206	Kab. Bima	5206	Kab. Bima	5206	Kab. Bima
5206	Kab. Bima	5272	Kota Bima	5272	Kota Bima	5272	Kota Bima
5271	Kota Mataram	5271	Kota Mataram	5271	Kota Mataram	5271	Kota Mataram
5300	Prov. Nusa Tenggara Timur	5300	Prov. Nusa Tenggara Timur	5300	Prov. Nusa Tenggara Timur	5300	Prov. Nusa Tenggara Timur
5301	Kab. Sumba Barat	5301	Kab. Sumba Barat	5301	Kab. Sumba Barat	5301	Kab. Sumba Barat
5301	Kab. Sumba Barat	5301	Kab. Sumba Barat	5301	Kab. Sumba Barat	5301	Kab. Sumba Barat
5301	Kab. Sumba Barat	5301	Kab. Sumba Barat	5301	Kab. Sumba Barat	5301	Kab. Sumba Barat
5302	Kab. Sumba Timur	5302	Kab. Sumba Timur	5302	Kab. Sumba Timur	5302	Kab. Sumba Timur
5303	Kab. Kupang	5303	Kab. Kupang	5303	Kab. Kupang	5303	Kab. Kupang
5303	Kab. Kupang	5314	Kab. Rote Ndao	5314	Kab. Rote Ndao	5314	Kab. Rote Ndao
5303	Kab. Kupang	5314	Kab. Rote Ndao	5314	Kab. Rote Ndao	5314	Kab. Rote Ndao
5371	Kota Kupang	5371	Kota Kupang	5371	Kota Kupang	5371	Kota Kupang
5304	Kab. Timor Tengah Selatan	5304	Kab. Timor Tengah Selatan	5304	Kab. Timor Tengah Selatan	5304	Kab. Timor Tengah Selatan
5305	Kab. Timor Tengah Utara	5305	Kab. Timor Tengah Utara	5305	Kab. Timor Tengah Utara	5305	Kab. Timor Tengah Utara
5306	Kab. Belu	5306	Kab. Belu	5306	Kab. Belu	5306	Kab. Belu
5307	Kab. Alor	5307	Kab. Alor	5307	Kab. Alor	5307	Kab. Alor
5308	Kab. Lembaria	5308	Kab. Lembaria	5308	Kab. Lembaria	5308	Kab. Lembaria
5309	Kab. Flores Timur	5309	Kab. Flores Timur	5309	Kab. Flores Timur	5309	Kab. Flores Timur
5310	Kab. Sikka	5310	Kab. Sikka	5310	Kab. Sikka	5310	Kab. Sikka
5311	Kab. Ende	5311	Kab. Ende	5311	Kab. Ende	5311	Kab. Ende
5312	Kab. Ngada	5312	Kab. Ngada	5312	Kab. Ngada	5312	Kab. Ngada
5312	Kab. Ngada	5312	Kab. Ngada	5312	Kab. Ngada	5312	Kab. Ngada
5313	Kab. Manggarai	5313	Kab. Manggarai	5313	Kab. Manggarai	5313	Kab. Manggarai
5313	Kab. Manggarai	5313	Kab. Manggarai	5313	Kab. Manggarai	5313	Kab. Manggarai
5313	Kab. Manggarai	5313	Kab. Manggarai	5315	Kab. Manggarai Barat	5315	Kab. Manggarai Barat
6100	Prov. Kalimantan Barat	6100	Prov. Kalimantan Barat	6100	Prov. Kalimantan Barat	6100	Prov. Kalimantan Barat
6101	Kab. Sambas	6101	Kab. Sambas	6101	Kab. Sambas	6101	Kab. Sambas
6102	Kab. Bengkayang	6102	Kab. Bengkayang	6102	Kab. Bengkayang	6102	Kab. Bengkayang
6172	Kota Singkawang	6172	Kota Singkawang	6172	Kota Singkawang	6172	Kota Singkawang
6103	Kab. Landak	6103	Kab. Landak	6103	Kab. Landak	6103	Kab. Landak
6104	Kab. Pontianak	6104	Kab. Pontianak	6104	Kab. Pontianak	6104	Kab. Pontianak
6104	Kab. Pontianak	6104	Kab. Pontianak	6104	Kab. Pontianak	6104	Kab. Pontianak
6105	Kab. Sanggau	6105	Kab. Sanggau	6105	Kab. Sanggau	6105	Kab. Sanggau
6105	Kab. Sanggau	6105	Kab. Sanggau	6109	Kab. Sekadau	6109	Kab. Sekadau
6106	Kab. Ketapang	6106	Kab. Ketapang	6106	Kab. Ketapang	6106	Kab. Ketapang
6106	Kab. Ketapang	6106	Kab. Ketapang	6106	Kab. Ketapang	6106	Kab. Ketapang
6107	Kab. Sintang	6107	Kab. Sintang	6107	Kab. Sintang	6107	Kab. Sintang
6107	Kab. Sintang	6107	Kab. Sintang	6110	Kab. Melawi	6110	Kab. Melawi
6108	Kab. Kapuas Hulu	6108	Kab. Kapuas Hulu	6108	Kab. Kapuas Hulu	6108	Kab. Kapuas Hulu
6171	Kota Pontianak	6171	Kota Pontianak	6171	Kota Pontianak	6171	Kota Pontianak
6200	Prov. Kalimantan Tengah	6200	Prov. Kalimantan Tengah	6200	Prov. Kalimantan Tengah	6200	Prov. Kalimantan Tengah
6201	Kab. Kotawaringin Barat	6201	Kab. Kotawaringin Barat	6201	Kab. Kotawaringin Barat	6201	Kab. Kotawaringin Barat
6201	Kab. Kotawaringin Barat	6206	Kab. Sukamara	6206	Kab. Sukamara	6206	Kab. Sukamara
6201	Kab. Kotawaringin Barat	6207	Kab. Lamandau	6207	Kab. Lamandau	6207	Kab. Lamandau
6202	Kab. Kotawaringin Timur	6202	Kab. Kotawaringin Timur	6202	Kab. Kotawaringin Timur	6202	Kab. Kotawaringin Timur
6202	Kab. Kotawaringin Timur	6208	Kab. Seruyan	6208	Kab. Seruyan	6208	Kab. Seruyan
6202	Kab. Kotawaringin Timur	6209	Kab. Katingan	6209	Kab. Katingan	6209	Kab. Katingan
6203	Kab. Kapuas	6203	Kab. Kapuas	6203	Kab. Kapuas	6203	Kab. Kapuas
6203	Kab. Kapuas	6210	Kab. Pulang Pisau	6210	Kab. Pulang Pisau	6210	Kab. Pulang Pisau
6203	Kab. Kapuas	6211	Kab. Gunung Mas	6211	Kab. Gunung Mas	6211	Kab. Gunung Mas
6204	Kab. Barito Selatan	6204	Kab. Barito Selatan	6204	Kab. Barito Selatan	6204	Kab. Barito Selatan
6204	Kab. Barito Selatan	6212	Kab. Barito Timur	6212	Kab. Barito Timur	6212	Kab. Barito Timur
6205	Kab. Barito Utara	6205	Kab. Barito Utara	6205	Kab. Barito Utara	6205	Kab. Barito Utara
6205	Kab. Barito Utara	6213	Kab. Murung Raya	6213	Kab. Murung Raya	6213	Kab. Murung Raya
6271	Kota Palangka Raya	6271	Kota Palangka Raya	6271	Kota Palangka Raya	6271	Kota Palangka Raya
6300	Prov. Kalimantan Selatan	6300	Prov. Kalimantan Selatan	6300	Prov. Kalimantan Selatan	6300	Prov. Kalimantan Selatan
6301	Kab. Tanah Laut	6301	Kab. Tanah Laut	6301	Kab. Tanah Laut	6301	Kab. Tanah Laut
6302	Kab. Kota Baru	6302	Kab. Kota Baru	6302	Kab. Kota Baru	6302	Kab. Kota Baru
6302	Kab. Kota Baru	6302	Kab. Kota Baru	6310	Kab. Tanah Bumbu	6310	Kab. Tanah Bumbu
6303	Kab. Banjar	6303	Kab. Banjar	6303	Kab. Banjar	6303	Kab. Banjar
6372	Kota Banjar Baru	6372	Kota Banjar Baru	6372	Kota Banjar Baru	6372	Kota Banjar Baru
6304	Kab. Barito Kuala	6304	Kab. Barito Kuala	6304	Kab. Barito Kuala	6304	Kab. Barito Kuala
6305	Kab. Tapin	6305	Kab. Tapin	6305	Kab. Tapin	6305	Kab. Tapin
6306	Kab. Hulu Sungai Selatan	6306	Kab. Hulu Sungai Selatan	6306	Kab. Hulu Sungai Selatan	6306	Kab. Hulu Sungai Selatan
6307	Kab. Hulu Sungai Tengah	6307	Kab. Hulu Sungai Tengah	6307	Kab. Hulu Sungai Tengah	6307	Kab. Hulu Sungai Tengah
6308	Kab. Hulu Sungai Utara	6308	Kab. Hulu Sungai Utara	6308	Kab. Hulu Sungai Utara	6308	Kab. Hulu Sungai Utara
6308	Kab. Hulu Sungai Utara	6308	Kab. Hulu Sungai Utara	6311	Kab. Balangan	6311	Kab. Balangan
6309	Kab. Tabalong	6309	Kab. Tabalong	6309	Kab. Tabalong	6309	Kab. Tabalong
6371	Kota Banjarmasin	6371	Kota Banjarmasin	6371	Kota Banjarmasin	6371	Kota Banjarmasin
6400	Prov. Kalimantan Timur	6400	Prov. Kalimantan Timur	6400	Prov. Kalimantan Timur	6400	Prov. Kalimantan Timur
6401	Kab. Paser	6401	Kab. Paser	6401	Kab. Paser	6401	Kab. Paser
6401	Kab. Paser	6409	Kab. Penajam Paser Utara	6409	Kab. Penajam Paser Utara	6409	Kab. Penajam Paser Utara
6402	Kab. Kutai Barat	6402	Kab. Kutai Barat	6402	Kab. Kutai Barat	6402	Kab. Kutai Barat
6403	Kab. Kutai	6403	Kab. Kutai	6403	Kab. Kutai	6403	Kab. Kutai
6404	Kab. Kutai Timur	6404	Kab. Kutai Timur	6404	Kab. Kutai Timur	6404	Kab. Kutai Timur
6474	Kota Bontang	6474	Kota Bontang	6474	Kota Bontang	6474	Kota Bontang
6405	Kab. Berau	6405	Kab. Berau	6405	Kab. Berau	6405	Kab. Berau
6406	Kab. Malinau	6406	Kab. Malinau	6406	Kab. Malinau	6406	Kab. Malinau
6407	Kab. Bulungan	6407	Kab. Bulungan	6407	Kab. Bulungan	6407	Kab. Bulungan
6407	Kab. Bulungan	6407	Kab. Bulungan	6407	Kab. Bulungan	6407	Kab. Bulungan
6408	Kab. Nunukan	6408	Kab. Nunukan	6408	Kab. Nunukan	6408	Kab. Nunukan
6473	Kota Tarakan	6473	Kota Tarakan	6473	Kota Tarakan	6473	Kota Tarakan
6471	Kota Balikpapan	6471	Kota Balikpapan	6471	Kota Balikpapan	6471	Kota Balikpapan

