FACTORS ASSOCIATED WITH DIARRHEA AMONG UNDER-FIVE YEARS OLD CHILDREN IN BANTEN PROVINCE INDONESIA: A SECONDARY ANALYSIS OF INDONESIAN NATIONAL SOCIO-ECONOMIC SURVEY 2007 AND BASIC HEALTH RESEARCH 2007

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ปัจจัยที่เกี่ยวข้องกับโรคอุจจาระร่วงในเด็กที่มีอายุต่ำกว่า 5 ปี ในจังหวัดบันเท็น ประเทศอินโดนีเซีย: การวิเคราะห์ข้อมูลทุติยภูมิจากการสำรวจทางสังคมเศรษฐกิจแห่งชาติอินโดนีเซีย ปี 2550 และการวิจัยพื้นฐานด้านสุขภาพ ปี 2550

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วิทยานิพนธ์เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
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Thesis Title	FACTORS ASSOCIATED WITH DIARRHEA AMONG UNDER-FIVE YEARS OLD CHILDREN IN BANTEN PROVINCE INDONESIA: A SECONDARY ANALYSIS OF INDONESIAN NATIONAL SOCIO-ECONOMIC SURVEY 2007 AND BASIC HEALTH RESEARCH 2007
By	Mrs. Nida Rohmawati
Field of Study	Public Health
Thesis Advisor	Alessio Panza, M.D., M.Com.H, DTM&H
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การศึกษานี้เป็นการวิเคราะห์ข้อมูลทุติยภูมิจากการสำรวจสองกรณีคือ การสำรวจทางสังคมเศรษฐกิจแห่งชาติ อินโดนีเซีย ปี 2550 และการวิจัยพื้นฐานด้านสุขภาพ ปี 2550 ตัวแปรที่เกี่ยวข้องซึ่งค้นพบจากการสำรวจดังกล่าวได้ นำมาใช้การศึกษาเพื่อทดสอบความสัมพันธ์ระหว่างโรคอุจจาระร่วงในเด็กอายุต่ำกว่าห้าปีในจังหวัดบันเท็น ประเทศ อินโดนีเซีย แหล่งข้อมูลปฐมภูมิประกอบด้วย เศรษฐกิจของครัวเรือน เศรษฐกิจระดับบุคคล และข้อมูลสุขภาพ การสุ่มตัวอย่างใช้วิธีการสุ่มแบบแบ่งกลุ่มสองขั้นตอนโดยอาศัยสัดส่วนความน่าจะเป็นจากจำนวนครัวเรือนในระดับอำเภอ ได้กลุ่มบล็อกสำมะโนประชากรจำนานทั้งสิ้น 303 กลุ่มโดยแต่ละกลุ่มมี 150 ครัวเรือน จากนั้นจึงสุ่มได้ 16 ครัวเรือนจากแต่ละกลุ่มบล็อกสำมะโนประชากร การศึกษาครั้งนี้ใช้ข้อมูลปฐมภูมิในกลุ่มเด็กอายุต่ำกว่าห้าปีจำนวน 1655 ราย ที่ได้จากมารดาหรือสมาชิกในครอบครัวอื่นๆซึ่งเป็นตัวแทนครัวเรือน ดำเนินการวิเคราะห์ Bivariate ด้วยการทดสอบ Chi-Square การประมาณค่าด้วย Crude Odd Ratio และการวิเคราะห์แบบหลายตัวแปรด้วย Binary logistic regression

ความชุกของโรคอุจจาระร่วงในเด็กอายุต่ำกว่าห้าปีมีค่าเท่ากับ 18.9% พบความเสี่ยงต่อการเกิดโรคดังกล่าวสูงขึ้นในเด็กที่มารดามีการศึกษาในระดับต่ำ อาศัยอยู่ในชนบท ไม่มีห้องส้วม ใช้บริการสุขภาพจากสถานบริการสุขภาพของรัฐในชุมชนที่ให้บริการสำหรับผู้ป่วยนอก เด็กที่มีอายุระหว่าง 6 - 23 เดือน และ ที่ดื่มนมแม่พบว่ามีความเสี่ยงต่อการเกิดโรคอุจจาระร่วงมากที่สุด พฤติกรรมการล้างมือของมารดามีความสัมพันธ์กับการเกิดโรคท้องร่วงในเด็กอย่างมีนัยยะสำคัญ (p - value <0.001) มารดาวัยรุ่นมีความเสี่ยงต่อการเกิดโรคท้องร่วงในเด็ก (p - value 0.042) และพบว่ามีมารดาที่ไม่ล้างมือด้วยสบู่ในสัดส่วนที่สูง (15.8%) การใช้แหล่งการดื่มน้ำที่ไม่ปลอดภัยและน้ำที่มีคุณภาพต่ำมีความสัมพันธ์กับโรคท้องร่วงในเด็ก (p - value <0.001 และ 0.005) ครัวเรือนที่ใช้แหล่งน้ำร่วมกัน ใช้ภาชนะบรรจุน้ำเปิดฝา เปิดท่อระบายของเสีย และไม่ใช้ถังบำบัดน้ำเสียพบว่ามีความเสี่ยงสูงขึ้นต่อการเกิดโรคท้องร่วงในเด็ก

การจัดบริการสุขภาพสำหรับเด็ก เช่น การสอนเรื่องการให้นมแม่เพียงอย่างเดียว, การให้อาหารและวิตามินเสริม, การฉีดวัคซีนป้องกันโรคหัด ยังไม่เพียงพอในการป้องกันการเกิดโรคอุจจาระร่วงในเด็กอายุต่ำกว่าห้าปี ข้อเสนอแนะการวิจัยคือควรมีการให้สุขศึกษาแก่มารดาและส่งเสริมการใช้แหล่งน้ำดื่มที่ปลอดภัย การใช้ส้วม และการสุขาภิบาลในครัวเรือน ควรดำเนินโครงการ/กิจกรรมเพื่อแก้ไขปัญหาในพื้นที่ชนบทที่ประสบความยากลำบากเรื่องแหล่งน้ำดื่ม เนื่องจากโรคอุจจาระร่วงเป็นโรคติดต่อผ่านทางน้ำที่มีการปนเปื้อนอุจจาระ จึงควรมีการทดสอบห่วงโซ่ของการติดต่อของโรคนี้ในเด็กสำหรับการวิจัยในอนาคต

สาขาวิชา: สาธารณสุขศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา: 2553 ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก .....

ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์ร่วม .....

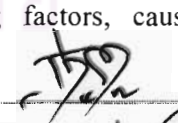
##5379118253 MAJOR PUBLIC HEALTH
KEYWORDS: FACTORS/DIARRHEA/CHILDREN/BANTEN/INDONESIA

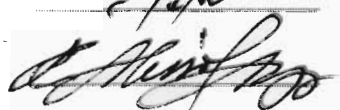
NIDA ROHMAWATI: FACTORS ASSOCIATED WITH DIARRHEA AMONG UNDER-FIVE YEARS OLD CHILDREN IN BANTEN PROVINCE INDONESIA: A SECONDARY ANALYSIS OF INDONESIAN NATIONAL SOCIO-ECONOMIC SURVEY 2007 AND BASIC HEALTH RESEARCH 2007. ADVISOR: ALESSIO PANZA, M.D., M. Com. H., DTM&H, CO-ADVISOR: ASSOCIATE PROFESSOR SOMRAT LERTMAHARIT, M.Sc., M. Med. Stat.,102 pp

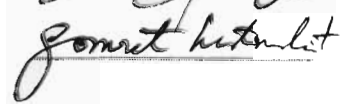
This study was a secondary analysis of two surveys in Indonesia, Indonesian National Socio-economic Survey 2007 and Basic Health Research 2007. Related variables from these surveys were used to examine factors associated with diarrhea among under-five years old children in Banten Province, Indonesia. Primary data sources were consist of household economic, individual economic and health information. A two stage sampling was done using probability proportional to the number of households in district/city. There were 303 census blocks selected by random sampling which each block consist of 150 households. Then, from each census block 16 households randomly selected as the sample of household. Each household member became respondent of primary data collection. This study used the data of 1655 children under-five years old along with data of their mothers and households. Bi-variate analysis was done with Pearson's Chi-square test, crude odds ratio for risk estimation, and multivariate analysis being done using binary logistic regression.

The prevalence of diarrhea among under-five years children was 18.9%. The highest risk was in children age 6-11 months, lower education mother (p-value 0.001) and without gender influences. Mother's defecation place and hand washing behavior has strong association with diarrhea in children (p-value < 0.001 and <0.001). Teenage mothers were found have high risk of having children with diarrhea (p-value 0.042) and also high proportion of never practiced hand washing with soap (15.8%). Using unsafe drinking water source and not good physical quality of drinking water were associated with diarrhea in children (p-value < 0.001 and 0.005). As well as the household that shared in the use of drinking water source and latrine, use open water container, open liquid drainage channel and did not use septic tank for feces landfills. Percentage of children's diarrhea was higher in rural area, but after controlling other variables, urban area has 0.6 more likely develop diarrhea in children.

Child health care, such as exclusive breast feeding, food and vitamin A supplementation, measles immunization were not enough to prevent the under-five years old children suffer from diarrhea. Health educations, especially for teenage mother, and promote the use of safe drinking water source, latrine and household sanitations are recommended. Specific intervention should be implemented for rural area with difficulties to get drinking water source. Longitudinal study is needed to identify confounding factors, causal relationships and seasonal differences in the epidemiology of diarrhea.

Field of Study : Public Health **Student's Signature:** 

Academic Year : 2010 **Advisor Signature:** 

Co-advisor Signature: 

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ASABRI	*Asuransi Angkatan Bersenjata Republik Indonesia* (Republic Indonesia Army Insurance)
Askeskin	*Asuransi Kesehatan Masyarakat Miskin* (Insurance for poor people)
BHR	Basic Health Research
CSB	Central Statistic Board
DHS	Demographic Health Survey
HWWS	Hand Washing With Soap
IDHS	Indonesia Demographic and Health Survey
IU	International Unit
Jamsostek	*Jaminan sosial tenaga kerja* (Labor social security)
JPKM	*Jaminan Pemeliharaan Kesehatan Masyarakat* (Community Health Insurance)
KMS	*Kartu Menuju Sehat* (Card Towards Healthy)
MICS	Multiple Indicator Cluster Survey
MoH	Ministry of Health
NICPS	National Indonesia Contraceptive Prevalence Survey
NSS	National Socio-economic Survey
ORS	Oral Rehydration Solution
ORT	Oral Rehydration Therapy
PATH	Program for Appropriate Technology in Health
PNPM	*Program Nasional Pemberdayaan Masyarakat* (National Program for Community Empowerment)
P.T. ASTEK	*Perseroan Terbatas Asuransi Tenaga Kerja* (Labor Insurance Government Company)
P.T. ASKES	*Perseroan Terbatas Asuransi Kesehatan* (Health Insurance Government Company)
RHF	Recommended Home Fluids

Riskesdas	*Riset Kesehatan Dasar* (Basic Health Research)
SCB	Statistic Center Board
STMB	*Sanitasi Total Berbasis Masyarakat* (Community Based Total Sanitation)
Susenas	*Survei Sosio-ekonomi Nasional* (National Socio-economic Survey)
UNFPA	United Nations Population Fund
VAD	Vitamin A Deficiency
WHO	World Health Organization

CHAPTER I
INTRODUCTION

1.1. Background

1.1.1. Child Morbidity and Mortality

Diarrhea is one of the causes of the highest mortality and morbidity in children, especially in children younger than 5 years. In the world, as many as 6 million children die each year from diarrhea, where most deaths occur in developing countries (Parashar U. D. et. al., 2003). Based on the WHO report, deaths due to diarrhea in developing countries is estimated to have declined from 4.6 million deaths in 1982 to 2 million deaths in 2003 (WHO, 2003), which translates to 18% of deaths of children under the age of 5 between 2000-2003 (Usfar, A. A., 2010), mostly among young children in developing countries (Kermani, 2010).

Diarrheal diseases can be caused by numerous pathogens and transmitted through multiple vehicles. Persons living in developing countries with poor access to safe water, sanitation, or hygiene infrastructure have increased risk of exposure to viral, bacterial, and parasitic pathogens that can cause diarrheal diseases (Arvelo, 2010, N.A. Kermani, 2010).

Globally, children aged less than five years experience, on average, 3.2 episodes of diarrhea every year and consequently 1.87 million children will die from dehydration associated with diarrheal disease. In Indonesia it was reported that each child has diarrhea 1.3 episodes per year (MoH, 2003a). Indonesia contributed 39.000 deaths due to diarrhea in developing region of the world (Pinto, 2008).

Table1. The country was accounting for three-quarters of deaths due to diarrhea in developing regions of the world in 2004.

Country	WHO Sub-region	Deaths due to diarrhea (thousands)
India	SEAR D	535
Nigeria	AFR D	175
Democratic Republic of the Congo	AFR E	95
Ethiopia	AFR E	86
Pakistan	EMR D	77
China	WPR B	74
Bangladesh	SEAR D	69
Afghanistan	EMR D	65
Indonesia	SEAR B	39
Angola	AFR D	34
Niger	AFR D	33
Uganda	AFR E	28
Myanmar	SEAR D	26
United Republic of Tanzania	AFR E	25
Mali	AFR D	24
Total of 15 countries		1384

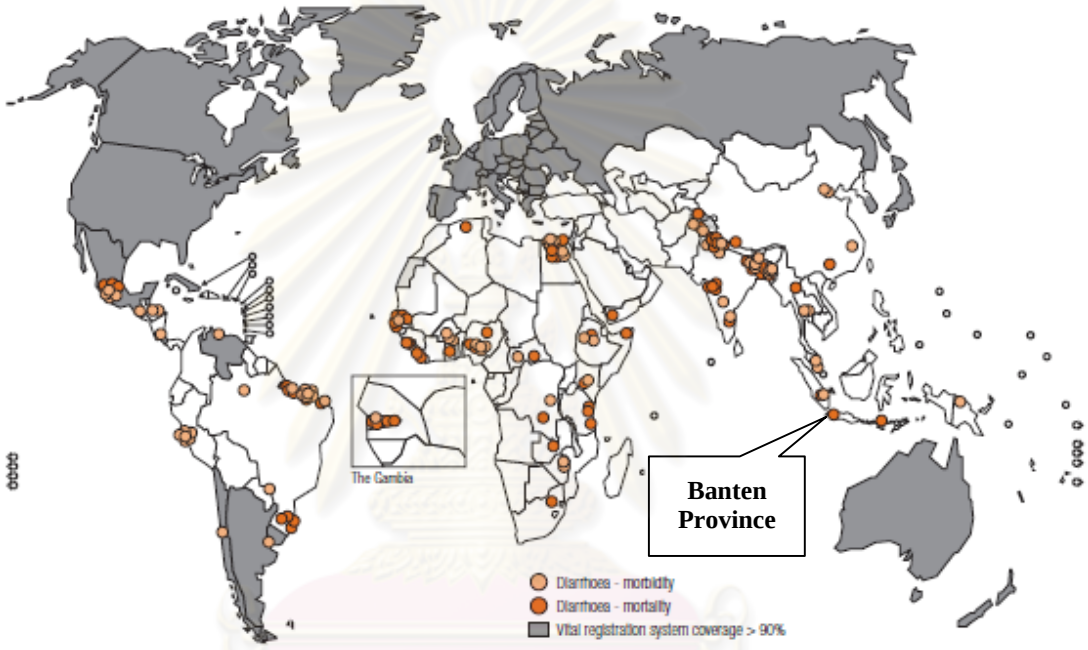
AFR=African region, AMR=Region of the Americas, EMR= Eastern Mediterranean region, SEAR= South-east Asia region, WPR= Western pacific region
A=very low child and very low adult mortality, B= low child and low adult mortality, C= low child and high adult mortality, D= high child and high adult mortality, E=high child and very high adult mortality.
Source: Bulletin of the World Health Organization, September 2008

In Indonesia, the death rate from diarrhea has declined sharply. Based on the results of household surveys, diarrhea mortality is estimated to decline from 40% in 1972 to 26.9% in 1980, 26.4% in 1986 to 13% in 2001 of all cases of death (MoH, 2003a).

Although the death rate from diarrhea has decreased, morbidity remains high because of diarrhea, both in developed countries and developing countries. Based on the Demographic Health Survey of Indonesia (IDHS) in 2002 - 2003, the prevalence of diarrhea in children less than 5 years was 0.8% in male and 11.2% in female, by age, the highest prevalence at age 6-11 months (19.4%), 12-23 months (14.8%) and 24-35 months (12.0%), (CSB, 2003).

According the Bulletin of the World Health Organization 2008, the highest mortality due to diarrhea in Indonesia occurred in Nusa Tenggara Timur (East Southeast Nusa) and Banten Province.

Figure1. Distribution of diarrhea epidemiological study



Source: Bulletin of the World Health Organization 2008

The prevalence of diarrhea among 12-23 months children in rural Banten Province, Indonesia was 19%, with a higher prevalence in urban areas. Seventy percent of all cases of diarrhea in children may be attributed to food contamination. The incidence of diarrhea increases after the introduction of complementary food due to the unhygienic preparation of weaning food, especially in children aged 6 to 24 months (Usfar, A. A., 2010). Banten is not only one of the contributors the diarrhea mortality, but also the lowest use of ORS. Use of ORS in Indonesia is still low (54 %), the lowest is in Banten Province 29.4% (MoH, 2008).

The combined effects of inadequate sanitation, unsafe water supplies, and poor personal hygiene are responsible for 88% of childhood deaths from diarrhea. As a

consequence of poor feeding and repeated infections, one-third of children under the age of 5 in developing countries were estimated to be stunted in 2005. Due to its overwhelming long-term consequences, which affect not only physical growth, but also cognitive ability, productivity, and economic return, tackling diarrhea should be prioritized. Hence, factors contributing to diarrhea among children in the community should be identified (Usfar, A. A., 2010).