Susenus 2007		Susenus 2008		Susenus 2009	
Code9	Name	Code10	Name	Code11	Name
5104	Kab. Gianyar	5104	Kab. Gianyar	5104	Kab. Gianyar
5105	Kab. Klungkung	5105	Kab. Klungkung	5105	Kab. Klungkung
5106	Kab. Bangil	5106	Kab. Bangil	5106	Kab. Bangil
5107	Kab. Karang Asem	5107	Kab. Karang Asem	5107	Kab. Karang Asem
5108	Kab. Buleleng	5108	Kab. Buleleng	5108	Kab. Buleleng
5171	Kota Denpasar	5171	Kota Denpasar	5171	Kota Denpasar
5200	Prov. Nusa Tenggara Barat	5200	Prov. Nusa Tenggara Barat	5200	Prov. Nusa Tenggara Barat
5201	Kab. Lombok Barat	5201	Kab. Lombok Barat	5201	Kab. Lombok Barat
5201	Kab. Lombok Barat	5201	Kab. Lombok Barat	5201	Kab. Lombok Barat
5202	Kab. Lombok Tengah	5202	Kab. Lombok Tengah	5202	Kab. Lombok Tengah
5203	Kab. Lombok Timur	5203	Kab. Lombok Timur	5203	Kab. Lombok Timur
5204	Kab. Sumbawa	5204	Kab. Sumbawa	5204	Kab. Sumbawa
5207	Kab. Sumbawa Barat	5207	Kab. Sumbawa Barat	5207	Kab. Sumbawa Barat
5205	Kab. Dompu	5205	Kab. Dompu	5205	Kab. Dompu
5206	Kab. Bima	5206	Kab. Bima	5206	Kab. Bima
5272	Kota Bima	5272	Kota Bima	5272	Kota Bima
5271	Kota Mataram	5271	Kota Mataram	5271	Kota Mataram
5300	Prov. Nusa Tenggara Timur	5300	Prov. Nusa Tenggara Timur	5300	Prov. Nusa Tenggara Timur
5301	Kab. Sumba Barat	5301	Kab. Sumba Barat	5301	Kab. Sumba Barat
5316	Kab. Sumba Tengah	5316	Kab. Sumba Tengah	5316	Kab. Sumba Tengah
5317	Kab. Sumba Barat Daya	5317	Kab. Sumba Barat Daya	5317	Kab. Sumba Barat Daya
5302	Kab. Sumba Timur	5302	Kab. Sumba Timur	5302	Kab. Sumba Timur
5303	Kab. Kupang	5303	Kab. Kupang	5303	Kab. Kupang
5314	Kab. Rote Ndao	5314	Kab. Rote Ndao	5314	Kab. Rote Ndao
5314	Kab. Rote Ndao	5314	Kab. Rote Ndao	5314	Kab. Rote Ndao
5371	Kota Kupang	5371	Kota Kupang	5371	Kota Kupang
5304	Kab. Timor Tengah Selatan	5304	Kab. Timor Tengah Selatan	5304	Kab. Timor Tengah Selatan
5305	Kab. Timor Tengah Utara	5305	Kab. Timor Tengah Utara	5305	Kab. Timor Tengah Utara
5306	Kab. Belu	5306	Kab. Belu	5306	Kab. Belu
5307	Kab. Alor	5307	Kab. Alor	5307	Kab. Alor
5308	Kab. Lembuta	5308	Kab. Lembuta	5308	Kab. Lembuta
5309	Kab. Flores Timur	5309	Kab. Flores Timur	5309	Kab. Flores Timur
5310	Kab. Sikka	5310	Kab. Sikka	5310	Kab. Sikka
5311	Kab. Ende	5311	Kab. Ende	5311	Kab. Ende
5312	Kab. Ngada	5312	Kab. Ngada	5312	Kab. Ngada
5318	Kab. Nagekeo	5318	Kab. Nagekeo	5318	Kab. Nagekeo
5313	Kab. Manggarai	5313	Kab. Manggarai	5313	Kab. Manggarai
5313	Kab. Manggarai	5313	Kab. Manggarai	5319	Kab. Manggarai Timur
5315	Kab. Manggarai Barat	5315	Kab. Manggarai Barat	5315	Kab. Manggarai Barat
6100	Prov. Kalimantan Barat	6100	Prov. Kalimantan Barat	6100	Prov. Kalimantan Barat
6101	Kab. Sambas	6101	Kab. Sambas	6101	Kab. Sambas
6102	Kab. Bengkayang	6102	Kab. Bengkayang	6102	Kab. Bengkayang
6172	Kota Singkawang	6172	Kota Singkawang	6172	Kota Singkawang
6103	Kab. Landak	6103	Kab. Landak	6103	Kab. Landak
6104	Kab. Pontianak	6104	Kab. Pontianak	6104	Kab. Pontianak
6104	Kab. Pontianak	6104	Kab. Pontianak	6112	Kab. Kubu Raya
6105	Kab. Sanggau	6105	Kab. Sanggau	6105	Kab. Sanggau
6109	Kab. Sekadau	6109	Kab. Sekadau	6109	Kab. Sekadau
6106	Kab. Ketapang	6106	Kab. Ketapang	6106	Kab. Ketapang
6111	Kab. Kayong Utara	6111	Kab. Kayong Utara	6111	Kab. Kayong Utara
6107	Kab. Sintang	6107	Kab. Sintang	6107	Kab. Sintang
6110	Kab. Melawi	6110	Kab. Melawi	6110	Kab. Melawi
6108	Kab. Kapuas Hulu	6108	Kab. Kapuas Hulu	6108	Kab. Kapuas Hulu
6171	Kota Pontianak	6171	Kota Pontianak	6171	Kota Pontianak
6200	Prov. Kalimantan Tengah	6200	Prov. Kalimantan Tengah	6200	Prov. Kalimantan Tengah
6201	Kab. Kotawaringin Barat	6201	Kab. Kotawaringin Barat	6201	Kab. Kotawaringin Barat
6206	Kab. Sukamara	6206	Kab. Sukamara	6206	Kab. Sukamara
6207	Kab. Lamandau	6207	Kab. Lamandau	6207	Kab. Lamandau
6202	Kab. Kotawaringin Timur	6202	Kab. Kotawaringin Timur	6202	Kab. Kotawaringin Timur
6208	Kab. Seruyan	6208	Kab. Seruyan	6208	Kab. Seruyan
6209	Kab. Katingan	6209	Kab. Katingan	6209	Kab. Katingan
6203	Kab. Kapuas	6203	Kab. Kapuas	6203	Kab. Kapuas
6210	Kab. Pulang Pisau	6210	Kab. Pulang Pisau	6210	Kab. Pulang Pisau
6211	Kab. Gunung Mas	6211	Kab. Gunung Mas	6211	Kab. Gunung Mas
6204	Kab. Barito Selatan	6204	Kab. Barito Selatan	6204	Kab. Barito Selatan
6212	Kab. Barito Timur	6212	Kab. Barito Timur	6212	Kab. Barito Timur
6205	Kab. Barito Utara	6205	Kab. Barito Utara	6205	Kab. Barito Utara
6213	Kab. Murung Raya	6213	Kab. Murung Raya	6213	Kab. Murung Raya
6271	Kota Palangkaraya	6271	Kota Palangkaraya	6271	Kota Palangkaraya
6300	Prov. Kalimantan Selatan	6300	Prov. Kalimantan Selatan	6300	Prov. Kalimantan Selatan
6301	Kab. Tanah Laut	6301	Kab. Tanah Laut	6301	Kab. Tanah Laut
6302	Kab. Kota Baru	6302	Kab. Kota Baru	6302	Kab. Kota Baru
6310	Kab. Tanah Bumbu	6310	Kab. Tanah Bumbu	6310	Kab. Tanah Bumbu
6303	Kab. Banjar	6303	Kab. Banjar	6303	Kab. Banjar
6372	Kota Banjar Baru	6372	Kota Banjar Baru	6372	Kota Banjar Baru
6304	Kab. Barito Kuala	6304	Kab. Barito Kuala	6304	Kab. Barito Kuala
6305	Kab. Tapin	6305	Kab. Tapin	6305	Kab. Tapin
6306	Kab. Hulu Sungai Selatan	6306	Kab. Hulu Sungai Selatan	6306	Kab. Hulu Sungai Selatan
6307	Kab. Hulu Sungai Tengah	6307	Kab. Hulu Sungai Tengah	6307	Kab. Hulu Sungai Tengah
6308	Kab. Hulu Sungai Utara	6308	Kab. Hulu Sungai Utara	6308	Kab. Hulu Sungai Utara
6311	Kab. Balangan	6311	Kab. Balangan	6311	Kab. Balangan
6309	Kab. Tabalong	6309	Kab. Tabalong	6309	Kab. Tabalong
6371	Kota Banjarmasin	6371	Kota Banjarmasin	6371	Kota Banjarmasin
6400	Prov. Kalimantan Timur	6400	Prov. Kalimantan Timur	6400	Prov. Kalimantan Timur
6401	Kab. Paser	6401	Kab. Paser	6401	Kab. Paser
6409	Kab. Penajam Paser Utara	6409	Kab. Penajam Paser Utara	6409	Kab. Penajam Paser Utara
6402	Kab. Kutai Barat	6402	Kab. Kutai Barat	6402	Kab. Kutai Barat
6403	Kab. Kutai	6403	Kab. Kutai Kartanegara	6403	Kab. Kutai Kartanegara
6404	Kab. Kutai Timur	6404	Kab. Kutai Timur	6404	Kab. Kutai Timur
6474	Kota Bontang	6474	Kota Bontang	6474	Kota Bontang
6405	Kab. Berau	6405	Kab. Berau	6405	Kab. Berau
6406	Kab. Malinau	6406	Kab. Malinau	6406	Kab. Malinau
6407	Kab. Bulungan	6407	Kab. Bulungan	6407	Kab. Bulungan
6407	Kab. Bulungan	6407	Kab. Bulungan	6410	Kab. Tana Tidung
6408	Kab. Nunukan	6408	Kab. Nunukan	6408	Kab. Nunukan
6473	Kota Tarakan	6473	Kota Tarakan	6473	Kota Tarakan
6471	Kota Balikpapan	6471	Kota Balikpapan	6471	Kota Balikpapan

Code12	Susenus 2010 Name	Susenus 2011 Name	Susenus 2012-2014 Name
Code13		Code14	
5104	Kab. Gianyar	5104 Kab. Gianyar	5104 Kab. Gianyar
5105	Kab. Klungkung	5105 Kab. Klungkung	5105 Kab. Klungkung
5106	Kab. Bangli	5106 Kab. Bangli	5106 Kab. Bangli
5107	Kab. Karang Asem	5107 Kab. Karang Asem	5107 Kab. Karang Asem
5108	Kab. Buleleng	5108 Kab. Buleleng	5108 Kab. Buleleng
5171	Kota Denpasar	5171 Kota Denpasar	5171 Kota Denpasar
5200	Prov. Nusa Tenggara Barat	5200 Prov. Nusa Tenggara Barat	5200 Prov. Nusa Tenggara Barat
5201	Kab. Lombok Barat	5201 Kab. Lombok Barat	5201 Kab. Lombok Barat
5208	Kab. Lombok Utara	5208 Kab. Lombok Utara	5208 Kab. Lombok Utara
5202	Kab. Lombok Tengah	5202 Kab. Lombok Tengah	5202 Kab. Lombok Tengah
5203	Kab. Lombok Timur	5203 Kab. Lombok Timur	5203 Kab. Lombok Timur
5204	Kab. Sumbawa	5204 Kab. Sumbawa	5204 Kab. Sumbawa
5207	Kab. Sumbawa Barat	5207 Kab. Sumbawa Barat	5207 Kab. Sumbawa Barat
5205	Kab. Dompu	5205 Kab. Dompu	5205 Kab. Dompu
5206	Kab. Bima	5206 Kab. Bima	5206 Kab. Bima
5272	Kota Bima	5272 Kota Bima	5272 Kota Bima
5271	Kota Mataram	5271 Kota Mataram	5271 Kota Mataram
5300	Prov. Nusa Tenggara Timur	5300 Prov. Nusa Tenggara Timur	5300 Prov. Nusa Tenggara Timur
5301	Kab. Sumba Barat	5301 Kab. Sumba Barat	5301 Kab. Sumba Barat
5313	Kab. Sumba Tengah	5316 Kab. Sumba Tengah	5316 Kab. Sumba Tengah
5317	Kab. Sumba Barat Daya	5317 Kab. Sumba Barat Daya	5317 Kab. Sumba Barat Daya
5302	Kab. Sumba Timur	5302 Kab. Sumba Timur	5302 Kab. Sumba Timur
5303	Kab. Kupang	5303 Kab. Kupang	5303 Kab. Kupang
5314	Kab. Rote Ndao	5314 Kab. Rote Ndao	5314 Kab. Rote Ndao
5320	Kab. Sabu Raijua	5320 Kab. Sabu Raijua	5320 Kab. Sabu Raijua
5371	Kota Kupang	5371 Kota Kupang	5371 Kota Kupang
5303	Kab. Timor Tengah Selatan	5304 Kab. Timor Tengah Selatan	5304 Kab. Timor Tengah Selatan
5305	Kab. Timor Tengah Utara	5305 Kab. Timor Tengah Utara	5305 Kab. Timor Tengah Utara
5306	Kab. Belu	5306 Kab. Belu	5306 Kab. Belu
5307	Kab. Alor	5307 Kab. Alor	5307 Kab. Alor
5308	Kab. Lembuta	5308 Kab. Lembuta	5308 Kab. Lembuta
5309	Kab. Flores Timur	5309 Kab. Flores Timur	5309 Kab. Flores Timur
5310	Kab. Sikka	5310 Kab. Sikka	5310 Kab. Sikka
5311	Kab. Ende	5311 Kab. Ende	5311 Kab. Ende
5312	Kab. Ngada	5312 Kab. Ngada	5312 Kab. Ngada
5318	Kab. Nagekeo	5318 Kab. Nagekeo	5318 Kab. Nagekeo
5313	Kab. Manggarai	5313 Kab. Manggarai	5313 Kab. Manggarai
5319	Kab. Manggarai Timur	5319 Kab. Manggarai Timur	5319 Kab. Manggarai Timur
5315	Kab. Manggarai Barat	5315 Kab. Manggarai Barat	5315 Kab. Manggarai Barat
6100	Prov. Kalimantan Barat	6100 Prov. Kalimantan Barat	6100 Prov. Kalimantan Barat
6101	Kab. Sambas	6101 Kab. Sambas	6101 Kab. Sambas
6102	Kab. Bengkayang	6102 Kab. Bengkayang	6102 Kab. Bengkayang
6172	Kota Singkawang	6172 Kota Singkawang	6172 Kota Singkawang
6103	Kab. Landak	6103 Kab. Landak	6103 Kab. Landak
6104	Kab. Pontianak	6104 Kab. Pontianak	6104 Kab. Pontianak
6112	Kab. Kubu Raya	6112 Kab. Kubu Raya	6112 Kab. Kubu Raya
6105	Kab. Sanggau	6105 Kab. Sanggau	6105 Kab. Sanggau
6109	Kab. Sekadau	6109 Kab. Sekadau	6109 Kab. Sekadau
6106	Kab. Ketapang	6106 Kab. Ketapang	6106 Kab. Ketapang
6111	Kab. Kayong Utara	6111 Kab. Kayong Utara	6111 Kab. Kayong Utara
6107	Kab. Sintang	6107 Kab. Sintang	6107 Kab. Sintang
6110	Kab. Melawi	6110 Kab. Melawi	6110 Kab. Melawi
6108	Kab. Kapuas Hulu	6108 Kab. Kapuas Hulu	6108 Kab. Kapuas Hulu
6171	Kota Pontianak	6171 Kota Pontianak	6171 Kota Pontianak
6200	Prov. Kalimantan Tengah	6200 Prov. Kalimantan Tengah	6200 Prov. Kalimantan Tengah
6201	Kab. Kotawaringin Barat	6201 Kab. Kotawaringin Barat	6201 Kab. Kotawaringin Barat
6206	Kab. Sukamara	6206 Kab. Sukamara	6206 Kab. Sukamara
6207	Kab. Lamandau	6207 Kab. Lamandau	6207 Kab. Lamandau
6202	Kab. Kotawaringin Timur	6202 Kab. Kotawaringin Timur	6202 Kab. Kotawaringin Timur
6208	Kab. Seruyan	6208 Kab. Seruyan	6208 Kab. Seruyan
6209	Kab. Katingan	6209 Kab. Katingan	6209 Kab. Katingan
6203	Kab. Kapuas	6203 Kab. Kapuas	6203 Kab. Kapuas
6210	Kab. Pulang Pisau	6210 Kab. Pulang Pisau	6210 Kab. Pulang Pisau
6211	Kab. Gunung Mas	6211 Kab. Gunung Mas	6211 Kab. Gunung Mas
6204	Kab. Barito Selatan	6204 Kab. Barito Selatan	6204 Kab. Barito Selatan
6212	Kab. Barito Timur	6212 Kab. Barito Timur	6212 Kab. Barito Timur
6205	Kab. Barito Utara	6205 Kab. Barito Utara	6205 Kab. Barito Utara
6213	Kab. Murung Raya	6213 Kab. Murung Raya	6213 Kab. Murung Raya
6271	Kota Palangkaraya	6271 Kota Palangkaraya	6271 Kota Palangkaraya
6300	Prov. Kalimantan Selatan	6300 Prov. Kalimantan Selatan	6300 Prov. Kalimantan Selatan
6301	Kab. Tanah Laut	6301 Kab. Tanah Laut	6301 Kab. Tanah Laut
6302	Kab. Kota Baru	6302 Kab. Kota Baru	6302 Kab. Kota Baru
6310	Kab. Tanah Bumbu	6310 Kab. Tanah Bumbu	6310 Kab. Tanah Bumbu
6303	Kab. Banjar	6303 Kab. Banjar	6303 Kab. Banjar
6372	Kota Banjar Baru	6372 Kota Banjar Baru	6372 Kota Banjar Baru
6304	Kab. Barito Kuala	6304 Kab. Barito Kuala	6304 Kab. Barito Kuala
6305	Kab. Tapin	6305 Kab. Tapin	6305 Kab. Tapin
6306	Kab. Hulu Sungai Selatan	6306 Kab. Hulu Sungai Selatan	6306 Kab. Hulu Sungai Selatan
6307	Kab. Hulu Sungai Tengah	6307 Kab. Hulu Sungai Tengah	6307 Kab. Hulu Sungai Tengah
6308	Kab. Hulu Sungai Utara	6308 Kab. Hulu Sungai Utara	6308 Kab. Hulu Sungai Utara
6311	Kab. Balangan	6311 Kab. Balangan	6311 Kab. Balangan
6309	Kab. Tabalong	6309 Kab. Tabalong	6309 Kab. Tabalong
6371	Kota Banjarmasin	6371 Kota Banjarmasin	6371 Kota Banjarmasin
6400	Prov. Kalimantan Timur	6400 Prov. Kalimantan Timur	6400 Prov. Kalimantan Timur
6401	Kab. Pasir	6401 Kab. Pasir	6401 Kab. Pasir
6409	Kab. Penajam Paser Utara	6409 Kab. Penajam Paser Utara	6409 Kab. Penajam Paser Utara
6402	Kab. Kutai Barat	6402 Kab. Kutai Barat	6402 Kab. Kutai Barat
6403	Kab. Kutai Kartanegara	6403 Kab. Kutai Kartanegara	6403 Kab. Kutai Kartanegara
6404	Kab. Kutai Timur	6404 Kab. Kutai Timur	6404 Kab. Kutai Timur
6474	Kota Bontang	6474 Kota Bontang	6474 Kota Bontang
6405	Kab. Berau	6405 Kab. Berau	6405 Kab. Berau
6406	Kab. Malinau	6406 Kab. Malinau	6406 Kab. Malinau
6407	Kab. Bulungan	6407 Kab. Bulungan	6407 Kab. Bulungan
6410	Kab. Tana Tidung	6410 Kab. Tana Tidung	6410 Kab. Tana Tidung
6408	Kab. Nunukan	6408 Kab. Nunukan	6408 Kab. Nunukan
6473	Kota Tarakan	6473 Kota Tarakan	6473 Kota Tarakan
6471	Kota Balikpapan	6471 Kota Balikpapan	6471 Kota Balikpapan