1.1.2. Banten Province

Banten province is one of 33 provinces in Indonesia which was before the year 2006 as one of the region of West Java Province (Banten Provincial Health Office, 2009). Banten province has the urban areas because it borders the capital city of Jakarta, industrial areas, and rural areas which are the coastal and mountains area.

The total area of Banten Province is 8,800.83 km^2. Located at astronomical boundary 105^0 1'11"-$106^0$7'12" East Longitude and $5^0$7'50"-$7^0$1'1" South Latitude. Temperatures in coastal and hilly areas range are between 22^0C and 32^0C, while temperatures in the mountains with an altitude between 400 to 1.350 m can be reached between 18^0C - 29^0C. Banten Province borders are:

1. North side is bordered by the Java Sea
2. East side is bordered by Jakarta Province and West Java Province
3. South side is bordered by the Indian Ocean
4. West side is bordered by the Sunda straits

Total population in 2008 is 9,602,445 peoples consisting of 50.50% male and 49.50% female. This number is an increase of 178.939 peoples from in 2007. Population growth occurred in Tangerang district of 100.777 people or an increase in 2.90% of total population in 2007. In 2007 the number of infant deaths was 801 and in 2008 reached 895 people (Banten Provincial Health Office, 2009)

Figure2. Map of Banten Province

Source: Indonesia Demographic and Health Survey, 2008

In 2007, Banten Province has 2 municipalities (Tangerang city and Cilegon city) and 4 districts (Tangerang district, Serang district, Lebak district and Pandeglang district). But, in 2010 the areas have been splited in to 8 local government areas (Tangerang city, Cilegon city, Serang city and Tangerang district, Serang district, Lebak district, Pandeglang district and South Tangerang district). This study is still use 6 local government areas.

1.2. Rationale

A number of socioeconomic, environmental, and biological factors influence infant and child mortality. The proximate determinants which are factors that affect mortality directly include: maternal characteristics such as age, parity, and birth interval; environmental contamination; nutrition; injury; and personal illness. Socioeconomic factors operate through the proximate determinants (SCB, 2007a).

In the 2007 IDHS, mothers of children who had diarrhea were asked about what was done to treat the illness. Fifty one percent of children under five with diarrhea in the two weeks preceding the survey were taken to a health facility or provider, similar to the percentage reported in the 2002-2003 IDHS. Treatment of diarrhea varies by age of child. Infants under 6 months are the least likely to be taken to a health facility or provider

compared with other age groups. Male children are slightly more likely to be taken to a health facility or provider than female children. Mother's level of education and the socioeconomic status of the household are related to whether young children receive treatment for diarrhea. The higher the mother's level of education and the higher the household wealth quintile, the more likely it is that children with diarrhea are to be taken for treatment to a health facility or provider (SCB, 2007a).

The Millennium Development Goals (MDGs) were adopted in 2000 with the aim of reducing the severe gaps between rich and poor populations. Most countries have endorsed Goal 4 of the MDGs to "*reduce by two thirds* [between 1990 and 2015] *the mortality rate among children under-five*". Reliable information on the magnitude, patterns and trends of causes of death of children aged less than 5 years helps decision-makers to assess programmatic needs, prioritize interventions and monitor progress. It is also crucial for planning and evaluating effectiveness of health services and interventions. Yet, data are very scarce in low-income settings where they are most needed and estimations are necessary for these areas (Pinto, 2008)

Diarrhea among children is disease that can be prevent by giving sufficient essential child health care such as exclusive breast feeding, immunization, nutrition and growth monitoring and good sanitation. Diarrhea can easily treat at home or by health provider at primary care unit. But from the last Survey in Indonesia, IDHS 2007 and BHS 2007 found that the prevalence of diarrhea for children < 1 year old was 16.5% and 1-4 year old was 16.77%.

Diarrheal disease control can not only be done by the Ministry of Health and Provincial and District Health Office in the area. The problem of diarrhea associated with the availability of clean water, latrines, waste water disposal, hand washing habits, level of education is also associated with economic level. It is important to find the factors and association within child health care, household characteristic regarding the sanitation and health services utilization and between diarrhea and mother health behavior and mother socio-demographic.

In the year 2007 has made 2 national surveys of the National Socio Economic Survey and Basic Health Research. These two surveys can be utilized to analyze the factors associated with diarrheal disease in children under five in Banten province in 2007. Hopeful, it can be useful for planning, decision making, for revised the technical guidelines combating diarrhea, cross-sector coordination and advocacy to relevant departments.

1.3. Research questions

What factors are significantly associated with diarrhea among under-five years old children in Banten Province, Indonesia?

1.4. Statistical Hypothesis (null hypothesis)

1. There is no association between child socio-demographics, health care, and nutritional status factors and diarrhea among under five years old children in Banten Province, Indonesia
2. There is no association between mother socio-demographic, hand washing and defecation behaviors, and health services utilization factors and diarrhea among under five years old children in Banten Province, Indonesia
3. There is no association between drinking water, sanitation and house characteristic factors and diarrhea among under five years old children in Banten Province, Indonesia

P-value of ≤ 0.05 will be considered statistically significant.

1.5. Study Objectives

1.5.1. General objective:

To determine factors which are significantly associated with diarrhea among under-five years old children in Banten Province, Indonesia.

1.5.2. Specific objectives:

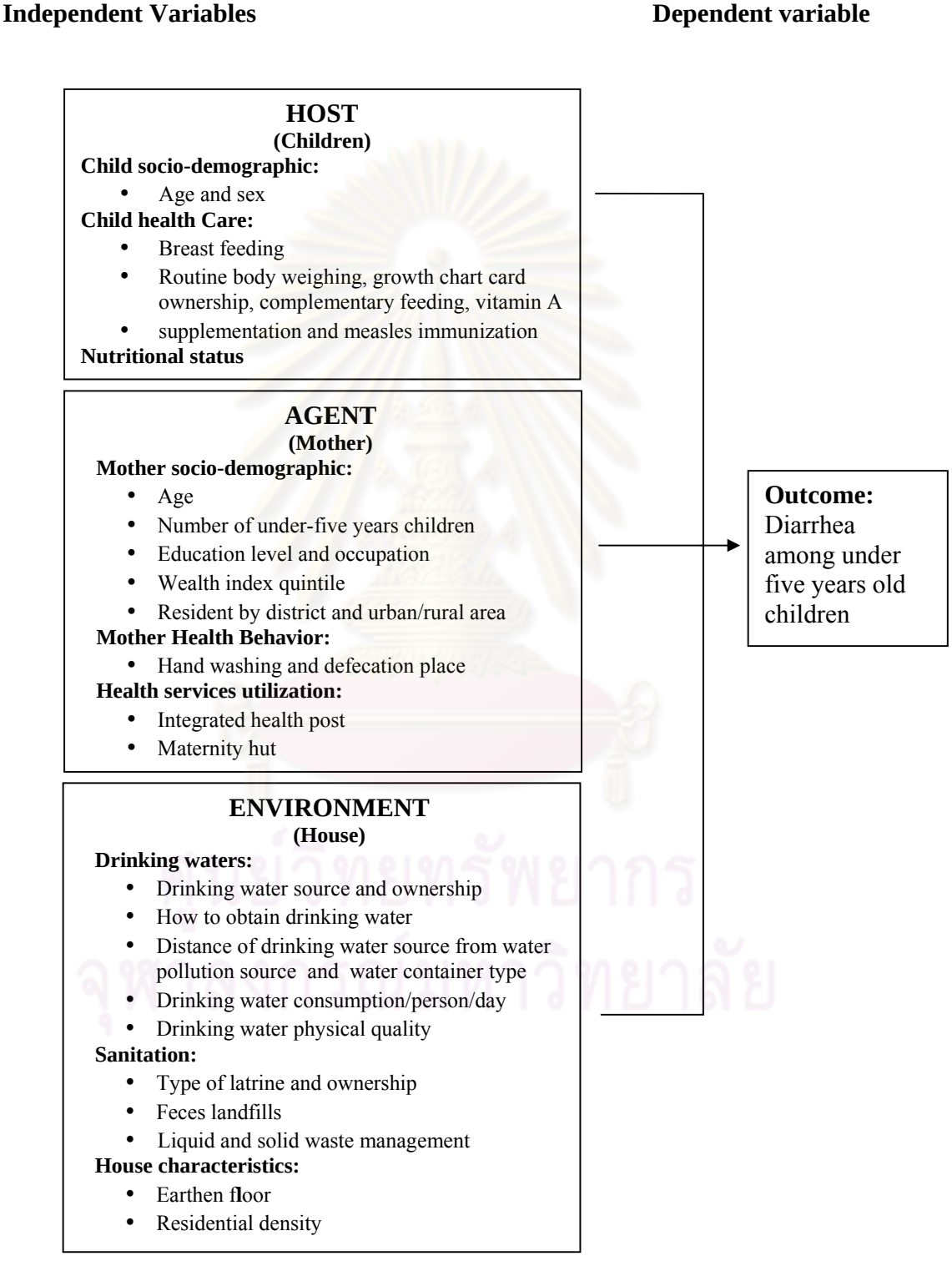
1. To explore the association between child socio-demographics, health care and nutritional status factors with diarrhea among under five children in Banten Province, Indonesia
2. To explore the association between mother socio-demographics, hand washing and defecation behaviors, and health services utilization factors with diarrhea among under five children in Banten Province, Indonesia
3. To explore the association between drinking water, sanitation and house characteristic factors and diarrhea among under five children in Banten Province, Indonesia

1.6. Conceptual Framework

Diarrhea is a communicable disease caused by viral or bacterial. The transmission of diarrhea disease is through food or water consumed by the host. It is called water born or food born disease. The clinical symptom of diarrhea is the result of an intricate relationship between the infectious agent (virus, bacteria, or other), the host's immune response, the management and environmental factors imposed on the host. (John C. Harding, 2005).

In this study, the agent is define as the mother as the under-five years old children care taker, who can spread the diarrhea bacteria or virus to the children. The host is the children his/her self, and the environment is the household physical conditions. This study is only to find the association between the host, agent and environment factors that are associated to diarrhea, not to study the interaction between the host, agent and environment.

Figure 3. Conceptual Framework



1.7 Operational Definitions

1.7.1 Outcome

- **Diarrhea.** Diarrhea is a disease characterized by a water stool more than 3 times a day, with the smooth or liquid feces consistency. It is calculated as the sum to the two questions B10 and B11 in appendix A.

1.7.2 Host

- **Child age.** Child age was defined as the age of the children in days or months at the moment of the survey
- **Child sex.** Child sex was divided as male and female.
- **Exclusive breast feeding**. Exclusive breast feeding was define as no food or liquid other than breast milk, not even water, is given to the infant from birth until six months of age.
- **Measles immunization** was the process of inducing immunity to rubella/measles virus. A recommended schedule of measles immunizations for infants in Indonesia at 9 months of age.
- **Routine body weighing.** Body weighing was measure the under five years old children weight regularly once a month in the integrated health post or other health facilities and the result is recorded on WHO standard growth charts card. It is defined as routine body weighing if it is done every month in the past 6 months.
- **Growth chart card ownership.** Growth chart card ownership was defined as the children who have WHO standard growth chart card separately or insert in Maternal and Child Health Handbook.
- **Vitamin A supplementation.** Vitamin A supplementation was giving 100,000 IU of vitamin A for infants aged 6-11 months and 200,000 IU for children aged 12-59 months in the integrated health post or other health Facilities within last 6 months.

- **Complementary feeding.** Complementary feeding was defined as provision of food by the Public Health Center for children 6-24 months who suffer from malnutrition for 90 days.
- **Nutritional status.** Nutritional status of children was measured by age, body weight and height. Weight of children were weighed with digital scales that have a precision 0.1 kg, body length was measured with a length-board with a precision 0.1 cm, and height were measured by using micro-toise with 0.1 cm precision. To assess the nutritional status of children, then the weight and height converted into standardized values (z-score) using a standard anthropometry WHO, 2006. The criteria is:
- **Weight for age z-score** was a nutritional status indicator of weight and age of a child expressed in standard deviations from the median of the NCHS-CDC reference population. This was classified as : < -3 SD (severe underweight). 3 to < -2 SD (underweight), -2 to ≤ 2 SD (normal), > 2 SD (overweight).
- **Height for age z-score** was a nutritional status indicator of height and age of a child expressed in standard deviation from the median of the NCHS-CDC reference population. This was classified as: < -3 SD (severe stunting), ≥ -3 to < -2 SD (stunting), ≥ -2 SD (normal).
- **Weight for height z-score** was a nutritional status indicator for weight and height of a child expressed in standard deviations from the median of the NCHS-CDC reference population. This was classified as: < -3 SD (severe wasting), ≥ -3 to < -2 SD (wasting), ≥ -2 to ≤ 2 SD (normal), > 2 SD (overweight).

1.7.3 Agent

- **Mother age.** Mother age was defined as the age of mother in year on the day of the survey.

- **Mother education level.** Mother educational level was defined as the completed formal education of mother [illiterate, not complete elementary school, elementary school (grade 1-6), junior high school (grade 7-9), senior high school (grade 10-12), and college].
- **Mother occupation.** Mother occupation was divided as jobless, students, housewives, army or police women, government employees, employees of state enterprises, private employees, private business/traders, services providers, farmers, fishermen, laborers and other.
- **Number of under five children** was define as how many children age under-five years live in the household regarding they were from same mother or not.
- **Hand washing.** Hand washing behavior was defined as the behavior of hand washing before eating, before preparing food, after defecation, after clean up a child's stool, and holding animals.
- **Defecation place.** Defecation place was classified as latrine, pond/wetland/ ditch, river/lake/sea, ground holes, beach/field/ garden/courtyard and other.
- **Integrated health post.** Integrated health post was a center in the village that opens once a month at a house or public place which provide children body weighing, immunization, growth and development detection, ante natal care for pregnant women, family planning services and diarrhea treatment. Integrated health post manned by health care volunteer and health provider.
- **Maternity Hut.** Maternity hut was a house in the village as one of the community-based health participations which is a concrete manifestation of the role of society in providing a rescue service delivery and other maternal and child health, including family planning in the village and serves an out-patient for basic health services. The maternity hut is manned by a midwife may be offered in a room in her house or in a structure in that is the property of and was built by the village government.

1.7.4 Environment

- **Drinking water source and water container.** Type of drinking water sources were classified with bottled water, tap water, drilling wells, pump wells, unprotected wells, unprotected wells, unprotected springs, protected springs, river water, rainwater and other. Water container is classified by Drinking water reservoirs are classified with an open container, closed container, no container, drink immediately.
- **Distance of drinking water source to water pollution source.** There was water pollution source is if in the vicinity of water sources originating from ground water (dug wells, pump wells, springs) there are sources of water pollution (waste water/pit latrine/septic tank/solid waste dump) that will affect the quality of water within a radius of <10 meters.
- **Drinking water consumption/person/day.** Drinking water consumption was defined as the volume of water that is usually used for the purposes of all activities of household members in a day, for drinking, cooking, bathing, washing, and for other purposes such as defecation, washing utensils, washing vehicles and watering the plants. When using water from the piped source, ask how many cubic meters of water consumption within a month as stated in the accounts, then divided by the number of days within a month (30 days). When using sources from dug wells or hand well pumps, how many buckets of use in a day. When using the electricity well pump and use water tank, how many times a day and night to fill water tank and note how many liters of tank volume. When using more than 1 source of water (in combination), add the volume of water according to the type of used. Then, the result is divided by the number of household members. Criterion for enough water for personal consumption is $\geq$ 20 liters per person/day.
- **Ease to get drinking water** was classified as easy to getting drinking water, difficult during dry season and difficult for all year round

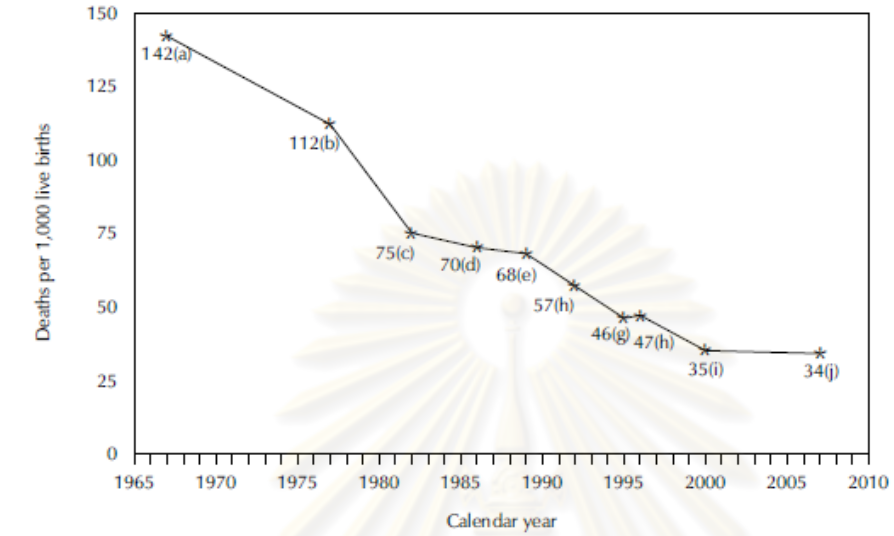
- **How to obtain drinking water** was classified as buy and do not buy the drinking water
- **Physical quality of drinking water.** Physical quality of drinking water was classified by cloudy, colored, tasty, frothy, smelly, and remain is classified as good.
- **Type of latrine.** Type of latrine is classified by latrine type was classified with swan neck, pour-flush latrine, pit latrine or without latrine.
- **Liquid waste management.** Liquid waste management is defined as disposal of liquid waste at household level as open or closed.
- **Solid waste management.** Solid waste management was defined as disposal of solid waste at household level, indoor and outdoor as open, closed or none.
- **Earthen floor.** Earthen floor is defined as the floor of the house that was not made by cement, tile, ceramic or wood, but only ground.
- **Residential density (in-house over-crowding).** Residential density was defined as the density of household which calculate by divided the house floor area per square meter and the number of family members. In-house over crowded is if 1 person less than 8 square meters.