Susenas 2001-2003		Susenas 2004		Susenas 2005		Susenas 2006	
Code5	Name	Code6	Name	Code7	Name	Code8	Name
6472	Kota Samarinda	6472	Kota Samarinda	6472	Kota Samarinda	6472	Kota Samarinda
7100	Prov. Sulawesi Utara	7100	Prov. Sulawesi Utara	7100	Prov. Sulawesi Utara	7100	Prov. Sulawesi Utara
7500	Prov. Gorontalo	7500	Prov. Gorontalo	7500	Prov. Gorontalo	7500	Prov. Gorontalo
7501	Kab. Boalemo	7501	Kab. Boalemo	7501	Kab. Boalemo	7501	Kab. Boalemo
7501	Kab. Boalemo	7501	Kab. Boalemo	7503	Kab. Pohuwato	7503	Kab. Pohuwato
7502	Kab. Gorontalo	7502	Kab. Gorontalo	7502	Kab. Gorontalo	7502	Kab. Gorontalo
7502	Kab. Gorontalo	7502	Kab. Gorontalo	7502	Kab. Gorontalo	7502	Kab. Gorontalo
7502	Kab. Gorontalo	7502	Kab. Gorontalo	7504	Kab. Bone Bolango	7504	Kab. Bone Bolango
7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow
7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow
7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow
7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow
7102	Kab. Minahasa	7102	Kab. Minahasa	7102	Kab. Minahasa	7102	Kab. Minahasa
7102	Kab. Minahasa	7102	Kab. Minahasa	7105	Kab. Minahasa Selatan	7105	Kab. Minahasa Selatan
7102	Kab. Minahasa	7102	Kab. Minahasa	7105	Kab. Minahasa Selatan	7105	Kab. Minahasa Selatan
7102	Kab. Minahasa	7102	Kab. Minahasa	7106	Kab. Minahasa Utara	7106	Kab. Minahasa Utara
7102	Kab. Minahasa	7102	Kab. Minahasa	7173	Kota Tomohon	7173	Kota Tomohon
7103	Kab. Sangihe Talaud	7103	Kab. Kepulauan Sangihe	7103	Kab. Kepulauan Sangihe	7103	Kab. Kepulauan Sangihe
7103	Kab. Sangihe Talaud	7103	Kab. Kepulauan Sangihe	7103	Kab. Kepulauan Sangihe	7103	Kab. Kepulauan Sangihe
7103	Kab. Sangihe Talaud	7104	Kab. Kepulauan Talaud	7104	Kab. Kepulauan Talaud	7104	Kab. Kepulauan Talaud
7571	Kota Gorontalo	7571	Kota Gorontalo	7571	Kota Gorontalo	7571	Kota Gorontalo
7171	Kota Manado	7171	Kota Manado	7171	Kota Manado	7171	Kota Manado
7172	Kota Bitung	7172	Kota Bitung	7172	Kota Bitung	7172	Kota Bitung
7200	Prov. Sulawesi Tengah	7200	Prov. Sulawesi Tengah	7200	Prov. Sulawesi Tengah	7200	Prov. Sulawesi Tengah
7201	Kab. Banggai Kepulauan	7201	Kab. Banggai Kepulauan	7201	Kab. Banggai Kepulauan	7201	Kab. Banggai Kepulauan
7202	Kab. Banggai	7202	Kab. Banggai	7202	Kab. Banggai	7202	Kab. Banggai
7203	Kab. Morowali	7203	Kab. Morowali	7203	Kab. Morowali	7203	Kab. Morowali
7204	Kab. Poso	7204	Kab. Poso	7204	Kab. Poso	7204	Kab. Poso
7204	Kab. Poso	7204	Kab. Poso	7209	Kab. Tojo Una-Una	7209	Kab. Tojo Una-Una
7205	Kab. Donggala	7205	Kab. Donggala	7205	Kab. Donggala	7205	Kab. Donggala
7205	Kab. Donggala	7205	Kab. Donggala	7205	Kab. Donggala	7205	Kab. Donggala
7205	Kab. Donggala	7208	Kab. Parigi Moutong	7208	Kab. Parigi Moutong	7208	Kab. Parigi Moutong
7206	Kab. Tolli-Tolli	7206	Kab. Tolli-Tolli	7206	Kab. Tolli-Tolli	7206	Kab. Tolli-Tolli
7207	Kab. Buol	7207	Kab. Buol	7207	Kab. Buol	7207	Kab. Buol
7271	Kota Palu	7271	Kota Palu	7271	Kota Palu	7271	Kota Palu
7300	Prov. Sulawesi Selatan	7300	Prov. Sulawesi Selatan	7300	Prov. Sulawesi Selatan	7300	Prov. Sulawesi Selatan
7300	Prov. Sulawesi Selatan	7300	Prov. Sulawesi Selatan	7300	Prov. Sulawesi Selatan	7300	Prov. Sulawesi Selatan
7301	Kab. Selaway	7301	Kab. Selaway	7301	Kab. Selaway	7301	Kab. Selaway
7302	Kab. Bulukumba	7302	Kab. Bulukumba	7302	Kab. Bulukumba	7302	Kab. Bulukumba
7303	Kab. Bantaeng	7303	Kab. Bantaeng	7303	Kab. Bantaeng	7303	Kab. Bantaeng
7304	Kab. Jeneponto	7304	Kab. Jeneponto	7304	Kab. Jeneponto	7304	Kab. Jeneponto
7305	Kab. Takalar	7305	Kab. Takalar	7305	Kab. Takalar	7305	Kab. Takalar
7306	Kab. Gowa	7306	Kab. Gowa	7306	Kab. Gowa	7306	Kab. Gowa
7307	Kab. Sinjai	7307	Kab. Sinjai	7307	Kab. Sinjai	7307	Kab. Sinjai
7308	Kab. Maros	7308	Kab. Maros	7308	Kab. Maros	7308	Kab. Maros
7309	Kab. Pangkajene Kepulauan	7309	Kab. Pangkajene Kepulauan	7309	Kab. Pangkajene Kepulauan	7309	Kab. Pangkajene Kepulauan
7310	Kab. Barru	7310	Kab. Barru	7310	Kab. Barru	7310	Kab. Barru
7311	Kab. Bone	7311	Kab. Bone	7311	Kab. Bone	7311	Kab. Bone
7312	Kab. Soppeng	7312	Kab. Soppeng	7312	Kab. Soppeng	7312	Kab. Soppeng
7313	Kab. Wajo	7313	Kab. Wajo	7313	Kab. Wajo	7313	Kab. Wajo
7314	Kab. Sidenreng Rappang	7314	Kab. Sidenreng Rappang	7314	Kab. Sidenreng Rappang	7314	Kab. Sidenreng Rappang
7315	Kab. Pinrang	7315	Kab. Pinrang	7315	Kab. Pinrang	7315	Kab. Pinrang
7316	Kab. Enrekang	7316	Kab. Enrekang	7316	Kab. Enrekang	7316	Kab. Enrekang
7317	Kab. Luwu	7317	Kab. Luwu	7317	Kab. Luwu	7317	Kab. Luwu
7317	Kab. Luwu	7373	Kota Palopo	7373	Kota Palopo	7373	Kota Palopo
7322	Kab. Luwu Utara	7322	Kab. Luwu Utara	7322	Kab. Luwu Utara	7322	Kab. Luwu Utara
7322	Kab. Luwu Utara	7322	Kab. Luwu Utara	7325	Kab. Luwu Timur	7325	Kab. Luwu Timur
7318	Kab. Tana Toraja	7318	Kab. Tana Toraja	7318	Kab. Tana Toraja	7318	Kab. Tana Toraja
7318	Kab. Tana Toraja	7318	Kab. Tana Toraja	7318	Kab. Tana Toraja	7318	Kab. Tana Toraja
7319	Kab. Polewali Mamasa	7319	Kab. Polewali Mamasa	7319	Kab. Polewali Mamasa	7319	Kab. Polewali Mamasa
7319	Kab. Polewali Mamasa	7323	Kab. Mamasa	7323	Kab. Mamasa	7323	Kab. Mamasa
7320	Kab. Majene	7320	Kab. Majene	7320	Kab. Majene	7601	Kab. Majene
7321	Kab. Mamuju	7321	Kab. Mamuju	7321	Kab. Mamuju	7604	Kab. Mamuju
7321	Kab. Mamuju	7321	Kab. Mamuju	7324	Kab. Mamuju Utara	7605	Kab. Mamuju Utara
7371	Kota Ujung Pandang	7371	Kota Makassar	7371	Kota Ujung Pandang	7371	Kota Makassar
7372	Kota Pare-Pare	7372	Kota Pare-Pare	7372	Kota Pare-Pare	7372	Kota Pare-Pare
7400	Prov. Sulawesi Tenggara	7400	Prov. Sulawesi Tenggara	7400	Prov. Sulawesi Tenggara	7400	Prov. Sulawesi Tenggara
7401	Kab. Buton	7401	Kab. Buton	7401	Kab. Buton	7401	Kab. Buton
7401	Kab. Buton	7401	Kab. Buton	7406	Kab. Bombana	7406	Kab. Bombana
7401	Kab. Buton	7401	Kab. Buton	7407	Kab. Wakatobi	7407	Kab. Wakatobi
7472	Kota Baubau	7472	Kota Baubau	7472	Kota Baubau	7472	Kota Baubau
7402	Kab. Muna	7402	Kab. Muna	7402	Kab. Muna	7402	Kab. Muna
7402	Kab. Muna	7402	Kab. Muna	7402	Kab. Muna	7402	Kab. Muna
7403	Kab. Kendari	7403	Kab. Kendari	7403	Kab. Kendari	7403	Kab. Kendari
7403	Kab. Kendari	7403	Kab. Kendari	7403	Kab. Kendari	7403	Kab. Kendari
7403	Kab. Kendari	7403	Kab. Kendari	7405	Kab. Konawe Selatan	7405	Kab. Konawe Selatan
7471	Kota Kendari	7471	Kota Kendari	7471	Kota Kendari	7471	Kota Kendari
7404	Kab. Kolaka	7404	Kab. Kolaka	7404	Kab. Kolaka	7404	Kab. Kolaka
7404	Kab. Kolaka	7404	Kab. Kolaka	7408	Kab. Kolaka Utara	7408	Kab. Kolaka Utara
8100	Prov. Maluku	8100	Prov. Maluku	8100	Prov. Maluku	8100	Prov. Maluku
8200	Prov. Maluku Utara	8200	Prov. Maluku Utara	8200	Prov. Maluku Utara	8200	Prov. Maluku Utara
8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat
8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat
8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara
8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara
8103	Kab. Maluku Tengah	8103	Kab. Maluku Tengah	8103	Kab. Maluku Tengah	8103	Kab. Maluku Tengah
8103	Kab. Maluku Tengah	8103	Kab. Maluku Tengah	8105	Kab. Kepulauan Aru	8105	Kab. Kepulauan Aru
8103	Kab. Maluku Tengah	8103	Kab. Maluku Tengah	8105	Kab. Kepulauan Aru	8105	Kab. Kepulauan Aru
8104	Kab. Buru	8104	Kab. Buru	8104	Kab. Buru	8104	Kab. Buru
8104	Kab. Buru	8104	Kab. Buru	8104	Kab. Buru	8104	Kab. Buru
8201	Kab. Maluku Utara	8201	Kab. Maluku Utara	8201	Kab. Maluku Utara	8201	Kab. Maluku Utara
8201	Kab. Maluku Utara	8201	Kab. Maluku Utara	8203	Kab. Kepulauan Sula	8203	Kab. Kepulauan Sula
8201	Kab. Maluku Utara	8201	Kab. Maluku Utara	8204	Kab. Halmahera Selatan	8204	Kab. Halmahera Selatan
8201	Kab. Maluku Utara	8201	Kab. Maluku Utara	8205	Kab. Halmahera Utara	8205	Kab. Halmahera Utara
8201	Kab. Maluku Utara	8201	Kab. Maluku Utara	8205	Kab. Halmahera Utara	8205	Kab. Halmahera Utara

Susenus 2007		Susenus 2008		Susenus 2009	
Code9	Name	Code10	Name	Code11	Name
6472	Kota Samarinda	6472	Kota Samarinda	6472	Kota Samarinda
7100	Prov. Sulawesi Utara	7100	Prov. Sulawesi Utara	7100	Prov. Sulawesi Utara
7500	Prov. Gorontalo	7500	Prov. Gorontalo	7500	Prov. Gorontalo
7501	Kab. Boalemo	7501	Kab. Boalemo	7501	Kab. Boalemo
7503	Kab. Pohuwato	7503	Kab. Pohuwato	7503	Kab. Pohuwato
7505	Kab. Gorontalo Utara	7505	Kab. Gorontalo Utara	7505	Kab. Gorontalo Utara
7504	Kab. Bone Bolango	7504	Kab. Bone Bolango	7504	Kab. Bone Bolango
7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow
7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow
7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow	7101	Kab. Bolaang Mongondow
7107	Kab. Bolaang Mongondow Utara	7107	Kab. Bolaang Mongondow Utara	7107	Kab. Bolaang Mongondow Utara
7174	Kota Kotamobagu	7174	Kota Kotamobagu	7174	Kota Kotamobagu
7102	Kab. Minahasa	7102	Kab. Minahasa	7102	Kab. Minahasa
7105	Kab. Minahasa Selatan	7105	Kab. Minahasa Selatan	7105	Kab. Minahasa Selatan
7109	Kab. Minahasa Tengara (Mitra)	7109	Kab. Minahasa Tengara (Mitra)	7109	Kab. Minahasa Tengara (Mitra)
7106	Kab. Minahasa Utara	7106	Kab. Minahasa Utara	7106	Kab. Minahasa Utara
7173	Kota Tomohon	7173	Kota Tomohon	7173	Kota Tomohon
7103	Kab. Kepulauan Sangihe	7103	Kab. Kepulauan Sangihe	7103	Kab. Kepulauan Sangihe
7108	Kab. Siau Tagulandang Biaro (Sitaro)	7108	Kab. Siau Tagulandang Biaro (Sitaro)	7108	Kab. Kep. Siau Tagulandang Biaro (Sitaro)
7104	Kab. Kepulauan Talaud	7104	Kab. Kepulauan Talaud	7104	Kab. Kepulauan Talaud
7571	Kota Gorontalo	7571	Kota Gorontalo	7571	Kota Gorontalo
7171	Kota Manado	7171	Kota Manado	7171	Kota Manado
7172	Kota Bitung	7172	Kota Bitung	7172	Kota Bitung
7200	Prov. Sulawesi Tengah	7200	Prov. Sulawesi Tengah	7200	Prov. Sulawesi Tengah
7201	Kab. Banggai Kepulauan	7201	Kab. Banggai Kepulauan	7201	Kab. Banggai Kepulauan
7202	Kab. Banggai	7202	Kab. Banggai	7202	Kab. Banggai
7203	Kab. Morowali	7203	Kab. Morowali	7203	Kab. Morowali
7204	Kab. Poso	7204	Kab. Poso	7204	Kab. Poso
7209	Kab. Tojo Una-Una	7209	Kab. Tojo Una-Una	7209	Kab. Tojo Una-Una
7205	Kab. Donggala	7205	Kab. Donggala	7205	Kab. Donggala
7205	Kab. Donggala	7205	Kab. Donggala	7205	Kab. Donggala
7208	Kab. Parigi Moutong	7208	Kab. Parigi Moutong	7208	Kab. Parigi Moutong
7206	Kab. Toli-Toli	7206	Kab. Toli-Toli	7206	Kab. Toli-Toli
7207	Kab. Buol	7207	Kab. Buol	7207	Kab. Buol
7271	Kota Palu	7271	Kota Palu	7271	Kota Palu
7300	Prov. Sulawesi Selatan	7300	Prov. Sulawesi Selatan	7300	Prov. Sulawesi Selatan
7600	Prov. Sulawesi Barat	7600	Prov. Sulawesi Barat	7600	Prov. Sulawesi Barat
7301	Kab. Selaway	7301	Kab. Selaway	7301	Kab. Selaway
7302	Kab. Bulukumba	7302	Kab. Bulukumba	7302	Kab. Bulukumba
7303	Kab. Bantaeng	7303	Kab. Bantaeng	7303	Kab. Bantaeng
7304	Kab. Jeneponto	7304	Kab. Jeneponto	7304	Kab. Jeneponto
7305	Kab. Takalar	7305	Kab. Takalar	7305	Kab. Takalar
7306	Kab. Gowa	7306	Kab. Gowa	7306	Kab. Gowa
7307	Kab. Sinjal	7307	Kab. Sinjal	7307	Kab. Sinjal
7308	Kab. Maros	7308	Kab. Maros	7308	Kab. Maros
7309	Kab. Pangkajene Kepulauan	7309	Kab. Pangkajene Kepulauan	7309	Kab. Pangkajene Kepulauan
7310	Kab. Barru	7310	Kab. Barru	7310	Kab. Barru
7311	Kab. Bone	7311	Kab. Bone	7311	Kab. Bone
7312	Kab. Soppeng	7312	Kab. Soppeng	7312	Kab. Soppeng
7313	Kab. Wajo	7313	Kab. Wajo	7313	Kab. Wajo
7314	Kab. Sidenreng Rappang	7314	Kab. Sidenreng Rappang	7314	Kab. Sidenreng Rappang
7315	Kab. Pinrang	7315	Kab. Pinrang	7315	Kab. Pinrang
7316	Kab. Enrekang	7316	Kab. Enrekang	7316	Kab. Enrekang
7317	Kab. Luwu	7317	Kab. Luwu	7317	Kab. Luwu
7373	Kota Palopo	7373	Kota Palopo	7373	Kota Palopo
7322	Kab. Luwu Utara	7322	Kab. Luwu Utara	7322	Kab. Luwu Utara
7325	Kab. Luwu Timur	7325	Kab. Luwu Timur	7325	Kab. Luwu Timur
7318	Kab. Tana Toraja	7318	Kab. Tana Toraja	7318	Kab. Tana Toraja
7318	Kab. Tana Toraja	7318	Kab. Tana Toraja	7318	Kab. Tana Toraja
7602	Kab. Polewali Mandar	7602	Kab. Polewali Mandar	7602	Kab. Polewali Mandar
7603	Kab. Mamasa	7603	Kab. Mamasa	7603	Kab. Mamasa
7601	Kab. Majene	7601	Kab. Majene	7601	Kab. Majene
7604	Kab. Mamuju	7604	Kab. Mamuju	7604	Kab. Mamuju
7605	Kab. Mamuju Utara	7605	Kab. Mamuju Utara	7605	Kab. Mamuju Utara
7371	Kota Makassar	7371	Kota Makassar	7371	Kota Makassar
7372	Kota Pare-Pare	7372	Kota Pare-Pare	7372	Kota Pare-Pare
7400	Prov. Sulawesi Tenggara	7400	Prov. Sulawesi Tenggara	7400	Prov. Sulawesi Tenggara
7401	Kab. Buton	7401	Kab. Buton	7401	Kab. Buton
7406	Kab. Bombana	7406	Kab. Bombana	7406	Kab. Bombana
7407	Kab. Wakatobi	7407	Kab. Wakatobi	7407	Kab. Wakatobi
7472	Kota Baubau	7472	Kota Baubau	7472	Kota Baubau
7402	Kab. Muna	7402	Kab. Muna	7402	Kab. Muna
7409	Kab. Buton Utara	7409	Kab. Buton Utara	7409	Kab. Buton Utara
7403	Kab. Konawe	7403	Kab. Konawe	7403	Kab. Konawe
7410	Kab. Konawe Utara	7410	Kab. Konawe Utara	7410	Kab. Konawe Utara
7405	Kab. Konawe Selatan	7405	Kab. Konawe Selatan	7405	Kab. Konawe Selatan
7471	Kota Kendari	7471	Kota Kendari	7471	Kota Kendari
7404	Kab. Kolaka	7404	Kab. Kolaka	7404	Kab. Kolaka
7408	Kab. Kolaka Utara	7408	Kab. Kolaka Utara	7408	Kab. Kolaka Utara
8100	Prov. Maluku	8100	Prov. Maluku	8100	Prov. Maluku
8200	Prov. Maluku Utara	8200	Prov. Maluku Utara	8200	Prov. Maluku Utara
8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat
8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat	8101	Kab. Maluku Tenggara Barat
8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara
8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara	8102	Kab. Maluku Tenggara
8105	Kab. Kepulauan Aru	8105	Kab. Kepulauan Aru	8105	Kab. Kepulauan Aru
8103	Kab. Maluku Tengah	8103	Kab. Maluku Tengah	8103	Kab. Maluku Tengah
8106	Kab. Seram Bagian Barat	8106	Kab. Seram Bagian Barat	8106	Kab. Seram Bagian Barat
8107	Kab. Seram Bagian Timur	8107	Kab. Seram Bagian Timur	8107	Kab. Seram Bagian Timur
8104	Kab. Buru	8104	Kab. Buru	8104	Kab. Buru
8104	Kab. Buru	8104	Kab. Buru	8104	Kab. Buru
8201	Kab. Halmahera Barat	8201	Kab. Halmahera Barat	8201	Kab. Halmahera Barat
8203	Kab. Kepulauan Sula	8203	Kab. Kepulauan Sula	8203	Kab. Kepulauan Sula
8204	Kab. Halmahera Selatan	8204	Kab. Halmahera Selatan	8204	Kab. Halmahera Selatan
8205	Kab. Halmahera Utara	8205	Kab. Halmahera Utara	8205	Kab. Halmahera Utara
8205	Kab. Halmahera Utara	8205	Kab. Halmahera Utara	8205	Kab. Halmahera Utara