CHAPTER II
LITERATURE REVIEW

Diarrheal diseases account for nearly 20% of deaths in children 0-4 years of age, with 49% of these deaths attributable to acute watery diarrhea. The child mortality rate in Ethiopia in 2007 was 199 per 1,000 births, and approximately one of every five deaths every year in Ethiopia is due to diarrhea disease (Rishi, 2010). In northeastern Brazil, childhood mortality exceeds 14% during the first 5 years of life, and more than 50% of these recorded deaths are associated with diarrhea. In rural northeast Brazil 22/1000 children less than 1 year of age die of diarrhea1 diseases and attack rates of diarrhea are higher in urban poor than among rural poor. Children living in urban slums in northeastern Brazil describe rates of 14 to I6 diarrhea1 episodes per child per year (Siegel, R. R, 1996).

In Indonesia, infant mortality declined from 46 deaths per 1,000 live births in 1993-1997 to 34 per 1,000 in 2003-2007 from 35 deaths per 1,000 live births to 34 per 1,000. In the same period, under-five mortality declined from 58 deaths per 1,000 live births in 1993-1997 to 44 per 1,000 in 2003-2007 (SCB, 2007a).

Figure 4. The decline in the infant mortality rate has slowed in recent years in Indonesia.



Source: Indonesia Demographic and Health Survey 2007

2.1. Child Socio-demographic and child health care

Acute respiratory infection, diarrhea, and malaria are common causes of childhood death. In the two weeks before the IDHS 2007, 11% of children had diarrhea in the two weeks preceding the survey, 45% of whom were taken to a health provider (SCB, 2007a).

During outbreak of diarrhea, children with diarrhea were significantly less likely than children without diarrhea to be breastfed before developing diarrhea (Arvelo, 2010). Children who were breastfed and not completely weaned had half the risk of developing diarrhea than children who were not breastfed and not completely weaned. Further analysis revealed that children, aged 1-6 months, who were breastfed and not completely weaned, had a lower risk of acute diarrhea, with the same trend for children aged 13-24 months. However, children, aged 7-12 months, who were has breastfed had a higher risk of diarrhea (Rishi, 2010).

Breastfeeding is practiced almost universally in Indonesia, with 95% of under-five year old children having been breastfed for some period of time. However, only 44% of

babies are put to the breast within one hour of birth (as recommended), and a total of 62% of babies have begun breastfeeding within the first day after birth. The overall median duration of any breastfeeding is 22.3 months. But, exclusive breastfeeding is not widely practiced in Indonesia. Despite the government's recommendation that infants receive breast milk exclusively through the first 6 months of life, only 48% of infants under-two months of age are exclusively breastfed. At age 4 to 5 months, just 18% percent of infants are receiving breast milk only, without complementary foods. Overall, less than one in three infants under age 6 months (32%) was breastfed exclusively. This is lower than the level of exclusive breastfeeding reported in the 2002-2003 IDHS (40%). Male children, children of uneducated mothers and of mothers with secondary or higher education, and children in the highest wealth quintile have the lowest median duration of any breastfeeding, compared with other children (SCB, 2007a).

The World Health Organization recommends the introduction of solid food to infants around the age of six months because by that age breast milk by itself is no longer sufficient to maintain a child's optimal growth. Appropriate complementary nutrition includes feeding children a variety of foods to ensure that nutrient requirements are met. In the transition to eating a healthy diet, children age six months or older should be fed small quantities of solid and semisolid foods throughout the day. During this transition from breastfeeding to complementary feeding at ages 6-23 months, the prevalence of malnutrition among young children increases substantially in many countries. This phenomenon is attributed primarily to increased infections and poor feeding practices. The percentage of children receiving solid or semisolid food increases gradually by age. It is encouraging to note that at 6-8 months of age more than eight in ten children are consuming solid or semisolid food. However, the introduction of other liquids such as water, juice, and infant formula takes place earlier than the recommended age of six months. Even among the youngest group of breastfeeding children (<2 months), 33% receive infant formula in addition to breast milk. More than half (53%) of children age 4-5 months have started consuming solid or semisolid food. The early introduction of water

and foods increases the risk of infections, and thus contributes to malnutrition (SCB, 2007a).

The children have started supplemental feeding, defined as food or liquid that was not breast milk, were 2.70 times more likely to develop diarrhea than children who had not yet started supplemental feeding. Children, aged 7-12 months, who received food supplementary has a higher risk of diarrhea (32% cases vs. 22% controls). There were no differences between the cases and the controls with respect to when supplemental feeding was started, the amount of time children was breastfed, and the presence of bottle feeding (Rishi, 2010).

Supplementing with infant formula at any age is relatively common in Indonesia, with breast feeding children age 6-17 months being the most likely to consume it (29% - 30%). At age 6-8 months, children are more likely to consume foods made from grains—80% of breastfeeding children and 79% of non-breast feeding children—than other types of solid or semisolid foods (IDHS, 2007). Cleanliness of water to present the formula and the hygiene of bottles used affecting diarrhea diseases in children (SCB, 2007a).

In general, the prevalence of under nutrition among under-five children in Banten Province is 14.1%, and is above the boundary condition is considered serious (10%). All children in the district in Banten province is in serious condition according to the nutritional status indicator weight /height with under nutrition prevalence above 10%. Even the two districts (Lebak and Tangerang City) prevalence above 15% (Health Research and Development Board, 2008).

Integrated health post is the health services include child growth monitoring, immunizations, management and treatment of diarrhea and other childhood diseases, information, education and communication on family planning, and treatment of illnesses. During the first visit, each child receives a health card (*Kartu Menuju Sehat, KMS*) that contain child growth chart. During the mother's first antenatal care visit, she receives a maternal and child health book (*Buku Kesehatan Ibu dan Anak*), which is used to record basic information on the mother and her child. The information on the child includes birth weight, monthly weight, and type and dates of immunizations. Finally,

information about the child's immunizations is recorded in a registration book maintained by the field administrator of vaccines. Even though most mothers are aware of the importance of keeping the health card/book at home for their records, to be able to monitor their child's growth and keep track of immunizations, not all keep these documents for their records. Furthermore, not all infants receive postnatal care and therefore not all have a health card. Overall, 51% of children 12-23 months were fully immunized. Sixty-seven percent of children age 12-23 months received immunization against measles and 11% children 12-23 months did not receive any vaccinations at all (SCB, 2007a).

The frequency weighting in the past 6 months of under-five children are grouped into weighed ≥ 4 times, weighed 1-3 times and never weighed. Under-five children weighed in Banten province was 41.4 percent and who never weighed 21.9%. Growth chart card ownership is higher in families living in urban areas (28.7%) than in rural areas (15.1%). There is a tendency that growth chart card ownership higher in the age group 6-11 months (41.7%) and declined sharply in the older age group (Health Research and Development Board, 2008).

A higher prevalence of diarrhea was identified in children aged over 6 months and in those who had no immunization or follow-up cards in Saudi Arabia (Ahmed et al., 2002). In Indonesia, basic immunization coverage (BCG, Polio 3, DPT 3, Hepatitis B 3 and Measles) in Banten Province is still low, complete immunization (26.1%), incomplete immunization (60.0%) and did not get immunization (13.9%), it was below the national target (80.5%). Lebak Regency is the area with the lowest basic immunization coverage in Banten Province with did not get immunization 23.8% (Health Research and Development Board, 2008).

Micronutrient deficiency has serious consequences for childhood morbidity and mortality. Vitamin A is an essential micronutrient for the immune system. Severe vitamin A deficiency (VAD) can cause eye damage. VAD can also increase the severity of infections such as measles and diarrheal diseases in children and can slow recovery from illness. Periodic dosing (usually every six months) of vitamin A supplements is one

method of ensuring that children at risk do not develop VAD. Sufficient supply of vitamin A through diet or supplementation has an important role in preventing morbidity and mortality in children in developing countries (Glasziou P. P. and Mackerras D. E. M., 1992)

Some researchers have been carried out to find the mechanism of vitamin A on diarrhea prevention. Vitamin A supplementation can reduce diarrhea and respiratory infection maybe because of the effect of immune response regulation (Longi K. Z. et al., 2007). There is interrelationships between the immune system and some micronutrients (vitamins A, E, B_6 and B_{12}, folic acid, Fe, Zn and Se). Optimization of micronutrient supply improves immune competence (Ströhle, A. and Hahn, A., 2009). Those vitamin and minerals have role in supporting the body's natural defense system and restoring resistance to infections by enhancing the three levels of immunity: epithelial barriers, immune cells and antibody. The immune system protects the body against pathogens and cancer cells, thereby protecting it against infections and diseases. Low levels of vitamins, minerals and trace elements may suppress immunity, predisposing individuals to infections, which in turn worsen the nutritional status, leading to a vicious cycle. Supplying the deficient micronutrients with the diet can re-establish immune function (Maggini S. et. al., 2008).

Sixty-nine percent of children age 6-59 months received a vitamin A supplement in the last 6 months of IDHS 2007. Children age 6-8 months are the least likely to receive the vitamin A supplements when compared with older children. Children living in urban areas, those born to highly educated mothers, children of mothers age 20 or older, and children in the highest wealth quintiles are more likely to have received vitamin A supplements in past 6 months than other children. Sixty-six percent of breastfeeding children received vitamin A supplements compared with 70% of non-breastfeeding children (SCB, 2007a).

In Indonesia, vitamin A capsules given twice a year in February and August, since the child is six months old. Red capsules (100,000 IU dose) was given to infants aged 6-11 months and a blue capsules (200,000 IU dose) for children aged 12-59 months.

Vitamin A capsule coverage is 72.3% in Banten Province, with variations of coverage that is not too much, the lowest in Tangerang City (67.9%) and highest in Serang (79.9%), (Health Research and Development Board, 2008).

2.2. Mother Socio-demographic and mother characteristics

The mother was primary caretaker for 87% of low socio-economic status (Siegel, R. R., 1996). Some of determinant of child morbidity and mortality related to mother socio-demographic. Maternal socio demographic factors have been associated with the risk of diarrhea in children. Children with young mothers have increase incidence or prevalence of diarrhea (Melo et al. 2008)

Although childhood mortality continues to decline slowly, or has leveled off in some groups, one in three births in Indonesia has an elevated mortality risk that is avoidable. These include births in which the mother is too young (under age 18) or too old (age 35 or older), the birth interval is too short (less than two years), or the mother has had too many prior births (three or more) (SCB, 2007a).

Education is a key determinant of the lifestyle and status an individual enjoys in a society. Studies have consistently shown that educational attainment has a strong effect on reproductive behavior, contraceptive use, fertility, infant and child mortality, morbidity, and attitudes and awareness related to family health and hygiene. Mother's educational attainment is inversely related to childhood mortality levels; children of less educated mothers generally have higher mortality rates than those born to more educated mothers. For instance, the infant mortality rate for children whose mothers had no education is 73 deaths per 1,000 live births, compared with 24 deaths per 1,000 live births for children whose mothers have secondary or higher education. Also it shows a wide gap in infant and childhood mortality rates between children whose mothers have the lowest and highest education levels (SCB, 2007a).

Mother's age at birth can affect a child's chances of survival. It shows that neonatal mortality rates and infant mortality rates exhibit the expected U-shaped relationship with mother's age high for women in the young age groups, low for women

in the middle age groups, and high for women in the older age groups. For example, the infant mortality rate for women under age 20 when they gave birth is 56 deaths per 1,000 live births. The rate decreases for women who gave birth at age 20-29 years and 30-39 (32 and 42 deaths per 1,000 live births, respectively), and then rises to 59 deaths per 1,000 live births for women who gave birth at age 40-49 years. The higher rates for younger and older women may be related to biological factors that lead to complications during pregnancy and delivery (SCB, 2007a).

Many diseases are easily transmitted through contaminated foods or from hand to mouth. Hand washing minimizes the transmission of both enteric (fecal) and respiratory pathogens. In the 2007 IDHS, respondents were asked whether they washed their hands before preparing meals for their family. The women reported that they washed their hands before preparing the meal for their family the last time 97%. There are almost no variations in hand washing practices by background characteristics (SCB, 2007a).

Household conditions, individual status, age, education level of fathers and parents' habit of hand washing before taking care of the child were major factors affecting the incidence of diarrhea (Black, 2008). Hand washing after contact with feces and before contact with food can reduce rates of diarrhea among the under fives by 42–47%. Factors found to be crudely associated ($p<0.05$ significance) with the occurrence of any hand washing activity after mother or child defecation were mother's ethnicity, mother's education, income of the household's highest earner, knowledge of the key times for hand washing, awareness of the benefits of vitamin A, disgust sensitivity, the child care index, where defecation occurred, and percentage of time the mother spent with the infant (Scott, 2007). The parents who did not report washing their own hands after using the toilet or latrine were more likely to develop diarrhea than children of parents who did report washing their own hands. It is well known that hand washing interventions plus provision of soap can reduce the incidence of diarrhea by up to 53% in developing world settings (Arvelo, 2010).

More than half the population in the province of Banten (67.4%) claimed to defecate in the toilet. However, if observed by district/city, the variations in the rates are

quite striking. Percentage of people who behave good bowel habit highest in Tangerang City (98.4%) and Cilegon (84.0%), it showed that almost 100% of the population already have a latrine, while the lowest percentage is in Lebak (41.5%). Correct behavior in hand washing, generally still less owned by residents of the province of Banten. Only 24% of the population has hand washing correctly (Health Research and Development Board, 2008).

Under-five year old children with diarrhea were preferentially brought to a private practitioner, whereas diarrhea patients of older age groups treated themselves in Kolkata, India (Dipika S., 2004). But, there is also study results show that private doctors are much less accessible than government health posts and centers, on one hand, then curers and/or midwives, on the other. This is true in terms of location, fee levels, and payment terms. Health posts and centers are by far the cheapest alternative. Midwives are the most commonly available type of provider, although many of them do not treat children. Curers are somewhat more expensive than health posts and centers than midwives, and are about as prevalent in or near these communities as health posts and centers (Noreen, 2002).

Mother is the mostly caregiver for under-five year old children. Many factors can prevent women or mother from getting medical advice or treatment. Knowing where to go, getting permission to go, getting money needed for treatment, distance to the health facility, having to take transport, not wanting to go alone, and concern that there may not be a female health provider (SCB, 2007a).

One of mother accessibility to health services is delivery with skill birth attendance. It is also assumed that mothers who had contact with health provider get health information. Forty six percent of births in the five years preceding the survey were delivered at health facility, 10% were delivered in a public facility (public hospital or health center) and 36% were delivered in a private facility. There has been an increase of 6% in the proportion of deliveries occurring in health facilities since the 2002-2003 IDHS (from 40% to 46%). The utilization of health facilities for delivery is considerably higher in urban areas (70%) than in rural areas (29%). Births to mothers who have no education

are much more likely to be delivered at home than births to mothers who have secondary education (81%) and higher education (28%), (SCB, 2007a).

According to accessibility of health services in Banten province, the percentage of households that less than 1 km from health facilities is 48.0% and 44.6% located 1-5 km and only 7.5% of households are more than 5 km. This condition can be said that 92.6% of households in Banten Province is less than or equal to 5 km from health care facilities. This condition is not different from the situation in Indonesia as a whole. The area with a population residing more than 5 km from the health service is in Lebak (30.4%) and Pandeglang (12%). This is in accordance with the geographical conditions of the two regions that form mountains. In terms of travel time to health services facility showed that 66.3% of the population can reach into the health service facility is less than or equal to 15 minutes, 24.2% between 16-30 minutes. It can be said 90.5% of households in Banten province to achieve the health-care facility within 30 minutes; the remaining 9.5% take more than half an hour to achieve the health facilities. This condition is not different from the situation in Indonesia in general. Areas with a travel time of more than 30 minutes to the highest health facilities in Lebak 29,7%, 18.4% next Pandeglang (Health Research and Development Board, 2008).

The percentage of households who use integrated health post service in rural areas is higher than that of urban areas. When viewed from the level of household expenditure per capita, it appears there is a tendency that the higher the level of household spending less and less use of integrated health post services. Overall in Banten province many types of services used by households is child weighing (90.2%) , immunization (51.8%), Vitamin A supplementation (50.5%), food complementary (39.6%), counseling (28.1%), family planning (25.7%), treatment (23.8%), ante natal care (20.3%), and consulting service for the risk of disease (8.4%), (Health Research and Development Board, 2008).

2.3. House characteristic

Studies have shown that unsafe water, sanitation and hygiene remain major causes of mortality and morbidity in the world through infectious disease with estimated deaths

of about 1.7 million per annum. Nine out of ten deaths are amongst children and almost all are in developing countries. In the poorest countries and neighborhoods, unsanitary living conditions account for at least half of the total burden of ill health. The water and sanitation-related health burden for children under the age of five in Africa, for instance, is up to 240 times higher than that of high-income nations (Noreen, 2002). The physical characteristics of the dwelling in which a household lives are important determinants of the health status of household members, especially children (SCB, 2007a).

Availability of safe water, reliable sewage disposal facilities, and good hand washing practices are essential in efforts to reduce diarrhea morbidity in developing countries, and are important for safe formula feeding or when exclusive breastfeeding with early weaning are practiced (Arvelo, 2010).

Increasing access to improved drinking water is one of the Millennium Development Goals that Indonesia along with other nations worldwide has adopted. Lack of ready access to a water source may limit the quantity of suitable drinking water that is available to a household. Even if the water is obtained from an improved source, water that must be fetched from a source that is not readily accessible to the household may be contaminated during transport or storage. Another factor in considering the accessibility of water sources is the fact that burden of fetching water often falls disproportionately on female members of the household (SCB, 2007a).

Households that stored water in containers with a narrow nozzle were less likely to develop diarrhea than households that stored water in containers with wide nozzles (Rishi, 2010), and the children who developed diarrhea were more likely to have lived in households that stored drinking water. Wide-mouth buckets, which are easily contaminated by hands or utensils, were the most commonly reported storage vessel for household drinking water (Arvelo, 2010).

Water consumption per person per day in the Banten province is 50.3% more than 100 liters (optimal access). When compared between districts/cities, the highest percentage of people with access optimal water consumption is the Tangerang city (68.3%) and Cilegon (60.8%), (Health Research and Development Board, 2008).

Beside the availability of clean water, availability of toilets is also greatly affect waterborne disease. Households without proper toilet facilities are more exposed to the risk of diseases like dysentery, diarrhea, and typhoid fever (SCB, 2007a).

The type of flooring material in the dwelling can be considered as both an economic indicator and a health indicator for household. Some floor materials like dirt or earthen floor pose health problems for the household because they are the natural environment of pests such as insects and parasites, and may be a source of dust. This kind of flooring is also more difficult to keep clean. In Indonesia, 13 percent of households have an earthen floor. Almost half of households (48 percent) live in dwellings with a concrete, brick, or tile floor, while 13 percent have a wooden floor. There are substantial urban-rural differentials by type of floor material. Whereas 50 percent of urban households have a concrete, brick, or tile floor, the proportion in rural areas is 46 percent. Conversely, 18 percent of rural households have an earthen floor, compared with 5 percent in urban areas (SCB, 2007a).

The proper disposal of children's stool is extremely important in preventing the spread of diseases. If feces are left uncontained, diseases may spread by direct contact or through animal contact. From the IDHS 2007data, show that 71% mothers of children under-five years old dispose of their youngest child's stools safely (that is, children use a toilet or latrine, the stools are rinsed into the toilet or latrine, the stools are buried, or disposable or washable diapers are used). Mothers report that one in four children always use a toilet or latrine, three in ten have their stools thrown into a toilet or latrine, and 8% report throwing or burying their children's stools in the yard. Twelve percent of mothers throw their children's stools outside their dwelling, 4% rinse them away, and 11% of mothers leave the stools in the open. Mothers with secondary or higher education are much more likely to dispose of their children's stools safely (86%) than mothers with no education (48%). Similarly, mothers in the highest wealth quintile are much more likely to dispose of their children's stools safely (93%) than mothers in the lowest wealth quintile (47%). Access to a private toilet facility increases the likelihood that a child's stools are disposed of safely; about nine in ten children living in households with a

private toilet facility with a septic tank have their stools disposed of safely compare with only about three in ten children in a household without a toilet facility (SCB, 2007a).

Percentage of families that stay in a healthy house is one of the indicators in Indonesian National Development Program. Some studies show the relationship between housing conditions with health. Residential density (in-house overcrowding) would increase risk and severity environment based diseases, especially home environment. From the results of research in Kali Anyar West Jakarta conducted by Jes Clauson-Kaas, et al in 1993-1994, showing a correlation between residential density with the incident diarrhea and acute respiratory infection in children under 3 years. Households with no latrine 60% and which has a toilet meet requirement is 49%. Distance of water drink source with a septic tank is 61% which eligible (Supraptini, 2009).

Residential density (in-house over-crowding) is obtained by dividing the number of household members with floor area in square meters house. Calculation results are categorized according to criteria ministry of health guidance about the healthy house, that is eligible if ≥ 8m2/capita (not over-crowding) and are not eligible if <8m2/capita (over-crowding). There are still 10.7% of households with home earthen floor and 19.9% with in-house over- crowding. The highest percentage of earthen floor houses more than the provincial average are in Pandeglang (21.3%), followed by Serang (13.3%) and Tangerang district (10.8%).The districts with higher in-house over-crowding percentage than the provincial average are Tangerang city (27.1%), Pandeglang (23.4%) and Tangerang district (21.1%), (Health Research and Development Board, 2008).

Type of latrine that considered sanitary is when using of swan neck latrine. In Banten province, 87.7% of households use the swan neck latrine, the highest in Serang (93.4%) and the lowest in Pandeglang (73.1%). Percentage of households using septic tank is 54.3%, the rest is discharged into river/sea, yard, pond/wetland, and coastal/land. The percentage of using septic tank for excreta disposal is highest in Tangerang city (79.5%) and Cilegon (77.8%). The district that has percentage of septic tank excreta disposal below the provincial average is Pandeglang (14.0%) and Lebak (23.6%). The households have dust bins in urban areas is higher (55.9% and 42.4% in homes outside

the home) than in rural areas (34.8% and 9.3% in home away from home) (Health Research and Development Board, 2008).

CHAPTER III
RESEARCH METHODOLOGY

3.1. Study Design

This study was a secondary data analysis of two cross sectional national surveys that held in 2007 in Indonesia. :

1. National Socio-economic Survey 2007 by Statistic Center Board, Indonesia from July to August 2007.
2. Basic Health Research 2007 by Health Research and Development Board, MoH of Indonesia from August 2007 to September 2008.

The latest surveys that held in Indonesia were National Socio-economic Survey 2010 and Basic Health Research 2010. But the result of National Socio-economic survey has not launched until data collection period of this study in January-February 2011. In Basic Health Research 2010, samples of the survey were only taken at provincial level with sample size 10% of Basic Health Research 2007, and there was no question for diarrhea.

3.1.1. National Socio-economic Survey 2007

Indonesia National Socio-economic Survey 2007 is a nationwide survey which conducted to collect information on social and economics indices. It serves as a main source of monitoring the social and economic progress in the society. NSS 2007 was conducted on an annual basis since 1963. In 1992, in addition to a basic social and economic questionnaire (core), another questionnaire was introduced which gathers more detailed information on special interest topics (module). The core covers basic information of household and individual characteristics on health, death, education/literacy, employment, fertility and family planning, housing, and household expenditure.

NSS 2007 core covers 285,186 households with 282 variables and is designed to be representative up to district/municipality levels. The module is intended to gather

more detailed information on specific topics, especially on data that changed less frequently than yearly. There are three modules of NSS 2007 and each module is added in a three-year cycle. In 2007, the module's topic was housing. The data set covers 68,640 households. Please note that the NSS 2007 does not implement the health module, but rather a more detailed examination of housing and settlement variables. This occurred as although the three year topic cycle of NSS 2007 dictated that the health module should be undertaken in 2007, a separate Basic Health Research (BHR) 2007 was conducted this year by the Ministry of Health which covered much of the information that the health module would have. Both core questionnaire (NSS Core) and module questionnaires (NSS Module) contains data on household and individual characteristics. In this data archive the data were split into three main files, which contain information on household characteristics (data gathered both from core and module questionnaires), individual characteristics (data gathered both from core and module questionnaires) and information on cases of death (data gathered from core questionnaires). This file contains information on household characteristics.

The module is intended to gather more detailed information on specific topics, especially on data that changes less frequently than a year. There are three modules of NSS 2007 and each module is added in a three-year cycle. Information on household characteristics gathered both from core and module questionnaires. It contains information on household characteristics. Variables include identification of place, features of household, housing characteristics, housing ownership, physical condition of the house, facilities and house components, environmental condition, household expenditure, other social economic information, and communication and information technology. Individual characteristics gathered both from core and module questionnaires, and information on cases of death gathered from core questionnaires (SCB, 2007b).

3.1.2. Basic Health Research 2007

Basic Health Research (BHR) 2007 data collection was done on two stages; first stage begins in early August 2007 to January 2008 in 28 provinces including Banten Province, the second phase on August to September 2008 in the rest 5 provinces (East Nusa Tenggara, Maluku, North Maluku, Papua and West Papua).

Research questions that became the basis for developing BHR 2007 are: 1.How is the health status and health determinants, both at the national level, provincial and district/municipality; 2.How is the relationship between poverty and health; and 3. Is there a specific health problem? To answer these questions, among others, the goal formulated providing baseline health status and health determinants, both at the household and individual level, with the scope as follows: 1. Nutritional status; 2. Access and utilization of health services; 3. Environmental sanitation; 4. Consumption of food; 5. Communicable diseases, non-communicable diseases and disease history descent; 6. Responsiveness of health services; 7. Knowledge, attitudes and behavior; 8. Disability; 9. Mental health; 10.Immunization and growth monitoring; 11.Infant health; 12.Anthropometric measurements, blood pressure, abdominal circumference and circumference upper arm; 13.Biomedical measurement; 14.Visual acuity examination; 15.Dental examinations; 16.Various incidents of verbal autopsy death; and 17.Mortality.

Basic Health Research 2007 design was a cross sectional survey. The study population was all households in all around Republic of Indonesia. The sample of households and household members in was designed identical to the sample list of households and household members of National Socio-economic Survey 2007. Various sizes of sampling error include the standard error, relative standard error, confidence intervals, design effects and sample size weighted accompanies each estimated variable. Basic Health Research 2007 managed to collect 258,366 sample households and 987,205 samples for measurement of household members. Basic Health Research 2007 limitations are include non-random error: the formation of new districts, census block is not affordable, households are not met, period different data collection time, estimates the district could not apply for all indicators, and biomedical data that only represent urban

census blocks. All results with 900 indicators can be used for develop advanced research, new standards of health indicators, tracking the relationship causal-effect, and statistical modeling (Health Research and Development Board, 2008).

3.2 Study Area

Study area was in all 6 municipalities and districts in Banten Province in 2007.

Table 2. Population in Banten Province

Municipalities/districts	Population	Density (per km^2)	Type
Serang district	1,834,514	1,064	Rural
Pandeglang district	1,100,991	401	Rural
Lebak district	1,132,899	596	Rural*
Tangerang district	3,194,282	2,877	Rural
Tangerang municipality	1,488,666	8,091	Metro urban
Cilegon municipality	331,872	1,891	Industrial urban
	9,083,144	1,032	

* There is isolated ethnic group (Baduy tribe) in Lebak District

Source: Banten Province Regional Development Performance Evaluation Result, 2008

There are two urban area in Banten Province; Tangerang municipality and Cilegon municipality. Cilegon is also an industrial area. Another 4 areas (Serang district, Pandeglang district, Lebak district and Tangerang district) are rural areas. There is an isolated community in Lebak district, they are Baduy tribe. They are not easily to accept the modernization. Their daily life is used equipment and facilities from the nature.

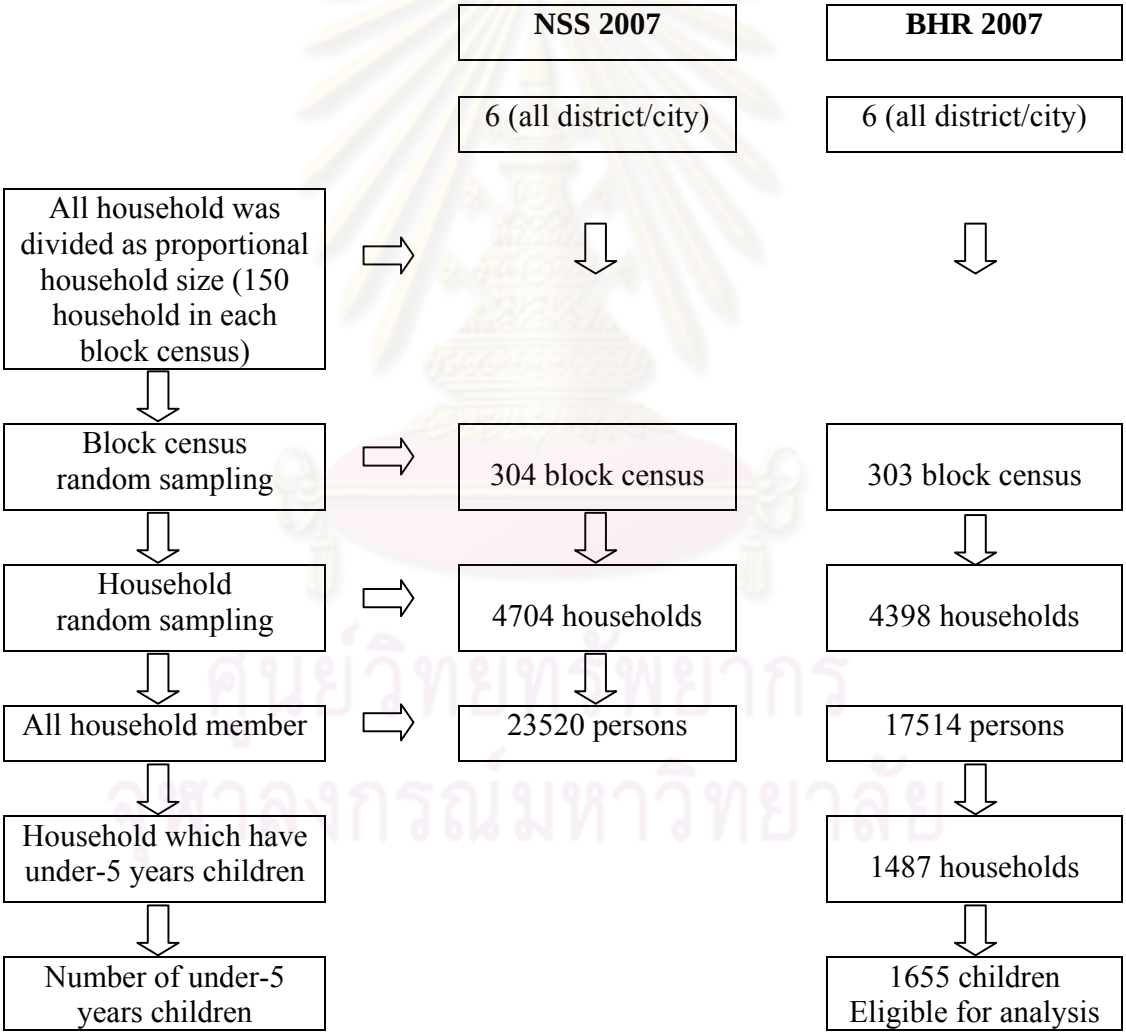
3.3 Study Population

Study population was all under-five year old children in Banten province in 2007.

3.4 Sampling technique and sample size

In order to obtain such data in 2007 Basic Health Research (BHR) design was cross sectional study, the data obtained by conducting interviews, measurements, examinations and blood sampling of respondents who have been determined. Research locations covering 4 districts and 2 cities: Pandeglang, Lebak, Serang, Tangerang, Tangerang City and Cilegon. The sample size was 303 census blocks for public health data (Health Research and Development Board, 2008).

Figure 6. Sampling Technique



Population in Basic Health Research 2007 was all household members in Banten province. The sample of households and household members in BHR 2007 in Banten Province were identical to the sample list in households and household members of National Socio-economic Survey 2007 that used two-stage sampling.

From each district included in the sample frame district taken some census blocks are proportional to the number of households in the district/city. The possibility of a census block entry into the sample census blocks in a district was proportional to the number of households in a county/city (probability proportional to size). When in a census block, there were more than 150 (one hundred and fifty) in the household then sampling at this level will be established sub-block census. Overall, based on census block sample from the survey, 2007, which amounted to 304 (three hundred and four) samples of census blocks, Basic Health Research 2007 managed to visit the 303 census blocks of 6 districts and cities that exist.

From each selected census block and then selected 16 (sixteen) of households randomly (simple random sampling), which became the sample households by number of households in the census block. Overall, the number of sample households from 6 districts in Banten province in NSS 2007 is 4,704 (four thousand seven hundred four), BHS 2007 managed to collect 4,398 (four thousand three hundred ninety eight) households. From 4398 household, there were 1655 children under-five years old. One household may has more than one under-five years old children (Health Research and Development Board, 2008).

3.4 Measurement tools

3.4.1 National Socio-economic Survey 2007

In National Socio-economic Survey there were NSS core questionnaire and module questionnaires, contain data on household and individual characteristics. In this data archive the data was split into three main files, which contain information on household characteristics (data gathered both from core and module questionnaires),

individual characteristics (data gathered both from core and module questionnaires) and information on cases of death (data gathered from core questionnaires). This file contains individual (i.e. household member) characteristics data which are gathered from core questionnaires (Block I, VI, VII, VIII and IX) and module questionnaires (all blocks) of NSS 2007 (SCB, 2007b).

3.4.2 Basic Health Research 2007

There were 6 questionnaires that is used in Basic Health Research 2007 (Household questionnaire, Nutrition questionnaire, Individual questionnaire, verbal autopsy questionnaire for < 29 days newborn baby, verbal autopsy questionnaire for children age 29 days - < 5 year olds, and verbal autopsy for 5 year old and above).

3.5 Data Collection

The primary data collection for Basic Health Research 2007 activities were begun with:

1. Coordination between Banten Provincial Health Office, Public Health Service districts in Banten province, Indonesia, local laboratory/Regional general hospital with Health Research and Development Board, in Cisarua, Bogor, West Java, Indonesia.
2. Training of personnel data collectors performed 2 times, dated July 30 to August 4, 2007and August 6 to 11, 2007.
3. Data collectors in Banten Province have a very varied background of health center personnel, nurses, midwives, to doctors. Data-gathering team in the area of Banten province consists of 25 teams, each consisting of 4 people, and one of whom acts as chairman of the team.
4. Before the start of data collection, briefing and socialization to the heads of the selected health center were conducted by the respective person in charge of operation at district level.

5. Periodic meetings between representative persons in charge of operation at district level and chairman of the team to discuss the problems encountered in the field of Public Health data collection. The household response rate of household was 91.1%, and individual response rate was 82.9%.
6. Data collection has done by interviewed to all household members (< 15 years old, sick or old, interview with the care taker).