Susenus 2010 Code12	Name	Susenus 2011 Code13	Name	Susenus 2012-2014 Code14	Name
6472 Kota Samarinda		6472 Kota Samarinda		6472 Kota Samarinda	
7100 Prov. Sulawesi Utara		7100 Prov. Sulawesi Utara		7100 Prov. Sulawesi Utara	
7500 Prov. Gorontalo		7500 Prov. Gorontalo		7500 Prov. Gorontalo	
7501 Kab. Boalemo		7501 Kab. Boalemo		7501 Kab. Boalemo	
7503 Kab. Pohuwato		7503 Kab. Pohuwato		7503 Kab. Pohuwato	
7502 Kab. Gorontalo		7502 Kab. Gorontalo		7502 Kab. Gorontalo	
7505 Kab. Gorontalo Utara		7505 Kab. Gorontalo Utara		7505 Kab. Gorontalo Utara	
7504 Kab. Bone Bolango		7504 Kab. Bone Bolango		7504 Kab. Bone Bolango	
7101 Kab. Bolaang Mongondow		7101 Kab. Bolaang Mongondow		7101 Kab. Bolaang Mongondow	
7110 Kab. Bolaang Mongondow Selatan		7110 Kab. Bolaang Mongondow Selatan		7110 Kab. Bolaang Mongondow Selatan	
7111 Kab. Bolaang Mongondow Timur		7111 Kab. Bolaang Mongondow Timur		7111 Kab. Bolaang Mongondow Timur	
7107 Kab. Bolaang Mongondow Utara		7107 Kab. Bolaang Mongondow Utara		7107 Kab. Bolaang Mongondow Utara	
7174 Kota Kotamobagu		7174 Kota Kotamobagu		7174 Kota Kotamobagu	
7102 Kab. Minahasa		7102 Kab. Minahasa		7102 Kab. Minahasa	
7105 Kab. Minahasa Selatan		7105 Kab. Minahasa Selatan		7105 Kab. Minahasa Selatan	
7109 Kab. Minahasa Tengara (Mitra)		7109 Kab. Minahasa Tengara (Mitra)		7109 Kab. Minahasa Tengara (Mitra)	
7106 Kab. Minahasa Utara		7106 Kab. Minahasa Utara		7106 Kab. Minahasa Utara	
7173 Kota Tomohon		7173 Kota Tomohon		7173 Kota Tomohon	
7103 Kab. Kepulauan Sangihe		7103 Kab. Kepulauan Sangihe		7103 Kab. Kepulauan Sangihe	
7108 Kab. Kep. Siau Tagulandang Biaro (Sitaro)		7108 Kab. Kep. Siau Tagulandang Biaro (Sitaro)		7108 Kab. Kep. Siau Tagulandang Biaro (Sitaro)	
7104 Kab. Kepulauan Talaud		7104 Kab. Kepulauan Talaud		7104 Kab. Kepulauan Talaud	
7571 Kota Gorontalo		7571 Kota Gorontalo		7571 Kota Gorontalo	
7171 Kota Manado		7171 Kota Manado		7171 Kota Manado	
7172 Kota Bitung		7172 Kota Bitung		7172 Kota Bitung	
7200 Prov. Sulawesi Tengah		7200 Prov. Sulawesi Tengah		7200 Prov. Sulawesi Tengah	
7201 Kab. Banggai Kepulauan		7201 Kab. Banggai Kepulauan		7201 Kab. Banggai Kepulauan	
7202 Kab. Banggai		7202 Kab. Banggai		7202 Kab. Banggai	
7203 Kab. Morowali		7203 Kab. Morowali		7203 Kab. Morowali	
7204 Kab. Poso		7204 Kab. Poso		7204 Kab. Poso	
7209 Kab. Tojo Una-Una		7209 Kab. Tojo Una-Una		7209 Kab. Tojo Una-Una	
7205 Kab. Donggala		7205 Kab. Donggala		7205 Kab. Donggala	
7210 Kab. Sigi		7210 Kab. Sigi		7210 Kab. Sigi	
7208 Kab. Parigi Moutong		7208 Kab. Parigi Moutong		7208 Kab. Parigi Moutong	
7206 Kab. Toli-Toli		7206 Kab. Toli-Toli		7206 Kab. Toli-Toli	
7207 Kab. Buol		7207 Kab. Buol		7207 Kab. Buol	
7271 Kota Palu		7271 Kota Palu		7271 Kota Palu	
7300 Prov. Sulawesi Selatan		7300 Prov. Sulawesi Selatan		7300 Prov. Sulawesi Selatan	
7600 Prov. Sulawesi Barat		7600 Prov. Sulawesi Barat		7600 Prov. Sulawesi Barat	
7301 Kab. Selayar		7301 Kab. Selayar		7301 Kab. Selayar	
7302 Kab. Bulukumba		7302 Kab. Bulukumba		7302 Kab. Bulukumba	
7303 Kab. Bantaeng		7303 Kab. Bantaeng		7303 Kab. Bantaeng	
7304 Kab. Jeneponto		7304 Kab. Jeneponto		7304 Kab. Jeneponto	
7305 Kab. Takalar		7305 Kab. Takalar		7305 Kab. Takalar	
7306 Kab. Gowa		7306 Kab. Gowa		7306 Kab. Gowa	
7307 Kab. Sinjal		7307 Kab. Sinjal		7307 Kab. Sinjal	
7308 Kab. Maros		7308 Kab. Maros		7308 Kab. Maros	
7309 Kab. Pangkajene Kepulauan		7309 Kab. Pangkajene Kepulauan		7309 Kab. Pangkajene Kepulauan	
7310 Kab. Barru		7310 Kab. Barru		7310 Kab. Barru	
7311 Kab. Bone		7311 Kab. Bone		7311 Kab. Bone	
7312 Kab. Soppeng		7312 Kab. Soppeng		7312 Kab. Soppeng	
7313 Kab. Wajo		7313 Kab. Wajo		7313 Kab. Wajo	
7314 Kab. Sidenreng Rappang		7314 Kab. Sidenreng Rappang		7314 Kab. Sidenreng Rappang	
7315 Kab. Pinrang		7315 Kab. Pinrang		7315 Kab. Pinrang	
7316 Kab. Enrekang		7316 Kab. Enrekang		7316 Kab. Enrekang	
7317 Kab. Luwu		7317 Kab. Luwu		7317 Kab. Luwu	
7373 Kota Palopo		7373 Kota Palopo		7373 Kota Palopo	
7322 Kab. Luwu Utara		7322 Kab. Luwu Utara		7322 Kab. Luwu Utara	
7325 Kab. Luwu Timur		7325 Kab. Luwu Timur		7325 Kab. Luwu Timur	
7318 Kab. Tana Toraja		7318 Kab. Tana Toraja		7318 Kab. Tana Toraja	
7326 Kab. Toraja Utara		7326 Kab. Toraja Utara		7326 Kab. Toraja Utara	
7602 Kab. Polewali Mandar		7602 Kab. Polewali Mandar		7602 Kab. Polewali Mandar	
7603 Kab. Mamasa		7603 Kab. Mamasa		7603 Kab. Mamasa	
7601 Kab. Majene		7601 Kab. Majene		7601 Kab. Majene	
7604 Kab. Mamuju		7604 Kab. Mamuju		7604 Kab. Mamuju	
7605 Kab. Mamuju Utara		7605 Kab. Mamuju Utara		7605 Kab. Mamuju Utara	
7371 Kota Makassar		7371 Kota Makassar		7371 Kota Makassar	
7372 Kota Pare-Pare		7372 Kota Pare-Pare		7372 Kota Pare-Pare	
7400 Prov. Sulawesi Tenggara		7400 Prov. Sulawesi Tenggara		7400 Prov. Sulawesi Tenggara	
7401 Kab. Buton		7401 Kab. Buton		7401 Kab. Buton	
7406 Kab. Bombana		7406 Kab. Bombana		7406 Kab. Bombana	
7407 Kab. Wakatobi		7407 Kab. Wakatobi		7407 Kab. Wakatobi	
7472 Kota Bau-bau		7472 Kota Bau-bau		7472 Kota Bau-bau	
7402 Kab. Muna		7402 Kab. Muna		7402 Kab. Muna	
7409 Kab. Buton Utara		7409 Kab. Buton Utara		7409 Kab. Buton Utara	
7403 Kab. Konawe		7403 Kab. Konawe		7403 Kab. Konawe	
7410 Kab. Konawe Utara		7410 Kab. Konawe Utara		7410 Kab. Konawe Utara	
7405 Kab. Konawe Selatan		7405 Kab. Konawe Selatan		7405 Kab. Konawe Selatan	
7471 Kota Kendari		7471 Kota Kendari		7471 Kota Kendari	
7404 Kab. Kolaka		7404 Kab. Kolaka		7404 Kab. Kolaka	
7408 Kab. Kolaka Utara		7408 Kab. Kolaka Utara		7408 Kab. Kolaka Utara	
8100 Prov. Maluku		8100 Prov. Maluku		8100 Prov. Maluku	
8200 Prov. Maluku Utara		8200 Prov. Maluku Utara		8200 Prov. Maluku Utara	
8101 Kab. Maluku Tenggara Barat		8101 Kab. Maluku Tenggara Barat		8101 Kab. Maluku Tenggara Barat	
8108 Kab. Maluku Barat Daya		8108 Kab. Maluku Barat Daya		8108 Kab. Maluku Barat Daya	
8102 Kab. Maluku Tenggara		8102 Kab. Maluku Tenggara		8102 Kab. Maluku Tenggara	
8172 Kota Tual		8172 Kota Tual		8172 Kota Tual	
8105 Kab. Kepulauan Aru		8105 Kab. Kepulauan Aru		8105 Kab. Kepulauan Aru	
8103 Kab. Maluku Tengah		8103 Kab. Maluku Tengah		8103 Kab. Maluku Tengah	
8106 Kab. Seram Bagian Barat		8106 Kab. Seram Bagian Barat		8106 Kab. Seram Bagian Barat	
8107 Kab. Seram Bagian Timur		8107 Kab. Seram Bagian Timur		8107 Kab. Seram Bagian Timur	
8104 Kab. Buru		8104 Kab. Buru		8104 Kab. Buru	
8109 Kab. Buru Selatan		8109 Kab. Buru Selatan		8109 Kab. Buru Selatan	
8201 Kab. Halmahera Barat		8201 Kab. Halmahera Barat		8201 Kab. Halmahera Barat	
8203 Kab. Kepulauan Sula		8203 Kab. Kepulauan Sula		8203 Kab. Kepulauan Sula	
8204 Kab. Halmahera Selatan		8204 Kab. Halmahera Selatan		8204 Kab. Halmahera Selatan	
8205 Kab. Halmahera Utara		8205 Kab. Halmahera Utara		8205 Kab. Halmahera Utara	
8207 Kab. Morotai		8207 Kab. Morotai		8207 Kab. Morotai	