For this secondary data analysis study, the raw data of National Socio-economic Survey 2007 was obtained from Directorate of Child Health, Ministry of Health Indonesia that has bought the raw data from Statistic Center Board in 2009. This data set included all of sample all over Indonesia and it was spitted as Individual economic (1,167,019 individual samples) data and Household economic data (285,186 household samples).

Basic Health Survey 2007 raw data was obtained from Health Research and Development Board, Ministry of Health Indonesia. The data set which received only included all under-five years old children data in Banten Province (1655 individual sample).

Supporting documents were collected from related sub-directorate in Ministry of Health, Statistic Center Board, Banten Provincial Health Office and 6 districts/municipalities in Banten Province.

3.6 Inclusion and exclusion criteria

Inclusion criterion for this study was all under-five years old children from Basic Health Research 2007 data in Banten Province, Indonesia. Children under-five years old, who include in NSS 2007 but not include in BHR 2007will excluded from analysis.

3.7 Data Analysis

For the primary analysis of the two data sources, the questionnaires that have been collected were batched, edited and coded, data was entered, cleaned and analyzed using SPSS. Then, the data of each survey were merged from multiple computers in the

provinces into one main data base in Jakarta. Then, all the data were grouped into data files based on an analysis unit (household or individual level).

For this secondary data analysis, the steps that have done were:

1. Reducing the data from nationwide to Banten Province only.
2. Reducing of variables, therefore the related variable with diarrhea among under-five years old was according the conceptual frame work taken as the data base.
3. Data was merged by using individual identification number and household identification number as key variables. Identification number in NSS 2007 was arranged separately in different variable; province, district, sub-district, village, urban and rural classification, sample code number, household sample serial number and individual number. To concatenate these 7 variables, this data was exported to excel 1997-2003 format by StatTransfer 9 software. After all numbers were merged, these data was re-exported to SPSS version 16.
4. The individual identification number of children in BHR 2007 was arranged in 1 variable but with some space between the numbers. This data was exported to excel 1997-2003 format by using StatTransfer 9 and reduced the space by using substitute function, then re-exported to SPSS version 16.
5. Children data in BHR 2007 was merged with NSS 2007Individual economic data by using individual identification number as key variable. Then, this result was merged with NSS 2007 household economic data by using household identification number as key variable.

Data of mother linked and included in children data in BHR 2007. Final analysis includes:

3.7.1 Uni-variate analysis

All data analyzed by using SPSS version 16. First of all, each variable will be described with uni-variate analysis to describe frequency distribution, percentage distribution, mean, median, and standard deviation as appropriate.

3.7.2 Bi-variate analysis

Pearson's chi-square test has used to determine association between each independent variable and diarrhea among under-five children in Banten province, Indonesia:

- Association between child socio-demographics, child health care, and nutritional status factors with diarrhea among under-five years old in Banten Province, Indonesia
- Association between mother socio-demographics, hand washing and defecation place, and health services utilization factors with diarrhea among under-five years old in Banten Province, Indonesia
- Association between drinking water, latrine, solid and liquid waste management and house characteristic factors with diarrhea among under-five years old in Banten Province, Indonesia
- Risk estimation has examined by calculating crude odds ratio.

3.8.3 Multivariable analysis

Multivariate analysis has used to determine the factors statistically significant associated with diarrhea among under-five year old children with controlling confounding variables. All variable that statistically significant in bi-variate analysis (with p-value ≤ 0.05) was included in binary logistic regression. Then, the result of multivariate analysis was modeled by chose the variables that has p-value < 0.2.

3.8 Study period

This secondary data analysis study has conducted on January 2011 to April 2011.

3.9 Ethical consideration

Ethical consideration was obtained from Ethical Committee College of Public Health Science, Chulalongkorn University, Thailand. And permission was obtained from Ministry of Health, Indonesia to use the NSS 2007 and BHR 2007 raw data set.

All data set anonymous and cannot refer to any individual person. The questionnaire does not involve any sensitive question or have any potential damage for the respondent.

3.10 Expected benefit and application

- Gained new knowledge on the factors regarding child socio-demographic and child health care, mother socio-demographics and mother characteristics, and house characteristics that are associated with occurrence of diarrhea in under-five year olds.
- The result can provide data for making further strategy and collaboration in decreasing diarrhea and eventually under-five mortality in Indonesia.

CHAPTER IV
RESULT

This chapter presents the results of the study under the following part.

1. General characteristic which include:
   - Children's socio-demographics, health care and nutritional status
   - Mother's socio-demographics, hand washing and defecation behavior, health financing and expenditure, and health services utilization
   - Drinking water, sanitation and house characteristics
   - Diarrhea case among under-five years old children

   The variables are described as simple percentage, means and standard deviation as appropriateness.
2. Bivariate analysis of factors associated between host with diarrhea among under-five children using Pearson's chi-square test
3. Bivariate analysis of factors associated between agent with diarrhea among under-five children using Pearson's chi-square test
4. Bivariate analysis of factors associated between environment with diarrhea among under-five children using Pearson's chi-square test
5. Risk estimate analysis of having diarrhea among under-five years old children from host, agent and environment factors as crude odd ratio.
6. Multivariate analysis of factors associated with diarrhea among under-five children using binary logistic regression

4.1 General characteristics

4.1.1 Children's socio-demographics, health care and nutritional status

A total of 1655 under-five years old children who included in this study were in almost equal proportion males (48.9%) and females (51.1%) with an almost even age distribution of 20% for each year of age. The median of age was 29 months. It shown at Table 3 below:

Table 3. Children's socio-demographics

Characteristics		Frequency	%
Age (n=1655) age in month			
	< 6	133	8.0
	6 – 11	163	9.8
	12 – 23	330	19.9
	24 – 35	330	19.9
	36 – 47	359	21.7
	48 – 59	340	20.5
Mean (SD)			28.74 (16.42)
Sex (n=1655)			
	Male	810	48.9
	Female	845	51.1

Although nearly all children had breastfed (95.4%) but only 20% until 6 months as exclusive breast feeding recommendation, 46.7% children had breastfed not more than 3 months (Mean 1.73 and SD 0.772).

Table 4. Breast feeding

Characteristics		Frequency	%
Had breastfed (n=1446)			
	Yes	1380	95.4
	No	66	4.6
Exclusive breast feeding (n=1380)			
	0 - < 3 months	645	46.7
	3 - < 6 months	459	33.3
	≥ 6 months	276	20.0
Mean (SD)			1.73 (0.772)

Table 5. shown that there were 63.8% children have growth chart card (including Maternal and Child Health Handbook), but only 29.7% have routine body weighing every month. Overall, 48.6% children had complementary feeding at integrated health post. It was only 68.7% of children above 6 month had vitamin A and only 66% of children above 9 months had measles immunization.

Table 5. Children's health care

Characteristics	Frequency	%
Routine body weighing at last 6 months (n=1655)		
Had body weighing every month	491	29.7
Did not have body weighing every month	1164	70.3
Growth chart card ownership (n=1616)		
Yes	1031	63.8
No	585	36.2
Had complementary feeding at integrated health post (n=1077)		
Yes	523	48.6
No	554	51.4
Vitamin A supplementation (n=1598)*		
Yes	1098	68.7
No	500	31.3
Measles immunization (n=1120)**		
Yes	739	66.0
No	381	34.0

*Only for children 6 – 59 months
**Only for children 9 – 59 months

Nutritional status was assessed through 3 parameters: weight for age, height for age and weight for height z score. Considering weight for age z score, Table 6 shown that 5.9% of children had a z score less than 3 standard deviation (SD), signaling severely underweight. While 13.4% had a score of between - 3 SD and less than -2 SD (moderately underweight).

For the height for age z score, 23.6% of children had a z score of less than -3 SD which means chronic malnutrition (severe stunting), 18.7% were moderately stunted with z score -3 to less than -2 SD. As for the weight for height, 7.2% of children had z score

less than -3 SD (severe wasted) with 8.8% had a score of between -3 and less than 2 SD (moderately wasted). But 15.1% of children had z score more than 2 SD (overweight).

Table 6. Children's nutritional status

Characteristics	Frequency	%
Weight for age (n=1571)		
< -3 SD (severe underweight)	93	5.9
≥ -3 to < -2 SD (underweight)	210	13.4
≥ -2 to ≤ 2 SD (normal)	1222	77.8
> 2 SD (overweight)	46	2.9
Height for age (n=1408)		
< -3 SD (severe stunting)	332	23.6
≥ -3 to < -2 SD (stunting)	263	18.7
≥ -2 SD (normal)	813	57.7
Weight for height (n=1414)		
< -3 SD (severe wasting)	102	7.2
≥ -3 to < -2 SD (wasting)	124	8.8
≥ -2 to ≤ 2 SD (normal)	974	68.9
> 2 SD (overweight)	214	15.1

4.1.2. Mother's socio-demographics, hand washing and defecation behavior, and health services utilization

There were 1655 mothers included in National Socio-economic Survey 2007, but only 1410 mothers in Basic Health Research 2007, therefore, this section has two different denominators.

Table 7. shown that the mean age of mothers was 30.39 years old. Thirty eight women were below than 20 years old with the youngest age was 13 years old. They are considered as teenage mothers. Six care taker women were grandmothers (data not shown). Most mothers (78.5%) had one child only. The children of two households with 4 under-five and of the five households with 5 under-five were all grandchildren.

There were 3.9% illiterate mothers, 18.1% graduated from senior high school and only small number of mothers (3.8%) had bachelor degree or more. A big majority of

mothers was housewife (77.2%), moreover were private and government employees, entrepreneurs, daily wage earners, farmers, service providers and students.

More than half of household were poor and poorest (26.0% and 27.6%) according the wealth index quintile. A small proportion (10.9%) is classified as richest. The higher percentage of the poorest was in Pandeglang district (22.1%) and the richest was in Serang district (25%) (data not shown). The household in these surveys were slightly more in rural areas (55.4%) than urban areas (44.6%).

Table 7. Mother's socio-demographics

Characteristics	Frequency	%
Age (n=1410)		
< 20 (teenage mothers)	38	2.7
20 - < 30	622	44.1
30 - < 40	612	43.4
≥ 40	138	9.8
Minimum=13, maximum= 67*		
Mean (SD)		30.39 (6.73)
Number of under-five children in the household (n=1655)		
1	1330	80.4
2	298	18.0
3	18	1.1
4	4	0.2
5	5	0.3
Mean (SD)		1.22 (0.49)
Educational level (n=1410)		
Illiteracy	55	3.9
Unfinished elementary school	275	19.5
Elementary school	500	35.5
Junior high school	271	19.2
Senior high school	255	18.1
Bachelor degree or more	54	3.8
Occupation (n=1410)		
Housewife	1089	77.2
Entrepreneurs	84	6.0
Daily wage earners	77	5.5
Private and government employees	70	5.0
Others (farmers, service providers, students, etc)	90	6.4

Characteristics	Frequency	%
Household wealth index quintile (n=1655)		
Poorest	457	27.6
Poor	430	26.0
Middle	319	19.3
Rich	269	16.3
Richest	180	10.9
Mothers residence by districts in Banten Province (n=1655)		
Pandeglang district	339	20.5
Serang district	320	19.3
Lebak district	296	17.9
Tangerang district	272	16.4
Cilegon city	234	14.1
Tangerang city	194	11.7
Area (n=1655)		
Urban	738	44.6
Rural	917	55.4

* The relationship of 48, 50, 55, 56 and 67 years old mothers is grandmother.

Tabel 8. shown that there were only 24.1% of mothers always practiced four hand washing behaviors, while 11.1% never washed their hand using soap. And, about 61% of mothers defecated at latrine, rest of them defecate at river, sea, lake, pond, ground hole, beach, garden and other open areas. The smallest proportion of using latrine was in Lebak district (43.9%) and the biggest was in Tangerang city (97.4%) (data not shown).

Table 8. Mother's hand washing and defecation behaviors

Characteristics	Frequency	%
Hand washing * (n=1410)		
Never	157	11.1
1 hand washing action	339	24.0
2 hand washing actions	313	22.2
3 hand washing actions	261	18.5
4 hand washing actions	340	24.1
Defecation place (n=1410)		
Latrine	861	61.1
River/sea/lake	143	10.1
Pond/wetland/gutter	128	9.1
Others (ground hole/beach/field/garden/yard, etc.)	278	19.7

*Hand washing actions out of four that can be practiced (before eating, before preparing food, after defecation/clean up baby stool, and after touching animals).

Health services utilization result shown at Table 9. In 3 months preceding the survey, 65.6% children were brought by their mother to utilized health services at integrated health post. Few mothers who brought their children to maternity hut (35%).

Table 9. Health services utilization

Characteristics	Frequency	%
Integrated health post at last 3 months (n=1655)		
Yes	1085	65.6
No	570	34.4
Maternity hut (n=1655)		
Yes	579	35.0
No	1076	65.0

4.1.3 Drinking water, sanitation and house characteristics

Table 10. shown that drinking water sources were divided as safe (bottled water, tap water, pump water, protected well, and protected spring), and unsafe (unprotected well, unprotected spring, river, rainfall, etc.). Only 57% of household used safe drinking water source and 55.6% households had owned drinking water source. The rest used unsafe drinking water source (43%) and sharing (38.6%), even 5.8% have no water source. Access to drinking water was difficult during dry season or year-round for 38.8% of households, and 25.2% of them pay for drinking water.

The households which have drinking water source that located < 10 meters from water pollution source were 30.6%. Closed drinking water container has been used by 72.4% household. Water consumption for all purpose varies from < 5 to > 30 liters per person per day.

The physical quality of drinking water was designated as good and not good. Eighteen percent of drinking water was found have one or more of not good criteria (cloudy, colored, tasty, frothy, and smelly).

Table 10. Drinking water characteristics

Characteristics	Frequency	%
Type of drinking water source (n=1655)*		
Safe	944	57.0
Unsafe	711	43.0
Water source ownership (n=1387)		
Belong to household	771	55.6
Sharing or public facility	536	38.6
There is no water source	80	5.8
Ease of getting drinking water (n=1655)		
Easy	1013	61.2
Difficult at dry season or all year round	642	38.8
How to obtain drinking water (n=1655)		
Buy	417	25.2
Do not buy	1238	74.8
The distance of drinking water source to water pollution source (n=1655)		
< 10 m	506	30.6
≥ 10 m	1048	63.3
There is no water source	101	6.1
Type of drinking water container (n=1655)		
Without container**	289	17.5
Open container	167	10.1
Closed container	1199	72.4
Drinking and other purposes water consumption/day/person (n=1655)		
< 20 liters	977	59.0
≥ 20 liters	678	41.0
Physical quality of drinking water (n=1655)		
Good	1353	81.8
Not good***	302	18.2

* Safe (bottled water, tap, pump, protected well and protected spring) and unsafe (unprotected well, Un-protected spring, river, rainfall and others)

** Taken directly from drinking water source before cooking/boiling

*** If there was one or more water physical quality condition (cloudy, colored, tasty, frothy, smelly)

Most type of latrine used was swan neck (83.6%). Less than half of latrine was belong to household (47.4%) and big number of household have no latrine (40.8%) as shown at Table 11. below:

Table 11. Latrine characteristics

Characteristics	Frequency	%
Type of latrine (n=980)		
Swan neck	819	83.6
Pour-flush latrine	87	8.9
Pit latrine	48	4.9
Do not use latrine	26	2.7
Latrine ownership (n=1655)		
Belong to household	784	47.4
Sharing or public facility	196	11.8
There is no latrine	675	40.8
Landfills of feces (n=1655)		
Septic tank	737	44.5
Beach/yard/garden/ground hole	374	22.6
Others (river, sea, lake, pond, wetland, etc.)	544	32.9

Most of liquid waste was discharged through open channel or without used channel. Only 29.5% of household used closed channel. Solid waste disposal outside the house were generally open (88.7%). There was only data of 276 household which have organic waste container inside the house, 72.8% used open container.

Table 12. Waste management

Characteristics	Frequency	%
Liquid drainage channel type (n=1655)		
Open	818	49.4
Closed	488	29.5
Without channel	349	21.1
Solid waste landfills type (n=656)		
Open	582	88.7
Closed	74	11.3
Type of organic waste container inside the house (n=276)		
Open	201	72.8
Closed	75	27.2

Table 13. shown that there were 12.3% houses still made from earthen floor. For overall area, mostly in Pandeglang district (36.9%) (Table is not shown). The household which had number of resident comparison with wide of floor less than 8 m^2 that consider

as overcrowded was 26.2% and also the biggest percentage was in Pandeglang district (25.6%) (data not shown).

Table 13. House characteristics

Characteristics	Frequency	%
Earthen floor (n=1655)		
Non earthen floor	1452	87.7
Earthen floor	203	12.3
Residential density (n=1655)		
Non crowded	1221	73.8
Overcrowded	434	26.2

4.1.4. Diarrhea case among under-five years old children

Diarrhea cases identified by ask "In the past 1 month, was [NAME] ever diagnosed as diarrhea by a health provider (doctor/nurse/midwife)?" If the answer is no, continued to next question "In the past 1 month, had [NAME] ever had watery/smooth stool more than 3 times a day?" Total diarrhea case was a combined of yes answer of two questions above. There were 132 children suffered from diarrhea within 1 month prior the survey (18.9%).

Table 14. Diarrhea case among under-five years old children at last 1 month

Characteristics	Frequency	%
Diagnosed as diarrhea (n=1655)		
Yes	192	11.6
No	1463	88.4
Have watery stool > 3 times a day (n=1463)		
Yes	120	8.2
No	1343	91.8
Diagnosed as diarrhea and have watery stool > 3 times a day (n=1655)		
Yes	312	18.9
No	1343	81.1

4.2. Bivariate analysis of factors associated between host with diarrhea among under-five years old children

There was a significant association between age of children and diarrhea. Different age group of children may have different incident of diarrhea. Children at the age of 6 – 11 months have high percentage of diarrhea cases than another age of under-five years children (p-value = 0.014). But, there was no significant difference of diarrhea case in boys and girls as Table 15 shown below:

Table 15. Association between children's socio-demographic and diarrhea

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Age in month (n=1655)			14.194	0.014*
< 6	24 (18.0)	109 (82.0)		
6 – 11	40 (24.5)	123 (75.5)		
12 – 23	78 (23.6)	252 (76.4)		
24 – 35	63 (19.1)	267 (80.9)		
36 – 47	55 (15.3)	304 (84.7)		
48 – 59	52 (15.3)	288 (84.7)		
Total	312 (18.9)	1343 (81.1)		
Sex (n=1655)			0.292	0.589
Male	157 (19.4)	653 (80.6)		
Female	155 (18.3)	690 (81.7)		

*Statistically significant with p-value ≤ 0.05

In term of breast feeding practices, there was statistically significant association between diarrhea with the children who ever had breastfed and never. Higher percentage of diarrhea cases (19.8%) was found in children who ever breastfed (4.5%) (p-value = 0.002). While the duration of having only breastfeeding (exclusive breastfeeding) had no effect to diarrhea in children as Table 16. shown below:

Table 16. Association between breast feeding and diarrhea

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Ever breastfed (n=1446)			9.469	0.002*
Yes	273 (19.8)	1107 (80.2)		
No	3 (4.5)	63 (95.5)		
Total	276 (19.1)	1170 (80.9)		
Exclusive breast feeding (n=1380)			0.956	0.620
0 - < 3 months	121 (18.8)	524 81.2 ()		
3 - < 6 months	97 (21.1)	362 (78.9)		
≥ 6 months	55 (19.9)	221 (80.1)		
Total	273 (19.8)	1107 (80.2)		

*Statistically significant with p-value ≤ 0.05

Table 17 below shown that there was no association between children's health care and diarrhea. The children who had routine body weighing, growth chart card, complementary feeding, vitamin A within last 6 months and measles immunization have same probability of having diarrhea with the children did not had those health care.

Table 17. Association between children's health care and diarrhea

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Routine body weighing at last 6 months (n=1655)			0.006	0.938
Yes	92 (18.7)	399 (81.3)		
No	220 (18.9)	944 (81.1)		
Total	312 (18.9)	1343 (81.1)		
Growth chart card ownership			0.655	0.418
Yes	202 (19.6)	829 (80.4)		
No	105 (17.9)	480 82.1 ()		
Total	307 (19.0)	1309 (81.0)		
Having complementary feeding at integrated health post (n=1077)			1.919	0.166
Yes	120 (22.9)	403 (77.1)		
No	108 (19.5)	446 (80.5)		
Total	228 (21.2)	849 (78.8)		

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Vitamin A (n=1598)			0.184	0.668
Yes	212 (19.3)	886 (80.7)		
No	92 (18.4)	408 (81.6)		
Total	304 (19.0)	1294 (81.0)		
Measles immunization (n=1120)			0.808	0.369
Yes	606 (82.0)	133 (18.0)		
No	304 (79.8)	77 (20.2)		
Total	910 (81.2)	210 (18.8)		

Furthermore, the result in Table 18 below shown that there was no significant association between children nutritional status and diarrhea in children. The children who had normal nutritional status have diarrhea almost as much as the children who suffered from severe underweight, severe stunting and severe waste.

Table 18. Association between children's nutritional status and diarrhea

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Nutritional status				
• **Weight for age (n=1571)**			0.423	0.936
< -3 (severe underweight)	19 (20.4)	74 (79.6)		
≥ -3 to < -2 (underweight)	42 (20.0)	168 (80.0)		
≥ -2 to ≤ 2 (normal)	228 (18.7)	994 (81.3)		
> 2 (overweight)	8 (17.4)	38 (82.6)		
Total	297 (18.9)	1274 (81.1)		
• **Height for age (n=1408)**			0.659	0.719
< -3 (severe stunting)	63 (19.0)	269 (81.0)		
≥ -3 to < -2 (stunting)	52 (19.8)	211 (80.2)		
≥ -2 (normal)	144 (17.7)	669 (82.3)		
Total	259 (18.4)	1149 (81.6)		
• **Weight for height (n=1414)**			1.377	0.711
< -3 (severe wasted)	21 (20.6)	81(79.4)		
≥ -3 to < -2 (wasted)	25 (20.2)	99 (79.8)		
≥ -2 to ≤ 2 (normal)	190 (19.5)	784 (80.5)		
> 2 (overweight)	35 (16.4)	179 (83.6)		
Total	271 (19.2)	1143 (80.8)		

4.3 Bivariate analysis of factors associated between agent with diarrhea among under-five years old children

Table 19. show that there was no association between overall age of mother and diarrhea in children, but there was statistically significant different of diarrhea case in children from teenage mothers. Out of 38 teenage mothers, there were 12 children have diarrhea (31.6%). From the association test result, it was found that the percentage of children diarrhea case within teenage mother was significant higher compare to diarrhea case in children within older mothers (p-value = 0.042) (data not shown). But, there was no association between numbers of children in the household.

There was a strong association between mother's education level and diarrhea in children (p-value = 0.001). The rate of diarrhea among children who had lower education mother was higher (23.6%) than those had higher education (10.6%), although there was an increase rate of diarrhea among children with bachelor degree or higher education mother (16.7%). While mother occupation and wealth index quintile have no association with diarrhea in children.

Residential area has a strong association with diarrhea in children. There was different incident of diarrhea in different district. The highest was in Pandeglang district (25.7%) followed by Lebak district and Cilegon city.The household in Serang district, Tangerang city and Tangerang district have lower diarrhea case (p-value < 0.001)). It was also consistent with the type of area. Rural area has more children with diarrhea than urban area (p-value = 0.008) and teenage mother mostly (31.6%) was in Pandeglang District (data not shown).

Table 19. Association between mother's socio-demographic factors and diarrhea among under-five years children

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes n (%)	No n (%)		
Age (n=1410)			6.128	0.106
< 20	12 (31.6)	26 (68.4)		
20 - < 30	113 (18.2)	509 (81.8)		
30 - < 40	128 (20.9)	484 (79.1)		
≥ 40	22 (15.9)	116 (84.1)		
Total	275 (19.5)	1135 (80.5)		
Number of under-five children in the household (n=1655)			0.187	0.666
1	248 (18.6)	1082 (81.4)		
> 1	64 (19.7)	261 (80.3)		
Total	312 (18.9)	1343 (81.1)		
Educational level (n=1410)			19.798	0.001*
Illiteracy	13 (23.6)	42 (76.4)		
Unfinished elementary school	65 (23.6)	210 (76.4)		
Elementary school	112 (22.4)	388 (77.6)		
Junior high school	49 (18.1)	222 (81.9)		
Senior high school	27 (10.6)	228 (89.4)		
Bachelor degree or more	9 (16.7)	45 (83.3)		
Total	275 (19.5)	1135 (80.5)		

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Occupation (n=1410)			3.876	0.423
Housewife	215 (19.7)	874 (80.3)		
Private and government employees	10 (14.3)	60 (85.7)		
Entrepreneurs	12 (14.3)	72 (85.7)		
Daily wage earners	17 (22.1)	60 (77.9)		
Farmers, service providers, students, others	21 (23.3)	69 (76.7)		
Total	275 (19.5)	1135 (80.5)		
Household wealth quintile index (n=1655)			7.265	0.123
Poorest	85 (18.6)	372 (81.4)		
Poor	88 (20.5)	342 (79.5)		
Middle	53 (16.6)	266 (83.4)		
Rich	61 (22.7)	208 (77.3)		
Richest	25 (13.9)	155 (86.1)		
Total	312 (18.9)	1343 (81.1)		
Mothers residence by districts in Banten Province (n=1655)			41.701	< 0.001*
Pandeglang district	87 (25.7)	252 (74.3)		
Lebak district	70 (23.6)	226 (76.4)		
Cilegon city	54 (23.1)	180 (76.9)		
Serang district	54 (16.9)	266 (83.1)		
Tangerang city	20 (10.3)	174 (89.7)		
Tangerang district	27 (9.9)	245 (90.1)		
Total	312 (18.9)	1343 (81.1)		
Area (n=1655)			7.136	0.008*
Urban	118 (16.0)	620 (84.0)		
Rural	194 (21.2)	723 (78.8)		
Total	312 (18.9)	1343 (81.1)		

*Statistically significant with p-value ≤ 0.05

The analysis revealed that there was strong association between percentage of diarrhea and mother's hand washing behavior. This is shown in Table 20 that there was gradual decrease of diarrhea in children if the mothers practiced more hand washing actions (p-value < 0.001).The highest percentage of mother whose never wash their hand with soap was teenage mothers (15.8%) (data not shown).

Diarrhea was detected have strong association with defecation place. Mothers who defecate at latrine have fewer children with diarrhea than mothers who defecate at other places (p-value <0.001) as shown at Table 20 below:

Table 20. Association between mother's hand washing and defecation place behaviors with diarrhea among under-five years children

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Hand washing behavior (n=1410)**			29.699	<0.001*
Never	43 (27.4)	114 (72.6)		
1 hand washing action	82 (24.2)	257 (75.8)		
2 hand washing actions	72 (23.0)	241 (77.0)		
3 hand washing actions	34 (13.0)	227 (87.0)		
4 hand washing actions	44 (12.9)	296 (87.1)		
Total	275 (19.5)	1135 (80.5)		
Defecation place (n=1410)			18.587	<0.001*
Latrine	140 (16.3)	721 (83.7)		
Pond/wetland/gutter	30 (23.4)	98 (76.6)		
River/sea/lake	43 (30.1)	100 (69.9)		
Ground hole/beach/ field/ garden/courtyard/others	62 (22.3)	216 (77.7)		
Total	275 (19.5)	1135 (80.5)		

*Statistically significant with p-value ≤ 0.05

**Hand washing actions out of four that can be practiced (before eating, before preparing food, after Defecation/clean up baby stool, and after touching animals).

Regarding to health services utilization analysis, Table 21. shown that diarrhea was found significant higher among the children who came to integrated health post at last 3 month (p-value = 0.001). but there was no association with the maternity hut

Table 21. Association between health services utilization and diarrhea among under-five years children

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Integrated Health Post (n=1655)			10.463	0.001*
Yes	229 (21.1)	856 (78.9)		
No	83 (14.6)	487 (85.4)		
Total	312 (18.9)	1343 (81.1)		
Maternity hut (n=1655)			0.814	0.367
Yes	116 (20.0)	463 (80.0)		
No	196 (18.2)	880 (81.8)		
Total	312 (18.9)	1343 (81.1)		

*Statistically significant with p-value ≤ 0.05

4.4 Bivariate analysis of factors associated between environments with diarrhea among under-five years old children

It was observed at Table 22. that children have more diarrheas at household which used unsafe drinking water source (p-value < 0.001) and did not have their own drinking water source (p-value = 0.010). The most diarrhea case (28.6%) was among children who drunk water from rainfall (data not shown). Difficult access of drinking water was found as significant factor that increasing diarrhea in children (p-value = 0.001).

There was a statistically significant different of diarrhea incidence between household who obtain the drinking water by buying and got it for free (p-value = 0.007). Short distance of drinking water source to water pollution sources (< 10 m) and amount of water consumption per person/day for all purpose were not have a significant effect to occurrence of diarrhea in children. Open water container has association with diarrhea in children (p-value = 0.027). While, the physical quality of drinking water have a significant association with diarrhea (p-value = 0.005). There was strong association between drinking water source and physical quality of drinking water. Good physical quality of drinking water originated from safe drinking water source, vice versa (p-value < 0.001) (data not shown).

Table 22. Association between drinking water characteristics and diarrhea among under-five years children

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Drinking water source (n=1655)			23.229	<0.001*
Safe	140 (14.8)	804 (85.2)		
Unsafe	172 (24.2)	539 (75.8)		
Total	312 (18.9)	1343 (81.1)		
Drinking water source ownership (n=1387)			11.253	0.010*
belong to household	130 (16.9)	641 (83.1)		
Sharing	71 (21.1)	265 (78.9)		
Public facility	54 (27.0)	146 (73.0)		
There is no water source	17 (21.2)	63 (78.8)		
Total	272 (19.6)	1115 (80.4)		
Ease of getting drinking water (n=1655)			10.372	0.001*
Easy	166 (16.4)	847 (83.6)		
Difficult at dry season or all year round	146 (22.7)	496 (77.3)		
Total	312 (18.9)	1343 (81.1)		

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
How to obtain drinking water (n=1655)			7.260	0.007*
Buy	60 (14.4)	357 (85.6)		
Do not buy	252 (20.4)	986 (79.6)		
Total	312 (18.9)	1343 (81.1)		
Distance of water source from water pollution source (n=1554)			0.204	0.651
< 10 m	99 (19.6)	407 (80.4)		
≥ 10 m	195 (18.6)	853 (81.4)		
Total	294 (18.9)	1260 (81.1)		
Type of water container n=1655)			7.259	0.027*
Without container	56 (19.4)	233 (80.6)		
Open container	44 (26.3)	123 (73.7)		
Closed container	212 (17.7)	987 (82.3)		
Total	312 (18.9)	1343 (81.1)		
Water consumption per person/day (n=1655)			0.023	0.880
< 20 liters	183 (18.7)	794 (81.3)		
≥ 20 liters	129 19.0 ()	549 (81.0)		
Total	312 (18.9)	1343 (81.1)		
Water physical quality (n=1655)			7.712	0.005*
Good	238 (17.6)	1115 (82.4)		
Not good	74 (24.5)	228 (75.5)		
Total	312 (18.9)	1343 (81.1)		

*Statistically significant with p-value ≤ 0.05

There was no association between diarrhea and type of latrine. The factors that statistically significant with diarrhea were latrine ownership and feces landfills. Diarrhea case was higher at household without latrine or used public facility or sharing with neighborhood (p-value < 0.001), and higher at the household which not used septic tank for feces landfills (p-value = 0.001).

Table 23. Association between latrine characteristics with diarrhea among under-five years children

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Type of latrine (n=954)			3.279	0.194
Swan neck latrine	120 (14.7)	699 (85.3)		
Pour-flush latrine	18 (20.7)	69 (79.3)		
Pit latrine	10 (20.8)	38 (79.2)		
Total	148 (15.5)	806 (84.5)		
Latrine ownership (n=1655)			19.186	< 0.001*
Belonged to household	118 (15.1)	666 (84.9)		
Sharing	27 (16.3)	139 (83.7)		
Public facility	6 (20.0)	24 (80.0)		
There is no latrine	161 (23.9)	514 (76.1)		
Total	312 (18.9)	1343 (81.1)		
Landfills of feces (n=1655)			14.985	0.001*
Septic tank	109 (14.8)	628 (85.2)		
Pond/wetland/river/lake/sea	78 (20.9)	296 (79.1)		
Others (ground hole/beach /yard/garden, etc.)	125 (23.0)	419 (77.0)		
Total	312 (18.9)	1343 (81.1)		

*Statistically significant with p-value ≤ 0.05

The association between diarrhea and waste management were studied for type of liquid drainage channel, type of solid waste landfills outside the house and type of organic waste inside the house. Open liquid drainage channel was statistically significant had association with diarrhea (p-value 0.017). There was no association between solid waste management and diarrhea.

Table 24. Association between waste management and diarrhea among under-five years children

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Type of liquid drainage channel (n=1655)			8.206	0.017*
Open	173 (21.1)	645 (78.9)		
Closed	72 (14.8)	416 (85.2)		
Without channel	67 (19.2)	282 (80.8)		
Total	312 (18.9)	1343 (81.1)		
Type of solid waste landfills (n=656)			0.708	0.400
Open	127 (21.8)	455 (78.2)		
Closed	13 (17.6)	61 (82.4)		
Total	140 (21.3)	516 (78.7)		
Type of organic waste container inside house (n=276)			0.824	0.364
Open	36 (17.9)	165 (82.1)		
Closed	10 (13.3)	65 (86.7)		
Total	46 (16.7)	230 (83.3)		

*Statistically significant with p-value ≤ 0.05

No association was found between diarrhea and earthen floor or overcrowded house. The proportion of diarrhea cases at earthen floor house and overcrowded house was almost similar with at non earthen floor and non crowed house (approximately 20% and 80%) as shown at Table 25 below:

Table 25. Association between house characteristic with diarrhea among under-five years children

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Earthen floor (n=1655)			0.821	0.365
Non earthen floor	269 (18.5)	1183 (81.5)		
Earthen floor	43 (21.2)	160 (78.8)		
Total	312 (18.9)	1343 (81.1)		

Factors	Diarrhea in the past 1 month		χ^2	p-value
	Yes	No		
	n (%)	n (%)		
Residential density (n=1655)			0.067	0.795
Non crowded	232 (19.0)	989 (81.0)		
Overcrowded	80 (18.4)	354 (81.6)		
Total	312 (18.9)	1343 (81.1)		

4.5 Risk estimate analysis of having diarrhea among under-five years old children from host, agent and environment factors

Table 26 illustrates the odds of having diarrhea in children in different characteristic condition. Age of children was not a significant factor on risk of having diarrhea. Children who ever had breastfed were 5.2 more likely of having diarrhea. Children from higher education level mothers were 0.5 less likely of having diarrhea. And children who went to integrated health post were 1.7 more likely of having diarrhea.

The mothers who wash their hand were 0.6 less likely to develop diarrhea in their children. While mothers were not used latrine 1.7 more likely for having children who suffer from diarrhea.