Susenas 2001-2003		Susenas 2004		Susenas 2005		Susenas 2006	
Code5	Name	Code6	Name	Code7	Name	Code8	Name
8271	Kota Ternate	8271	Kota Ternate	8271	Kota Ternate	8271	Kota Ternate
8202	Kab. Halmahera Tengah	8202	Kab. Halmahera Tengah	8202	Kab. Halmahera Tengah	8202	Kab. Halmahera Tengah
8202	Kab. Halmahera Tengah	8202	Kab. Halmahera Tengah	8206	Kab. Halmahera Timur	8206	Kab. Halmahera Timur
8202	Kab. Halmahera Tengah	8202	Kab. Halmahera Tengah	8272	Kota Tidore Kepulauan	8272	Kota Tidore Kepulauan
8171	Kota Ambon	8171	Kota Ambon	8171	Kota Ambon	8171	Kota Ambon
9400	Prov. Papua	9400	Prov. Papua	9400	Prov. Papua	9100	Prov. Irian Jaya Barat
9400	Prov. Papua	9400	Prov. Papua	9400	Prov. Papua	9400	Prov. Papua
9401	Kab. Merauke	9401	Kab. Merauke	9401	Kab. Merauke	9401	Kab. Merauke
9401	Kab. Merauke	9401	Kab. Merauke	9413	Kab. Boven Digoel	9413	Kab. Boven Digoel
9401	Kab. Merauke	9401	Kab. Merauke	9414	Kab. Mappi	9414	Kab. Mappi
9401	Kab. Merauke	9401	Kab. Merauke	9415	Kab. Asmat	9415	Kab. Asmat
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9416	Kab. Yahukimo	9416	Kab. Yahukimo
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9417	Kab. Pegunungan Bintang	9417	Kab. Pegunungan Bintang
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9418	Kab. Tolikara	9418	Kab. Tolikara
9403	Kab. Jayapura	9403	Kab. Jayapura	9403	Kab. Jayapura	9403	Kab. Jayapura
9403	Kab. Jayapura	9403	Kab. Jayapura	9419	Kab. Sarmi	9419	Kab. Sarmi
9403	Kab. Jayapura	9403	Kab. Jayapura	9419	Kab. Sarmi	9419	Kab. Sarmi
9403	Kab. Jayapura	9403	Kab. Jayapura	9420	Kab. Keerom	9420	Kab. Keerom
9404	Kab. Nabire	9404	Kab. Nabire	9404	Kab. Nabire	9404	Kab. Nabire
9404	Kab. Nabire	9404	Kab. Nabire	9404	Kab. Nabire	9404	Kab. Nabire
9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai
9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai
9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai
9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya
9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya
9405	Kab. Fak-Fak	9405	Kab. Fak-Fak	9405	Kab. Fak-Fak	9101	Kab. Fak-Fak
9405	Kab. Fak-Fak	9405	Kab. Fak-Fak	9421	Kab. Kaimana	9102	Kab. Kaimana
9412	Kab. Mimika	9412	Kab. Mimika	9412	Kab. Mimika	9412	Kab. Mimika
9406	Kab. Sorong	9406	Kab. Sorong	9406	Kab. Sorong	9107	Kab. Sorong
9406	Kab. Sorong	9406	Kab. Sorong	9406	Kab. Sorong	9107	Kab. Sorong
9406	Kab. Sorong	9406	Kab. Sorong	9422	Kab. Sorong Selatan	9106	Kab. Sorong Selatan
9406	Kab. Sorong	9406	Kab. Sorong	9422	Kab. Sorong Selatan	9106	Kab. Sorong Selatan
9406	Kab. Sorong	9406	Kab. Sorong	9423	Kab. Raja Ampat	9108	Kab. Raja Ampat
9472	Kota Sorong	9472	Kota Sorong	9472	Kota Sorong	9171	Kota Sorong
9407	Kab. Manokwari	9407	Kab. Manokwari	9407	Kab. Manokwari	9105	Kab. Manokwari
9407	Kab. Manokwari	9407	Kab. Manokwari	9424	Kab. Teluk Bintuni	9104	Kab. Teluk Bintuni
9407	Kab. Manokwari	9407	Kab. Manokwari	9425	Kab. Teluk Wondama	9103	Kab. Teluk Wondama
9408	Kab. Yapen Waropen	9408	Kab. Yapen Waropen	9408	Kab. Yapen Waropen	9408	Kab. Yapen Waropen
9408	Kab. Yapen Waropen	9408	Kab. Yapen Waropen	9426	Kab. Waropen	9426	Kab. Waropen
9409	Kab. Biak Numfor	9409	Kab. Biak Numfor	9409	Kab. Biak Numfor	9409	Kab. Biak Numfor
9409	Kab. Biak Numfor	9409	Kab. Biak Numfor	9409	Kab. Biak Numfor	9427	Kab. Supiori
9471	Kota Jayapura	9471	Kota Jayapura	9471	Kota Jayapura	9471	Kota Jayapura

Susenas 2007		Susenas 2008		Susenas 2009	
Code9	Name	Code10	Name	Code11	Name
8271	Kota Ternate	8271	Kota Ternate	8271	Kota Ternate
8202	Kab. Halmahera Tengah	8202	Kab. Halmahera Tengah	8202	Kab. Halmahera Tengah
8206	Kab. Halmahera Timur	8206	Kab. Halmahera Timur	8206	Kab. Halmahera Timur
8272	Kota Tidore Kepulauan	8272	Kota Tidore Kepulauan	8272	Kota Tidore Kepulauan
8171	Kota Ambon	8171	Kota Ambon	8171	Kota Ambon
9100	Prov. Irian Jaya Barat	9100	Prov. Papua Barat	9100	Prov. Papua Barat
9400	Prov. Papua	9400	Prov. Papua	9400	Prov. Papua
9401	Kab. Merauke	9401	Kab. Merauke	9401	Kab. Merauke
9413	Kab. Boven Digoel	9413	Kab. Boven Digoel	9413	Kab. Boven Digoel
9414	Kab. Mappi	9414	Kab. Mappi	9414	Kab. Mappi
9415	Kab. Asmat	9415	Kab. Asmat	9415	Kab. Asmat
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9429	Kab. Nduga
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9430	Kab. Lanny Jaya
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9431	Kab. Mamberamo Tengah
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9432	Kab. Yalimo
9416	Kab. Yahukimo	9416	Kab. Yahukimo	9416	Kab. Yahukimo
9417	Kab. Pegunungan Bintang	9417	Kab. Pegunungan Bintang	9417	Kab. Pegunungan Bintang
9418	Kab. Tolikara	9418	Kab. Tolikara	9418	Kab. Tolikara
9403	Kab. Jayapura	9403	Kab. Jayapura	9403	Kab. Jayapura
9419	Kab. Sarmi	9419	Kab. Sarmi	9419	Kab. Sarmi
9419	Kab. Sarmi	9419	Kab. Sarmi	9428	Kab. Mamberamo Raya
9420	Kab. Keerom	9420	Kab. Keerom	9420	Kab. Keerom
9404	Kab. Nabire	9404	Kab. Nabire	9404	Kab. Nabire
9404	Kab. Nabire	9404	Kab. Nabire	9434	Kab. Dogiyai
9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai
9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai
9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai
9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya
9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya	9433	Kab. Puncak
9101	Kab. Fak-Fak	9101	Kab. Fak-Fak	9101	Kab. Fak-Fak
9102	Kab. Kaimana	9102	Kab. Kaimana	9102	Kab. Kaimana
9412	Kab. Mimika	9412	Kab. Mimika	9412	Kab. Mimika
9107	Kab. Sorong	9107	Kab. Sorong	9107	Kab. Sorong
9107	Kab. Sorong	9107	Kab. Sorong	9107	Kab. Sorong
9106	Kab. Sorong Selatan	9106	Kab. Sorong Selatan	9106	Kab. Sorong Selatan
9106	Kab. Sorong Selatan	9106	Kab. Sorong Selatan	9106	Kab. Sorong Selatan
9108	Kab. Raja Ampat	9108	Kab. Raja Ampat	9108	Kab. Raja Ampat
9171	Kota Sorong	9171	Kota Sorong	9171	Kota Sorong
9105	Kab. Manokwari	9105	Kab. Manokwari	9105	Kab. Manokwari
9104	Kab. Teluk Bintuni	9104	Kab. Teluk Bintuni	9104	Kab. Teluk Bintuni
9103	Kab. Teluk Wondama	9103	Kab. Teluk Wondama	9103	Kab. Teluk Wondama
9408	Kab. Yapen Waropen	9408	Kab. Yapen Waropen	9408	Kab. Yapen Waropen
9426	Kab. Waropen	9426	Kab. Waropen	9426	Kab. Waropen
9409	Kab. Biak Numfor	9409	Kab. Biak Numfor	9409	Kab. Biak Numfor
9427	Kab. Supiori	9427	Kab. Supiori	9427	Kab. Supiori
9471	Kota Jayapura	9471	Kota Jayapura	9471	Kota Jayapura