The children who life at rural area have 1.4 more likely to have diarrhea and who life at household that used unsafe drinking water source were 1.8 more likely of having diarrhea and sharing for drinking water source were 1.5 more likely of having diarrhea. The children who life at household which difficult to getting drinking water have 1.5 more likely to develop diarrhea, and who life at household which buy drinking water have 0.7 less likely to having diarrhea. By using not good physical quality of drinking water will increase 1.5 more likely to having diarrhea. Open water container has risk of having diarrhea in children 1.3 more likely than closed water container.

The household which used latrine by sharing with the others 1.6 more likely has children with diarrhea. Similar with the household which did not used septic tank for feces landfills will have 1.6 more likely diarrhea in children. While household using open

water channel or not using channel for disposed liquid waste 1.5 more likely have diarrhea in children.

Table 26. Crude odds ratio of associated factors with diarrhea among under-five years old children

Factors	Diarrhea in the past 1 month		Crude OR	95% CI	
	No	Yes		Lower	Upper
	n (%)	n (%)			
Child age (n=1655)			0.809	0.594	1.102
< 1 year	232 (78.4)	64 (21.6)			
≥ 1 year	1111 (81.8)	248 (18.2)			
Total	1343 (81.1)	312 (18.9)			
Ever had breastfed (n=1446)			5.179	1.614	16.616
No	63 (95.5)	3 (4.5)			
Yes	1107 (80.2)	273 (19.8)			
Total	1170 (80.9)	276 (19.1)			
Mother's education level (n=1410)			0.476	0.327	0.693
≤ Junior high school	862 (78.3)	239 (21.7)			
≥ Senior high school	273 (88.3)	36 (11.7)			
Total	1135 (80.5)	275 (19.5)			
Area (n=1655)			1.410	1.095	1.815
Urban	620 (84.0)	118 (16.0)			
Rural	723 (78.8)	194 (21.2)			
Total	1343 (81.1)	312 (18.9)			
Mother's hand washing behavior (n=1410)			0.602	0.413	0.880
Never	114 (72.6)	43 (27.4)			
Yes	1021 (81.5)	232 (18.5)			
Total	1135 (80.5)	275 (19.5)			
Defecation place (n=1410)			1.679	1.288	2.190
Latrine	721 (83.7)	140 (16.3)			
Others	414 (75.4)	135 (24.6)			
Total	1135 (80.5)	275 (19.5)			

Factors	Diarrhea in the past 1 month		Crude OR	95% CI	
	No n (%)	Yes n (%)		Lower	Upper
Integrated health post utilization (n=1655)			1.570	1.193	2.066
No	487 (85.4)	83 (14.6)			
Yes	856 (78.9)	229 (21.1)			
Total	1343 (81.1)	312 (18.9)			
Drinking water source (n=1655)			1.833	1.430	2.349
Safe	804 (85.2)	140 (14.8)			
Unsafe	539 (75.8)	172 (24.2)			
Total	1343 (81.1)	312 (18.9)			
Drinking water source ownership (n=1307)			1.500	1.139	1.974
Belong to household	641 (83.1)	130 (16.9)			
Sharing	411 (76.7)	125 (23.3)			
Total	1052 (80.5)	255 (19.5)			
Ease to getting drinking water (n=1655)			1.502	1.171	1.926
Easy	847 (83.6)	166 (16.4)			
Difficult	496 (77.3)	146 (22.7)			
Total	1343 (81.1)	312 (18.9)			
How to obtain drinking water (n=1655)			0.658	0.484	0.893
Do not buy	986 (79.6)	252 (20.4)			
Buy	357 (85.6)	60 (14.4)			
Total	1343 (81.1)	312 (18.9)			
Physical quality of drinking water (n=1655)			1.521	1.130	2.047
Good	1115 (82.4)	238 (17.6)			
Not good	228 (75.5)	74 (24.5)			
Total	1343 (81.1)	312 (18.9)			
Water container (n=1655)			1.308	1.001	1.708
Close	987 (82.3)	212 (17.7)			
Open	356 (78.1)	100 (21.9)			
Total	1343 (81.1)	312 (18.9)			
Latrine ownership (n=1655)			1.617	1.256	2.082
Belong to household	666 (84.9)	118 (15.1)			
Sharing	677 (77.7)	194 (22.3)			
Total	1343 (81.1)	312 (18.9)			

Factors	Diarrhea in the past 1 month		Crude OR	95% CI	
	No n (%)	Yes n (%)		Lower	Upper
Feces landfills (n=1655)			1.636	1.266	2.114
Septic tank	628 (85.2)	109 (14.8)			
Others	715 (77.9)	203 (22.1)			
Total	1343 (81.1)	312 (18.9)			
Liquid drainage channel (n=1655)			1.496	1.122	1.994
Close	416 (85.2)	72 (14.8)			
Open	927 (79.4)	240 (20.6)			
Total	1343 (81.1)	312 (18.9)			

4.6 Multivariate analysis of factors associate with diarrhea among under-five children

Binary logistic regression was employed to predict the probability that a child under-five years old would suffer from diarrhea. Based on the results of bi-variate analysis, 17 variables which had a p-value ≤ 0.05 were selected as predictors. Variables which met this criterion and have been selected were age of children, ever breastfed, mother's education level, resident by district, area, mother's hand washing behavior, defecation place, integrate health post utilization, outpatient services utilization, drinking water source, drinking water source ownership, ease to getting drinking water, how to obtain drinking water, type of water container, physical quality of drinking water, latrine ownership, feces landfills, and type of liquid waste channel. While controlling for other factors and employed ≤ 0.25 (Hosmer D. W. and Lemenshow S., 2000) as statistically significant has found that:

- Mother education level, resident by district, defecation place, drinking water source ownership, ease to getting drinking water, how to obtain drinking water, latrine ownership, feces landfills and type of liquid drainage channel had no statistically significant effect on diarrhea among under-five years old children.
- Children age had a statistically significant association with diarrhea occurrence. Older children were 0.98 less likely had chance of having diarrhea than younger children (p-value = 0.001).

- Children who ever breastfed 2.68 more likely develop diarrhea than children who never breastfed (p-value = 0.110)
- Rural resident had a significant negative association with diarrhea in children (p-value 0.104). The children who live in rural area have 0.7 less likely to develop diarrhea.
- Mother hand washing behavior had a significant effect with diarrhea (p-value <0.001). Diarrhea cases in children were 0.79 less likely occurred if their mother practiced more hand washing behavior actions.
- The children who taken by their mother to integrated health post have 1.25 more likely develop diarrhea (p-value = 0.207)
- Unsafe drinking water sources were 1.3 more likely have effect to children diarrhea incidence (p-value = 0.110).
- Used open water containers were 1.2 more likely develop diarrhea in children (p-value = 0.234)
- Having not good physical quality of drink water was 1.4 more likely developed the diarrhea among under-five years old children (p-value 0.075).

Table 27 below shows the logistic regression coefficient, adjusted odds ratio, 95% confidence interval and Wald test p-value of predictor variables:

Table 27. Multivariate analysis of factors associate with diarrhea among under-five children

Variables	B	Adjusted OR	95% CI		p-value
			Lower	Upper	
Children age [a)]	-0.017	0.983	0.973	0.993	0.001*
Ever breastfed [b)]	0.985	2.679	0.801	8.955	0.110*
Mother's education level [c)]	-0.043	0.958	0.810	1.132	0.614
Resident by district [d)]	0.002	1.002	0.996	1.009	0.508
Area [e)]	-0.354	0.702	0.458	1.076	0.104*
Mother hand washing behavior [f)]	-0.239	0.787	0.692	0.896	<0.001*

Variables	B	Adjusted OR	95% CI		p-value
			Upper	Lower	
Defecation place [g)]	0.113	1.119	0.738	1.697	0.596
Integrated health post utilization [h)]	0.223	1.250	.884	1.766	0.207*
Drinking water source [i)]	0.271	1.312	0.787	1.351	0.110*
Drinking water source ownership [j)]	0.030	1.031	0.819	1.567	0.826
Ease to getting drinking water [k)]	0.125	1.133	0.546	1.676	0.450
How to obtain drinking water [l)]	-0.044	0.957	0.875	1.729	0.878
Type of water container [m)]	0.207	1.230	0.965	2.096	0.234*
Physical quality of drinking water [n)]	0.352	1.422	0.846	1.453	0.075*
Latrine ownership [o)]	0.103	1.109	0.709	1.856	0.455
Feces landfills [p)]	0.138	1.147	0.843	1.861	0.575
Liquid drainage channel [q)]	0.225	1.252	0.884	1.766	0.266
Constant	-2.173	0.114			0.005

*Statistically significant with p-value ≤ 0.25

a) children age as continuous data
b) never compare to ever breastfed
c) illiteracy compare to unfinished elementary school, elementary school, junior high school, senior high school, and bachelor degree or more
d) Pandeglang District compare to Lebak District, Tangerang District, Serang District, Tangerang City and Cilegon City
e) urban compare to rural
f) never wash hand with soap compare to 1action, 2 actions, 3 actions, and 4 actions
g) at latrine compare to other places
h) no compare to yes
i) safe compare to unsafe
j) belong to households compare to sharing or public facility, and there is no water source
k) easy compare to difficult at dry season or all year round
l) don't buy compare to buy
m) closed compare to open or without container
n) good compare to not good
o) belong to households compare to sharing or public facility, and there is no water source
p) septic tank compare to others
q) closed compare to open or without channel

The final multivariate logistic regression model built with chosen variables which p-value ≤ 0.25 (Hosmer D. W. and Lemenshow S., 2000). From first logistic regression model there were 8 variables with p-value ≤ 0.25 included children age, ever breastfed,

resident by urban or rural area, mother hand washing behavior, integrated health post utilization, drinking water source, water container type, and physical quality of drinking water, then found result as Table 28 below:

Table 28. Logistic regression modeling of factors associated with diarrhea among under-five years old children

Variables	B	Adjusted OR	95% CI		p-value
			Lower	Upper	
Children age [a)]	-0.015	.985	0.977	0.994	0.001*
Ever breastfed [b)]	1.343	3.829	1.169	12.538	0.027*
Area [c)]	-0.256	1.435	1.051	1.961	0.122
Mother hand washing behavior [d)]	-0.248	1.479	1.088	2.009	<0.001*
Integrated health post utilization [e)]	0.361	1.266	0.935	1.714	0.023*
Drinking water source [f)]	0.391	1.594	1.135	2.239	0.012*
Water container type [g)]	0.236	.104	0.977	0.994	0.127
Physical quality of drinking water [h)]	0.466	.985	1.169	12.538	0.007*
Constant	-2.260	3.829	0.559	1.071	<0.001

*Statistically significant with p-value ≤ 0.05

a. children age as continuous data
b. never compare to ever breastfed
c. urban compare to rural
d. never wash hand with soap compare to 1actions, 2 actions, 3 actions, and 4 actions
e. not utilized integrated health post compare to yes
f. safe compare to unsafe
g. closed compare to open or without water drainage channel
h. good compare to not good

Household locations by district and urban or rural areas and type of water container have no significant effect with diarrhea in children. While four other variables still have effect to diarrhea:

- Older children have 0.9 less likely of having diarrhea than younger children (p-value = 0.001)
- Children who ever breastfed have 3.8 more likely have diarrhea (p-value = 0.027)

- Mother hand washing behavior has association with diarrhea incidence among under-five years children. Children from mothers who practiced more hand washing actions were 0.8 less likely develop diarrhea (p-value < 0.001)
- The children who taken by their mother to integrated health post have 1.4 more likely develop diarrhea (p-value = 0.023)
- Diarrhea in children 1.5 more likely higher at household who used unsafe drinking water (p-value = 0.012)
- Used not good physical quality of drinking water will 1.6 more likely develop diarrhea in children (p-value = 0.007)

CHAPTER V
DISCUSSION, LIMITATION, CONCLUSION, AND RECOMMENDATION

5.1 Discussion

The objective of this study was to determine factors which are significantly associated with diarrhea among under-five years old children in Banten Province, Indonesia. Source of secondary data analysis was taken from Indonesia National Socio-economic Survey 2007 and Basic Health Research 2007. Statistical tests that using for examine the association were Pearson's Chi-square, crude odds ration and binary logistic regression.

The result of this study will be discussed under the following parts:

5.1.1 Prevalence of diarrhea among under-five years old children

5.1.2 Association between host factors and diarrhea among under-five years old children in Banten Province, Indonesia

5.1.3 Association between agent factors and diarrhea among under-five years old children in Banten Province, Indonesia

5.1.4 Association between environment factors and diarrhea among under-five years old children in Banten Province, Indonesia

5.1.1 Prevalence of diarrhea among under-five years old children

The prevalence of diarrhea in Banten among under-five years old children was 18.9% (132 out of 1655). From the same survey, the prevalence of diarrhea in Indonesia among 1-4 years old was 16% (MoH, 2010). The highest prevalence (16.0%) of diarrhea for all ages was found in Serang district (Health Research and Development Board, 2008), but in this study for under-five years old was found in Pandeglang district (27.9%).

In other district based studies of diarrhea in under-five children the prevalence of diarrhea in the two weeks preceding the surveys varied. In Bangladesh in 2003 was 8.1%

(Piechulek H. et. al., 2003), In Viet Nam, was 11.3% in 2000 (Takanashi K. et. al., 2009), in Kenya was 16.7% (Onyango D. M. and Angienda P. O., 2010), in Congo 18.6%. (Mock N. B. et. al., 1993) and in Ghana 38% (Osumanu I. K., 2007).

In the 2006 national MICS in Thailand prevalence was 8.2% (Wilunda C. and Panza A., 2009) which is much lower than the national prevalence of Indonesia of 16%, and in 1995-96 Pakistan Integrated Health Survey revealed that around 20% children suffer from diarrhea (Arif G. M. and Ibrahim S., 1998).

5.1.2 Association between host factors and diarrhea

Diarrhea prevalence was higher in children age 6 – 11 months. Prevalence among children aged < 6 months (18%), 6-11 months (24.5%), 12-23 (23.6%), 24-35 months (19.1%), 36-47 months (15.3%) and 48-59 months (15.3%). This result is similar with diarrhea prevalence all over Indonesia, the highest prevalence at age 6-11 months (19.4%), 12-23 months (14.8%) and 24-35 months (12.0%), (CSB, 2003). A secondary data analysis of Eritrea Demographic and Health Survey (EDHS) 1995 found the risk of having diarrhea evidently indicate a peak at the age 6-11months (Woldemicael G., 2001). The finding of study in Pakistan also found that child's age was negatively associated with diarrhea morbidity (Arif G. M. and Ibrahim S., 1998).

Another study in Banten Province found that prevalence of diarrhea was high among 12-23 months children (19%), with a higher prevalence in urban areas (Usfar, A. A., 2010).

From another study in Bangladesh, diarrhea attacks are more likely in children between 6 and 29 months of age with the peak in the age group 1 to 1.5 years. This reinforces the knowledge that the risk of acquiring diarrhea increases at the time the child starts moving around the house and receiving food other than breast milk (Piechulek H. et. al., 2003).

Prevalence of diarrhea was not different between boys and girls (48.9% in male and 51.1% in girls) which mean gender was not influential. In another research in India was found the prevalence of diarrhea marginally higher among the girls (Syed M., 2003).

A study in Congo has found that male sex was a significant predictor of diarrhea1 disease prevalence. That male children more than one year of age had increased odds of disease probably reflects sex-specific child-care practices (Mock N. B. et. al., 1993)

Breastfeeding frequency should be maintained for a year or more after adding food to the infant diet to reduce the risk of diarrhea that may have serious consequences to health, nutritional status, and survival. When breastfeeding stops, infants are exposed to food-borne germs and lose the protection of breast milk's anti-infective properties (PATH, 2008). In this study 95.4% children ever had breastfed but only 20% until 6 months, almost half of children had breastfed less than 3 months. The result shown that children who ever breastfed have more risk of diarrhea than those who never breastfed and exclusive breast feeding had no association with diarrhea prevalence. This could be explained because exclusive breast feeding can only prevent diarrhea as long as the children is exclusively breast fed. Older children have no protection from diarrhea even if they ever had breastfed up to six months.

Rotavirus gastroenteritis is the leading cause of diarrhea in children (Oqilvie I. et. al., 2011). The effect that breastfeeding has on decreasing the rotavirus infection only lasts for as long as the child is breast fed. This may seem like an obvious point, but many people think that exclusively breast fed infants have a long-lasting protection against rotavirus infection. As it turns out, there does not seem to be any long-lasting effect from breastfeeding against the severe diarrhea from rotavirus (Robert W. Steele, 1999).

This is consistent with previous research in Lalitpur district of Nepal in 2010 among 37 to 48 months old children that investigated exclusive breast feeding during six months of life. It was found that no differences of diarrhea occurrence between children with exclusive breast feeding and not at the age of 37 months and more (Karki T, et.al. 2010). A study in Congo shows that breastfeeding status was not statistically significantly associated with diarrheal disease (Mock N. B. et. al., 1993). Research in Bangladesh, however, suggests that breast feeding may prevent vitamin A deficiency and protecting the child up to 3 years against recurrent infections like diarrhea and acute respiratory infection (Mahalanabis D., 1991).

The < 6 month children who received vitamin A supplementation were 71.5 % in overall Indonesia (Health Research and Development Board, 2008) and this study found 68.7% in Banten Province. There was no association between Vitamin A supplementation and diarrhea attack in children. This is similar to the result of a study among preschool children in 34 rural villages in Indonesia in 1990 (Dibley M. et al. 1996) and a masked controlled field trial in India which gave low-dose of vitamin A supplementation for 52 weeks (Rahmatullah L. et. al., 1991)

In 2007 the percentage of measles immunization in Indonesia was 81.6%, the highest (99.2%) was in Yogyakarta and the second lowest for all kind of immunizations and the lowest (62.5%) for measles immunization were in Banten Province (Health Research and Development Board, 2008). This study found there was no association between measles immunization and diarrhea in under-five children. This can be explained by the fact that the protective effect of measles immunization on diarrhea morbidity is limited to 'with-measles' diarrhea (1week pre-rash-onset and 4 weeks post-rash-onset), and 'post-measles diarrhea' (4-26 weeks post-rash-onset) (Feachem R. G. and Koblinsky M. A., 1983) while our survey covered prevalence of diarrhea in all under-five children outside a period of measles epidemic.