Susenas 2010		Susenus 2011		Susenus 2012-2014	
Code12	Name	Code13	Name	Code14	Name
8271	Kota Ternate	8271	Kota Ternate	8271	Kota Ternate
8202	Kab. Halmahera Tengah	8202	Kab. Halmahera Tengah	8202	Kab. Halmahera Tengah
8206	Kab. Halmahera Timur	8206	Kab. Halmahera Timur	8206	Kab. Halmahera Timur
8272	Kota Tidore Kepulauan	8272	Kota Tidore Kepulauan	8272	Kota Tidore Kepulauan
8171	Kota Ambon	8171	Kota Ambon	8171	Kota Ambon
9100	Prov. Papua Barat	9100	Prov. Papua Barat	9100	Prov. Papua Barat
9400	Prov. Papua	9400	Prov. Papua	9400	Prov. Papua
9401	Kab. Merauke	9401	Kab. Merauke	9401	Kab. Merauke
9413	Kab. Boven Digoel	9413	Kab. Boven Digoel	9413	Kab. Boven Digoel
9414	Kab. Mappi	9414	Kab. Mappi	9414	Kab. Mappi
9415	Kab. Asmat	9415	Kab. Asmat	9415	Kab. Asmat
9402	Kab. Jayawijaya	9402	Kab. Jayawijaya	9402	Kab. Jayawijaya
9429	Kab. Nduga	9429	Kab. Nduga	9429	Kab. Nduga
9430	Kab. Lanny Jaya	9430	Kab. Lanny Jaya	9430	Kab. Lanny Jaya
9431	Kab. Mamberamo Tengah	9431	Kab. Mamberamo Tengah	9431	Kab. Mamberamo Tengah
9432	Kab. Yalimo	9432	Kab. Yalimo	9432	Kab. Yalimo
9416	Kab. Yahukimo	9416	Kab. Yahukimo	9416	Kab. Yahukimo
9417	Kab. Pegunungan Bintang	9417	Kab. Pegunungan Bintang	9417	Kab. Pegunungan Bintang
9418	Kab. Tolikara	9418	Kab. Tolikara	9418	Kab. Tolikara
9403	Kab. Jayapura	9403	Kab. Jayapura	9403	Kab. Jayapura
9419	Kab. Sarmi	9419	Kab. Sarmi	9419	Kab. Sarmi
9428	Kab. Mamberamo Raya	9428	Kab. Mamberamo Raya	9428	Kab. Mamberamo Raya
9420	Kab. Keerom	9420	Kab. Keerom	9420	Kab. Keerom
9404	Kab. Nabire	9404	Kab. Nabire	9404	Kab. Nabire
9434	Kab. Dogiyai	9434	Kab. Dogiyai	9434	Kab. Dogiyai
9410	Kab. Paniai	9410	Kab. Paniai	9410	Kab. Paniai
9435	Kab. Intan Jaya	9435	Kab. Intan Jaya	9435	Kab. Intan Jaya
9436	Kab. Deiyai	9436	Kab. Deiyai	9436	Kab. Deiyai
9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya	9411	Kab. Puncak Jaya
9433	Kab. Puncak	9433	Kab. Puncak	9433	Kab. Puncak
9101	Kab. Fak-Fak	9101	Kab. Fak-Fak	9101	Kab. Fak-Fak
9102	Kab. Kaiyana	9102	Kab. Kaiyana	9102	Kab. Kaiyana
9412	Kab. Mimika	9412	Kab. Mimika	9412	Kab. Mimika
9107	Kab. Sorong	9107	Kab. Sorong	9107	Kab. Sorong
9109	Kab. Tambräu	9109	Kab. Tambräu	9109	Kab. Tambräu
9106	Kab. Sorong Selatan	9106	Kab. Sorong Selatan	9106	Kab. Sorong Selatan
9110	Kab. Maybrat	9110	Kab. Maybrat	9110	Kab. Maybrat
9108	Kab. Raja Ampat	9108	Kab. Raja Ampat	9108	Kab. Raja Ampat
9171	Kota Sorong	9171	Kota Sorong	9171	Kota Sorong
9105	Kab. Manokwari	9105	Kab. Manokwari	9105	Kab. Manokwari
9104	Kab. Teluk Bintuni	9104	Kab. Teluk Bintuni	9104	Kab. Teluk Bintuni
9103	Kab. Teluk Wondama	9103	Kab. Teluk Wondama	9103	Kab. Teluk Wondama
9408	Kab. Yapen Waropen	9408	Kab. Yapen Waropen	9408	Kab. Yapen Waropen
9426	Kab. Waropen	9426	Kab. Waropen	9426	Kab. Waropen
9409	Kab. Biak Numfor	9409	Kab. Biak Numfor	9409	Kab. Biak Numfor
9427	Kab. Supiori	9427	Kab. Supiori	9427	Kab. Supiori
9471	Kota Jayapura	9471	Kota Jayapura	9471	Kota Jayapura

Notes: This table is adapted from the district proliferation crosswalk published by INDO-DAOER (World Bank Group, 2016). The adaptation is made as the crosswalk made by INDO-DAOER represents the actual district list at the end date (30 December) of the specified year. Meanwhile, the Susenus is fielded each year on March and September. It is likely that Susenus is fielded using the district list of the previous year(s). Kab.=Kabupaten (municipality/district). Kodya and Kota=city/ district. Prov.=Province.

SUMMARY
SAMENVATTING
ACKNOWLEDGEMENTS
ABOUT THE AUTHOR

SUMMARY

Chapter 1: Introduction

Access to safe water is a basic human right. However, its provision, specifically in developing countries, is still a challenge. While households in developed countries take good quality water from tap for granted, for many households in developing countries clean water is out of reach. Even when a clean water facility is available in the vicinity, affordability issues often restrict the households to be connected to a water network. Under these circumstances, many households are forced to turn to water sources that could jeopardize their health. The consequences may be detrimental and water borne diseases, primarily diarrhoea, are often a major concern. Diarrhoea is one of the major killers of children under five. Beyond these health consequences, the effect of poor access to water of good quality has also economic and development consequences, in the form of lost workdays, school absenteeism and school dropout.

This thesis attempts to shed more light on the water, health and development linkage by taking the case of Indonesia. Indonesia is a developing economy where access to safe water still is a serious problem. The coverage of piped water is limited and it is unevenly distributed. This low coverage is exacerbated by fluctuating debit and frequent supply interruptions. Given these circumstances, households are forced to use water from informal providers, such as mobile vendors and refilling (bottled water) depots that are relatively expensive. The majority of households cannot afford these expensive sources of water and thus have to use water from free sources, which are often of low quality and prone to contamination issues.

In this thesis, I assume that availability and affordability problems strongly influence the water sources that are used by households, and through this affects the households' (members') health status and educational outcomes. My first aim is therefore to analyse water affordability problems among households which pay for their water as well as among the (majority of) households with free water sources. Related to the choice of water sources and given the increasing use of refillable bottled water, my second aim was to investigate the motives influencing the decision of households to switch to refillable bottled water. Because I think that the sources of water used by households may have implications for the household members' health, my third aim is to study the effects of the

water source used by households on the incidence of diarrhoea among children under five. My last aim is to analyse the effect of water on educational outcomes, especially on school enrolment and school absenteeism. To achieve these four aims, in Chapters 2-5 of this thesis four studies are presented.

Chapter 2: Water affordability

Chapter 2 concentrates on the affordability of different water sources and is related to research question 1. The main theme of this chapter is the affordability of safe water sources in a developing country context. Commonly, water affordability is measured as the proportion of household income spent on water supply. For developing countries this is problematic, as many households use water from free sources, like wells, springs, rivers and lakes. As these free sources are often of questionable quality, a substantial number of households may use them because they cannot afford the better quality piped or bottled water. These households then suffer from what can be called a “hidden” affordability problem. In previous research on developing countries, households using free sources were excluded, as a result of which affordability problems were largely underestimated. We investigate both the “revealed” and this “hidden” water affordability problem in Indonesia. Using data of the Indonesia National Socio Economic Survey (Susenas) 2015, we determine the net affordability ratio (NAR) for all households, those who pay for their water supply as well as those with free water sources. For households who do not report data on water expenditure, we estimate the water price on the basis of the average price paid by other households in the same area. As far as we know, this is the first time this “hidden” affordability is estimated. If we look only at households with paid water, 1.8% of the Indonesian households suffer from an affordability problem. However, if the households that use free sources are included, this percentage increases to 15.2%. Hence, the scale of the hidden affordability problem is far bigger than that of the revealed affordability problem. Findings imply that water affordability problems in developing countries have been significantly masked by the fact that earlier research is restricted to households that pay for their water supply.

Chapter 3: The switch to refillable bottled water

Chapter 3 deals with research question 2 and concentrates on the increase of the consumption of refillable bottled water in Indonesia, which comes with a serious health risk. We investigate the motives of households for switching to refillable bottled water as their main source of drinking water. However, the quality of this water is often

questionable, as authorities lack the capacity to properly check refilling depots. Given that refillable bottled water not only replaces unimproved water sources, but also better quality sources, like piped and branded bottled water, its increasing use poses a major health risk. We investigate the motives behind the decision to switch to refillable bottled water in Indonesia. For this purpose, we use the Indonesian household panel socio-economic survey (Susenas panel) 2008 – 2010, which tracked 66,724 households during three consecutive years. These data enable us to estimate a logistic model of the switch to refillable bottled water. To our knowledge, this is the first study that uses longitudinal data for investigating this switching behaviour. Findings indicate that this switch is driven by lifestyle motives, as well as by cost and availability considerations. It is mostly the young affluent households who switch from piped and ‘other’ sources to refillable bottled water. In rural areas, the tendency to make this switch is negatively affected by availability problems and the higher price of refillable bottled water. Availability and costs also influence the switch from branded bottled to refillable bottled water, but here the poorer households have a higher propensity to switch. Further exploration of the lifestyle motive and affordability issues, as well as better monitoring of the refilling depots, are needed to improve the quality of drinking water in Indonesia and other emerging countries.

Chapter 4: Water and health

Chapter 4 is related to research question 3 and focusses on the relation between water and health. This chapter looks more specifically on the effects of access to and treatment of water and sanitation at the household level, and water and sanitation coverage at the community level on diarrhoea prevalence among children under five. Diarrhoea is an important health issue in low and middle income countries, including Indonesia. We applied a multilevel regression analysis on the Indonesian Demographic and Health Survey to examine the effects of drinking water and sanitation facilities at the household and community level on diarrhoea prevalence among children under five ($n=33,339$). The role of the circumstances was explored by studying interactions between the water and sanitation variables and other risk factors. Diarrhoea prevalence was reported by 4,820 (14.4%) children, who on average were younger, poorer and were living in a poorer environment. At the household level, piped water was significantly associated with diarrhoea prevalence, improved sanitation had no direct effect and water treatment was not related to diarrhoea incidence. At the community level, improved water coverage had no direct effect but improved sanitation coverage was associated with lower diarrhoea prevalence. Our interaction analysis showed that the protective effects of better sanitation at the community level was increased by better drinking water at the

community level. This illustrates the importance of improving both drinking water and sanitation simultaneously.

Chapter 5: Water, health and education

Chapter 5 focuses on the water, health and development linkage. In this chapter, the development aspect is measured by education outcomes among primary school-age children. This is important as the provision of clean water remains a serious problem, especially in developing countries. About 11 percent of the world population relies on unimproved water sources which have to be brought to the house from outside, mostly by women and children. This situation might increase the prevalence of water related diseases such as diarrhoea and reduce study time for the children. School attendance may therefore decrease due to the combined effects of diarrhoea disruption and fetching water. The current study investigates the direct and indirect effect of water access on school absenteeism and school enrolment in Indonesia using a balanced panel data set for 295 districts over the period 1994-2014. Our data show that even though the primary school enrolment in Indonesia already reached 95%, a significant portion of students are absent due to health problems. Our results show that the access to piped and bottled water and access to a private water facility—above and beyond the access to water and health—can potentially improve both short- and long-term measures of education outcomes. The availability of piped and bottled water, and access to a private water facility are inversely related to school absenteeism and positively related to school enrolment. Accordingly, this benefit should be taken into account by the policy makers in identifying and quantifying the potential benefit of water infrastructure development in developing countries.

Chapter 6: Conclusions

This study comprises a collection of research papers that are presented separately in the chapters of this dissertation in order to achieve our research objectives. This thesis makes several theoretical and empirical contributions to the water supply literature, and more specifically to the water-health-development linkage in developing countries. This thesis, as far as we know, is the first to investigate the hidden affordability and the switch to refillable bottled water in developing countries. The current thesis also contributes new knowledge to the water-health and the water-education linkages.

The findings of this thesis have important implications for policy makers in water supply areas. Our findings provide additional insight on the importance of safe, accessible and affordable water for households in Indonesia. This is not only because access to clean and affordable water is a human right, but also because the provision of safe, accessible and affordable water can potentially improve health and development/educational outcomes. My research further provides policy makers with valuable insight on the supportive effect of piped water in the dwellings on reducing diarrhoea prevalence. Moreover, the supportive effect of the availability of piped water on the premises on health and education, found in Chapter 5, calls policy makers to incorporate these benefits when they make cost benefit analyses with regard to investment in water infrastructure.

SAMENVATTING

Toegang tot veilig drinkwater is een mensenrecht. In ontwikkelingslanden is de beschikbaarheid van veilig drinkwater echter beperkt. Terwijl in ontwikkelde landen het overgrote deel van de huishoudens toegang heeft tot goed leidingwater, is voor veel huishoudens in ontwikkelingslanden schoon water onbereikbaar. En zelfs als schoon water in de omgeving aanwezig is, kan het toch nog onbereikbaar zijn, omdat men de prijs ervan niet kan opbrengen. Dit betekent dat veel huishoudens in ontwikkelingslanden noodgedwongen zijn aangewezen op (drink)water van slechtere kwaliteit dat schadelijk is voor de gezondheid. Dit kan leiden tot water-gerelateerde ziekten, zoals diarree. Diarree is één van de belangrijkste oorzaken voor het overlijden van kinderen onder de 5 jaar. Naast gevolgen voor de gezondheid, heeft slechte toegang tot goed water ook gevolgen voor de economische ontwikkeling, omdat er sprake is van verloren werkdagen, schoolabsenteïsme en school drop-out.

Deze dissertatie onderzoekt het verband tussen waterkwaliteit, gezondheid en ontwikkeling in Indonesië. Indonesië is een land in ontwikkeling, waar toegang tot veilig drinkwater nog steeds een groot probleem is. De dekkingsgraad van leidingwater is zeer beperkt en de beschikbaarheid ervan is ongelijk verdeeld over het land. Ook wordt de toevoer van leidingwater vaak onderbroken, waardoor het water toch in flessen en tanks moet worden opgeslagen. Het gebrek aan beschikbaarheid van goed (leiding)water dwingt gezinnen ertoe om gebruik te maken van informele aanbieders, zoals mobiele verkopers en verkopers van water in hervulbare flessen. Het water van deze aanbieders is duurder dan leidingwater, waardoor veel gezinnen het zich niet kunnen veroorloven. Deze gezinnen zijn daarom aangewezen op de goedkope of gratis waterbronnen, waarvan de kwaliteit laag is en het gezondheidsrisico hoog.

In deze dissertatie veronderstel ik dat de gebrekkige beschikbaarheid en hoge prijs van water van goede kwaliteit, van grote invloed zijn op de drinkwaterbronnen die door huishoudens in Indonesië worden gebruikt. Ik verwacht dat door het noodgedwongen gebruik van slechtere bronnen onder gezinsleden meer gezondheidsproblemen en problemen met het volgen van onderwijs voorkomen. Doel van het onderzoek dat in deze dissertatie wordt gepresenteerd, is het verkrijgen van inzicht in de complexe verbanden

tussen beschikbaarheid en prijs van verschillende waterbronnen, de keuze die huishoudens maken uit die verschillende bronnen en de gevolgen die deze keuzes hebben voor gezondheid en onderwijs. Om dat doel te bereiken heb ik vier studies verricht, die in de hoofdstukken 2-5 van deze dissertatie zijn gepresenteerd.

In de eerste van deze studies heb ik de betaalbaarheid van (goed) water in Indonesië geanalyseerd. Dit zowel voor gezinnen die betalen voor water als voor gezinnen die gebruik maken van gratis bronnen. Vanwege het toenemend gebruik van water in hervulbare flessen als belangrijkste waterbron, heb ik in mijn tweede studie geanalyseerd wat de motieven zijn van gezinnen om naar deze bron over te stappen. Vanwege de verwachting dat de waterbron van invloed is op de gezondheid van de gezinsleden, heb ik in mijn derde studie de samenhang onderzocht tussen het gebruik van verschillende bronnen en het voorkomen van diarree bij kinderen jonger dan 5 jaar. In mijn laatste studie heb ik onderzocht wat de gevolgen zijn van het gebruik van verschillende waterbronnen voor de onderwijsdeelname van kinderen. In de volgende secties worden deze vier studies meer uitgebreid besproken.

Hoofdstuk 2: De betaalbaarheid van water.

Hoofdstuk 2 concentreert zich op de betaalbaarheid van de verschillende bronnen van drinkwater. Het hoofddoel is om de betaalbaarheid van veilig drinkwater te onderzoeken binnen de context van een ontwikkelingsland. Normaliter wordt de betaalbaarheid van water gemeten door het deel van het huishoudensinkomen dat wordt besteed aan drinkwater. Dit noemen we de “zichtbare” betaalbaarheid. Voor ontwikkelingslanden is een dergelijke berekening problematisch, want veel huishoudens maken gebruik van bronnen die gratis zijn, zoals waterputten, rivieren en meren. Deze bronnen leveren vaak water van mindere kwaliteit. Een groot deel van de gezinnen maakt hiervan gebruik omdat ze zich geen water van betere kwaliteit, zoals leidingwater of water uit flessen, kunnen veroorloven. Deze huishoudens lijden dan aan wat we een “verborgen” betaalbaarheidsprobleem noemen. In het tot nu toe uitgevoerde onderzoek naar betaalbaarheidsproblemen in ontwikkelingslanden werden de huishoudens die gebruik maken van gratis bronnen niet meegenomen. Bij gevolg werden de problemen onderschat.

Wij bestuderen zowel de “zichtbare” als “verborgen” betaalbaarheidsproblemen in Indonesië. Door gebruik te maken van gegevens van het Susenas 2015 databestand kunnen we de netto betaalbaarheidsratio voor alle huishoudens bepalen, zowel voor de huishoudens die betalen voor het water als voor de huishoudens die gebruik maken van gratis bronnen. Voor huishoudens die gebruik maken van gratis bronnen schatten we de

“verborgen” prijs op basis van de gemiddelde prijs die betaald wordt door de huishoudens die wel betalen in hetzelfde gebied. Voor zover wij weten is dit de eerste keer dat de verborgen betaalbaarheid wordt geschat. Als we alleen kijken naar huishoudens die betalen voor hun water dan heeft 1,8% van de Indonesische huishoudens een betaalbaarheidsprobleem. Echter, als we de huishoudens meenemen die gebruik maken van gratis bronnen dan stijgt het percentage tot 15,2%. Bijgevolg is de omvang van het “verborgen” betaalbaarheidsprobleem veel groter dan dat van het “zichtbare” probleem. Onze onderzoeksresultaten laten dus zien dat in eerder onderzoek de problemen met betrekking tot de betaalbaarheid van water in ontwikkelingslanden waarschijnlijk sterk zijn onderschat, vanwege het feit dat men zich beperkte tot de huishoudens die betaalden voor het water.

Hoofdstuk 3: De switch naar hervulbare flessen.

Hoofdstuk 3 behandelt de vraag waarom de consumptie van water uit hervulbare flessen in Indonesië zo sterk is toegenomen. Het onderzoek richt zich op de motieven van huishoudens om over te stappen naar hervulbare flessen als belangrijkste bron van drinkwater. Probleem is dat hervulbare flessen niet alleen waterbronnen van slechtere kwaliteit vervangen. Er wordt ook overgestapt door huishoudens die bronnen van betere kwaliteit gebruiken, zoals leidingwater en water in merkflessen, dat zijn flessen die fabrieksmatig geproduceerd worden en onder een merknaam worden verkocht. Dit betekent dat het toenemend gebruik van hervulbare flessen gezondheidsrisico’s met zich meebrengt. We bestuderen de motieven achter de beslissing om over te gaan tot hervulbare flessen voor huishoudens die oorspronkelijk gebruik maakten van leidingwater, van water uit merkflessen en van water uit andere bronnen. Voor dit onderzoek gebruiken we het Indonesische huishoudpanel met sociaal economische indicatoren (Susenas-panel) en volgen we 66.724 gezinnen gedurende 3 opeenvolgende jaren (2008-2010). De gegevens maken het voor ons mogelijk om een logistisch model te schatten van de switch naar hervulbare flessen. Voor zover wij weten is dit de eerste studie die gebruik maakt van longitudinale gegevens voor het bestuderen van dit switch gedrag.

De resultaten geven aan dat de switch vooral veroorzaakt wordt door motieven die te maken hebben met de levensstijl. Daarnaast spelen kosten en beschikbaarheid een rol. Het zijn meestal jonge, meer welvarende gezinnen die switchen van leidingwater en andere bronnen naar hervulbare flessen. In rurale gebieden wordt deze tendens negatief beïnvloed door beschikbaarheidsproblemen en de hogere prijs voor hervulbare flessen. Beschikbaarheid en kosten beïnvloeden ook de switch van merkflessen naar hervulbare flessen, maar hier zijn het de arme gezinnen die een grotere kans maken om te switchen. Verdere analyse van de motieven en beschikbaarheidsproblemen, en een betere controle

van de depots waar de flessen gevuld worden, zijn noodzakelijk om de kwaliteit van het drinkwater in Indonesië te verbeteren.

Hoofdstuk 4: Water en gezondheid.

Hoofdstuk 4 concentreert zich op de relatie tussen water en gezondheid. Dit hoofdstuk bestudeert de effecten van de beschikbaarheid van water en sanitair op het risico op diarree bij kinderen onder de vijf jaar. Diarree is een belangrijk gezondheidsprobleem in lage en midden inkomenslanden, inclusief Indonesië. We maken een onderscheid tussen de beschikbaarheid van water en sanitair op het niveau van de huishoudens en op het niveau van de gemeenschap. Tevens wordt rekening gehouden met de vraag of de huishoudens het water behandelen voor ze het gebruiken (bijvoorbeeld door het te koken). We passen een multilevel regressieanalyse toe op de Indonesian Demographic and Health Survey. De rol van de omstandigheden wordt bestudeerd door de interactie te analyseren tussen de variabelen voor water en sanitair en andere risicofactoren. Diarree bleek voor te komen bij 4.820 (14,4%) kinderen. Het betreft vooral de jongste kinderen, kinderen uit arme gezinnen, en kinderen uit een arme omgeving. Kinderen uit huishoudens die leidingwater gebruikten bleken significant minder last van diarree te hebben. De kwaliteit van de sanitaire voorzieningen in het huishouden had geen direct effect op de kans om diarree te krijgen. Ook het behandelen van het water was niet gerelateerd aan diarree. Op het niveau van de gemeenschap had een toename van de waterkwaliteit geen direct effect, maar betere sanitaire voorzieningen wel. Verder liet onze interactie-analyse zien dat de beschermende effecten van sanitaire voorzieningen op het niveau van de gemeenschap sterker zijn, als de kwaliteit van het drinkwater op dat niveau beter is. Dit geeft aan dat het belangrijk is om gemeenschappelijke voorzieningen voor drinkwater en sanitair tegelijkertijd te verbeteren.

Hoofdstuk 5: Water, gezondheid en onderwijs.

Hoofdstuk 5 spitst zich toe op het verband tussen water, gezondheid en ontwikkeling. In dit hoofdstuk wordt ontwikkeling gemeten door de onderwijsuitkomsten van kinderen in de lagere schoolleeftijd. Het onderzoek is van belang omdat in ontwikkelingslanden de beschikbaarheid van schoon water nog een serieus probleem is. Ongeveer 11% van de wereldbevolking is afhankelijk van een natuurlijke waterbron (bijvoorbeeld put of rivier), waarvan het water vaak over grote afstand vervoerd moet worden. Meestal doen vrouwen of kinderen dit. De slechtere kwaliteit van deze bronnen en de risico's op vervuiling tijdens het vervoer verhogen het risico op water-gerelateerde ziektes zoals

diarree. Dit risico en de tijd die het kost om het water te halen kunnen de tijd die kinderen besteden aan onderwijs verminderen. De vierde studie van deze dissertatie richt zich op de directe en indirecte gevolgen van het beschikbaar hebben van water voor de onderwijsdeelname en het missen van lessen (absenteïsme) in Indonesië. Voor deze studie wordt gebruik gemaakt van een gebalanceerd panel van 295 districten over de periode 1994 – 2014. Onze gegevens laten zien dat de onderwijsdeelname met 95% relatief hoog is, maar dat een significant deel van de scholieren niet aanwezig is op school vanwege gezondheidsproblemen. Verder blijken beschikbaarheid van leidingwater of van eigen waterfaciliteiten en het gebruik van flessenwater zowel op korte als op langere termijn samen te gaan met betere opleidingsuitkomsten: de onderwijsdeelname is hoger en de uitval lager. Het is daarom belangrijk dat beleidmakers bij het nemen van beslissingen over investeringen in de water infrastructuur ook de potentiele gevolgen voor het onderwijsniveau van de bevolking in hun beslissing meenemen.

Hoofdstuk 6: Conclusies.

Deze dissertatie bestaat uit een verzameling van papers die in vier afzonderlijke hoofdstukken zijn gepresenteerd. De gepresenteerde studies dragen bij aan zowel theoretische als empirische aspecten van de literatuur m.b.t. tot het aanbod van drinkwater. Het onderzoek concentreert zich op verbanden tussen betaalbaarheid, beschikbaarheid en kwaliteit van drinkwater en gezondheid en onderwijs in ontwikkelingslanden. Deze dissertatie is voor zover wij weten de eerste die het verborgen betaalbaarheidsprobleem in ontwikkelingslanden analyseert en ook de eerste die de switch naar navulbare flessen onderzoekt. Ze draagt ook bij aan de kennis m.b.t. het verband tussen water en gezondheid en water en onderwijs. De bevindingen hebben belangrijke consequenties voor beleidsmaker op het gebied van het aanbod van drinkwater. Ze leveren additioneel inzicht in het belang van toegang tot veilig en betaalbaar water voor gezinnen in ontwikkelingslanden, en dan met name voor gezinnen in Indonesië. Deze toegang is een mensenrecht. Ze is essentieel voor de gezondheid en ontwikkeling van gezinnen en gebieden in alle regio's van onze wereld. Het onderzoek laat zien hoe belangrijk de beschikbaarheid is van leidingwater in huis of op het eigen terrein voor het tegengaan van diarree en het bevorderen van de onderwijsdeelname. Voor beleidmakers op het gebied van de waterinfrastructuur is het van groot belang om deze voordelen bij het maken van hun kosten-baten analyses mee te nemen.

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