A lack of association between measles vaccination and diarrhea in under-five children was also found in a study in India reporting that attack rates of diarrhea in immunized children (1.6/child/year) were no different to that in the non- immunized (1.5/child/year). The mean duration of diarrhea in both groups was 2.3 days. The prevalence diarrhea in immunized and non-immunized was 3.85 and 3.67 respectively (Reddaiah V. P. and Kapoor S. K., 1993). The Indian findings were not supported by a study in Pakistan that found children who had measles immunization were less likely have diarrhea than children without this immunization (Arif G. M. and Ibrahim S., 1998).

There was no association between nutritional status (weight for age, height for age and weight for height) and diarrhea in children. Some studies suggested a greater incidence of diarrhea in malnourished children, but failed to establish an association.

There is also a hypothesis that nutritional status will predict the duration of diarrhea, ie, severity but not the incidence (Rahmathullah L. et. al., 1991).

Adisasmito W studied about risk factors of diarrhea in under-five children in Indonesia through a systematic review of academic research. Five out of 10 studies, found significant associations between exclusive breast feeding and diarrhea and only 1 out of 7 studies showed a significant association between diarrhea and immunization (Adisasmito W., 2007). This study did not find significant association between diarrhea and child nutrition, growth monitoring, complementary feeding, vitamin A supplementation and measles immunization.

5.1.3 Association between agent factors and diarrhea among under-five years old children

Recent studies have evaluated maternal behavior as related predictors of diarrheal disease (Dikassa L. et. al., 1993). Early maternal marriage may lead to children's health vulnerabilities (Raj. A. et. al., 2010)

In this study overall mother's age groups had no association with risk of diarrhea in children. Bi-variate analysis, however, found that the prevalence of diarrhea in children within teenage mothers was significantly higher compared to children with older mothers (p-value = 0.042). Also, the mothers who never practiced hand washing with soap were mostly teenage mothers (15.8%).

Another study found that maternal age < 20 years increased the risk of rotavirus diarrhea. One in ten (10.3%, 1904/17 983) children under 5 born to young married women had experienced diarrhea acute in the past two weeks (Nakawesi Jane S. et al., 2010). Other researchers found that diarrhea prevalence was higher in children whose mother's age was below 18 years (Onyango D. M. and Angienda P. O., 2010).

At primary data of this study, maximum number of under-five years children in the household was 5 children. From the bi-variate analysis, there was no association between the numbers of children living in the house and diarrhea. Study in Eritrea, however, revealed that there was significant association with this variable. The

probability of having diarrhea was about 30 and 60% higher if there were 3-5 and 6 or more children respectively in the household (Woldemicael G, 2001).

There was no association between diarrhea in children with mother occupation. Similar with the result of study in Lesotho in 1987-1988 that there was no strong evidence of an association between diarrhea morbidity and mother's occupation (P = 0.13) (Daniels L. D., 1990).

In this study mother education level has significant effect in bivariate analysis on diarrhea prevalence in children. The higher of mother's education level, found the lower incidence of diarrhea among their children, but it was not significant after controlling other variables. Consistently previous study in Kenya found that children whose mothers had no education experienced higher prevalence of diarrhea (Onyango D. M. and Angienda P. O., 2010) and study in Eritrea also found that mother education shows a significant negative association with diarrhea in children, but did not show any significant effect after adjusting the influences of other variables as in this study (Woldemicael G. 2001). A study in Philippines, however suggested that the protective effect of mother education on infant diarrhea varies according to the socio-economic environment where the mother lives. Mother education protects against infant diarrhea in the more economically and socially advantaged communities but has no effect in the more disadvantaged communities (Molina D., 1994).

A nationwide survey in Saudi Arabia in 1987 found that prevalence of diarrhea among children less than five years old was significantly associated with fathers' occupation (p=0.0011) but no significant association with parents' education (Al-Mazrou Y. Y. et. al., 1991)

This study shown that diarrhea in children was found more in rural area than urban area in bivariate analysis (p-value 0.008) maybe because drinking water source and sanitation facility in rural area were worse than in urban areas. This finding is common in other low income countries as the result of study in Eritrea that found children living in urban areas were 46% less likely to have diarrhea (Woldemicael G., 2011). Multivariate analysis, however, shown that diarrhea prevalence was higher in children in urban area

than in rural area after adjusted of others variables (p-value = 0.104). Another study found that urban residence also was highly associated with diarrhea disease occurrence in Congo (Mock N. B. et. al., 1993). In northeast Brazil, attack rate of diarrhea was higher in urban poor than rural poor (Siegel, R. R., 1996).

In the Sudanese capital of Khartoum where slum population comprise 80% of urban population, prevalence of diarrhea was higher (33%) and specific in Khartoum slum was 40% compare with 29% in urban areas. In Nairobi, Kenya in 1998, the prevalence of children diarrhea was 12%, specific among slum children was 27% compare with 19% in rural areas (UN-HABITAT, 2005). The primary data of this study did not provide data about slum area variables in urban.

It is possible that other reasons explain higher prevalence in urban areas besides living in urban slums. Climate change has been reported as affecting human health in urban centres, particularly Least Developed Countries, which already experience a high burden of climate sensitive diseases in vector-borne disease transmission, increased malnutrition due to declining food yields, and increases in diarrheal diseases from changes in water quality and water availability. The effects of current and projected climate change will be felt most strongly by the urban poor, the elderly and children, traditional societies, subsistence farmers, and coastal populations (Dodman D., 2009).

Resident by district also has significant association. Children who live in Pandeglang and Lebak district have more diarrheas (20.5% and 19.3%), teenage mothers also found mostly (31.6%) in Pandeglang District, but at the second model of multivariate analysis, area and resident by district were not associated factors anymore. Another research which conducted in 3 districts in Kenya also found that area of residence had significant difference in influencing prevalence of diarrhea in children (Onyango D. M. and Angienda P. O., 2010).

In this study, wealth quintile index, have no association with diarrhea among under-five years old children. Study in Salvador, Brazil found that diarrheal disease among children of different socioeconomic groups living within the same urban community in a developing country appears to have distinct epidemiology and etiology,

and therefore, its management may require that these differences be taken into consideration (Siegel, R. R., 1996).Genser B. and colleague reported that major diarrhea determinant were low socio-economic status, poor sanitation and presence of intestinal parasites (Genser B et.al. 2006). An analysis of Eritrea DHS 1995 also found that the probability of having diarrhea among under-five children was 33-38% lower from medium and high economic groups than children from low economic group, however this effect disappear after controlling other variable (Woldemicael G., 2001).

The children taken by their mother to integrated health post utilization had more diarrhea than the children who did not use them. This does not mean that using services in integrated health post and government health facilities is causing diarrhea. There is probably a confounding factor to explain this finding such as that children 6-11 month old who have the highest prevalence of diarrhea are also those using the integrated health post most.

Promoting hand washing interventions can reduce diarrheal episodes by 29% in day-care centers in high-income countries and by 31% in communities in low- or middle-income countries (Barclay L, 2008).

There was gradual decrease of diarrhea in children if the mothers practiced more hand washing actions (p-value <0.001). At a systematic review found that washing hands with soap can reduce the risk of diarrhea diseases by 42-47% and interventions to promote hand washing might save a million lives (Curtis and Craincross, 2003).

In connection with the Hand Washing With Soap (HWWS) activities, Indonesian Ministry of Health has issued a decree of the Minister of Health of the National Strategy for Community Based Total Sanitation (*Sanitasi Total Berbasis Masyarakat*/STBM) No. 852/Menkes/SK/IX/2008, which sets HWWS as one of the important pillars of the strategy to be implemented in Indonesia. Thus the implementation of HWWS activities in Indonesia could sustainable.

This study found that mothers who defecate not at latrine ware having more children with diarrhea (Crude OR 1.3). River, sea and lake as defecation place had the most effect with diarrhea (30.1%) and p-value < 0.001. Then, mother behavior in hand

washing and defecation place have strong association with developing diarrhea in children.

5.1.4 Association between environment factors and diarrhea among under-five years old children

World-wide around 1.1 billion people lack access to improved water sources and 2.4 billion have no basic sanitation (WHO, 2000). In Banten Province found that 43% household used unsafe drinking water source, 38.8% have difficulties of getting drinking water during dry season or all year round, 25.2% buy the drinking water, and 40.8% have no latrine.

This study revealed drinking water has strong association with diarrhea occurrence among children. Who have safe drinking water source, and also own the drinking water source were protected of diarrhea (p-value < 0.001 and 0.010). The majority case of diarrhea (28.6%) was among children who drunk water from rainfall. This is not similar with a result of study in Kenya that found 33.2% case was among children who drunk water from unprotected wells (Onyango D. M. and Angienda P. O., 2010).

Diarrhea incidence was also higher among the children among the household with difficulties to get drinking water during dry season or all year round (p-value = 0.001). Who buy the drinking water have less diarrhea, because the drinking water source with pay safer than get for free (p-value = 0.007). And not good physical quality which has sign cloudy, colored, tasty, frothy and smelly also has association with diarrhea in children (p-value = 0.005).The data shown that 88.5% of buy of drinking water was safe drinking water source (bottled and tap water).

The household which have drinking water source have fewer children with diarrhea than the household with sharing or used public facility drinking water source (Crude OR 1.5 and p-value = 0.001). In Ethiopia, children whose families shared the water source with 6-10 households had almost twice the risk of developing diarrhea than families who had their own water source (OR=1.94, CI 1.04-3.63, p=0.038) (Rishi P. Mediratta et al., 2010).

This study found that diarrhea in children developed more in household which used open water container or without container (Crude OR 1.3 and p-value = 0.027). Similar with another study in Ethiopia that found the households which stored water in containers with a narrow nozzle were less likely to develop diarrhea than households that stored water in containers with wide nozzles (OR=0.56, CI 0.31-0.98, p=0.042) (Rishi P. Mediratta et al., 2010).

Type of latrine has no association with diarrhea, but the latrine ownership has strong association. Sharing utilization of latrine has risk of infection transmission of diarrhea (p-value < 0.001).

Study in Republic of Congo found that children of families with latrines had a lower prevalence of diarrheal disease than those children whose families did not (Mock N. B. et. al., 1993). Study in Lesotho on 1987 to September 1988 indicate that under-5-year-olds from households with a latrine may experience 24% fewer episodes of diarrhea than such children from households without a latrine (odds ratio = 0.76; 95% confidence interval, 0.58-1.01) (Daniels D. L. et. al. 1990). A study in Sri Langka also found that children from household where excreta were reported to be disposed of in a latrine were less likely to have diarrhea than children whose families improperly disposed of excreta (Mertens T. E. et. al., 1992). The availability of latrine facility in household also associated with 27% reduction in risk of diarrhea in children in Eritrea DHS 1995 (Woldemicael G., 2001).

The households which used septic tank for landfill feces have less diarrhea incidence in children.

Different landfills of solid waste outside the house and type of organic waste container inside the house have no association with diarrhea. The diarrhea .prevalence increased at the household which use open liquid waste drainage or no drainage at all channel. This is meant that the chain of diarrhea transmission is water born. The transmission by fly or another factor did not have effect to diarrhea in children.

This study was not found an association between diarrhea in children and earthen floor. Differ from the result of study in Eritrea that found that children who live in house

with non-earthen floor were 43% less likely to have diarrhea than those live in earthen floor house (Woldemicael G., 2001).

Residential density have no associations with developing diarrhea in children in this study, reverse with another study in North Jakarta, Indonesia that found that over-crowed house have more risk for diarrhea and acute respiratory incidence among children (Supraptini, 2009) and study in Nigeria that found high residential density area recorded the highest incidence of stomach ache and diarrhea, which may have been due to poor water treatment and lack of adequate in-house storage facilities (Fadare S. O. and Olawuni P.O. 2008).

5.2 Limitation

The limitations of this study were different time on data collection of these two surveys. First survey (NNS) in Banten Province was conducted on July to August 2007 and the second survey (BHS) was started from August 2007 until January 2008, therefore different conditions on some seasonal diseases may not be linked between the two survey.

Also because of two different times, there were 128 missing data of individual economic information. Probably because the economic survey held on July 2007 and health research held from August-December 2007, according the age of children, there were 133 children below 6 months, maybe 128 just born after economic survey.

The researcher did not directly involved in two primary data survey, so the reason of missing data was not known. Over all survey at national level, there were 6,006 missing data from 280,000 between National Socio-economic Survey 2007 and Basic Health Research 2007. In Banten province, the household response rate is 91.1% and individual response rate is 82.9%.

Interval of these two surveys was too close. According to staff of Health Research and Development Board, MoH of Indonesia, 1 block census missing in Basic Health Research 2007 because of that block refused to be interviewed again after National Socio-economic Survey 2007 1-5 months before.

Another missing data was mother data. For data of 1655 under-five years old children in Banten, the data of their mother was only 1410 individual mother.

Data set of children health information is only consists of all variable in the conceptual frame work. Some other condition as underlying of diarrhea, such as measles incidence, cannot be link for analysis.

Recall period of having diarrhea in children was 1 month before survey. It probably makes an under-reporting or recall bias of diarrhea morbidity.

Variable of exclusive breast feeding duration should be filled in days for children less than 1 month and in month for children more than 1 month. But, in fact, for data of children more than 1 month, some of it was filled in days. It made a doubt which one was day and month. Then, researcher should recode for the number that more than the age of children, it was concluded as days.

The result cannot be generalized to all over Indonesia because the socio-demographic, mother health behavior and health services utilization factor is different from one with another province.

5.3 Conclusion

This study provides the factors associated with diarrhea among under-five years old children in Banten Province, Indonesia based on two surveys in 2007. The higher rate of diarrhea prevalence among under-five years old children was significantly concentrated in the 6-11 months age group in bivariate and multivariate analysis. There was no gender difference.

Percentage of children who had 6 months exclusive breast feeding was low and breast feeding was not associated with diarrhea for children up to 59 months. Child health services delivery, such as food, vitamin A supplementation, and measles immunization were not enough to prevent the under-five years old children suffer from diarrhea.

Level of mother education affected the risk of diarrhea in children in bi-variate analysis, but not significant anymore after controlling other variables.

Age of mother was significant at less than 20 years old and considered as teenage mother. Young mother have found that had more children with diarrhea and the most of mother who never wash the hand with soap. Mother behavior on place of defecation also has strong association with diarrhea in their children in bi-variate analysis.

Diarrhea is water born disease. The environment factors associated with diarrhea in children in bivariate analysis were drinking water source, drinking water source ownership, ease to getting drinking water, how to obtain drinking water, type of water container, water physical quality, latrine ownership, feces landfills and type of liquid drainage channel. Multi-variate analysis, however, only drinking water source and physical quality of drinking water were had association with diarrhea in children after adjusted others variables.

5.4 Recommendations

5.4 1 Recommendations for interventions

Strong effort to reduce diarrhea in children in Indonesia is still needed at policy, and program levels (provider, community, household), because the leading cause of infant and under-five child mortality and morbidity is diarrhea. Recommendations from this study are:

At policy level

- Postpone the marriage of women until at least 20 years old, in collaboration with the Ministry of Religion because the highest risk of having diarrhea among children was with teenage mothers (aged < 20 year),
- Increase the enrolment of girls into senior high school (15-18 year olds) in collaboration with the Ministry of National Education because the highest risk of having diarrhea is among children with mother with lower level of education.
- Local government must have specific intervention for rural area with difficulties to get drinking water source.
- When make urban planning should take into account the water supply, liquid and solid waste disposal, and feces landfills.

At programme level

- Midwives, nurses and doctors in maternity huts, integrated health posts and Public Health Centers should provide health education for mothers and all family members about washing hands with soap before eating, preparing food, after defecating or cleaning up baby stool, and touching the animals.
- National Program for Community Empowerment (*PNPM Mandiri)* can be used by local governments for scaling up diarrhea prevention by encouraging and subsiding the family to have own latrine and promote the use of safe drinking water source.

5.4.2 Recommendation for Further Research

- The Indonesia survey using one month recall period probably gives room for more recall biases. In future surveys, it recommended to use a recall period of two weeks when asking for history of recent diarrhea episodes. This is standard practice in most Demographic Health Surveys around the world.
- The question with different ways of answers generate conclusion in the interpretation of results, interviewers should be better trained in recording duration of an event in days or months according to the age of the child (use days for children less than one month old, use months for all other children).
- Urban congested areas (slums) are specific environments with greater health hazards including higher prevalence to diarrhea. Future surveys should record if the household is located in urban congested areas or normal urban areas.
- Cross sectional study cannot explain diarrhea disease's change over time in different seasons and cannot explain causal relationships between independents and dependent variable. Longitudinal study is needed to identify confounding factors, causal relationships between independent and dependent variables and seasonal differences in the epidemiology of diarrhea.

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APPENDICES

APPENDIX A

BHR 2007 Questionnaire of Variables Used in Secondary Analysis Study

REPUBLIC OF INDONESIA
MINISTRY OF HEALTH
HEALTH RESEARCH AND DEVELOPMENT BOARD

BASIC HEALTH RESEARCH 2007

INDIVIDUAL AND HOUSEHOLD QUESTIONNAIRE

Note: sequential questions numbers are those from primary survey questionnaire

CONFIDENTIAL **RKD07.RT**

	I. PLACE INFORMATION		
1	Province		☐☐
2	District/municipality*)		☐☐
3	Sub-district		☐☐☐
4	Village		☐☐☐
5	Village classification	1. Urban 2. Rural	☐
6	a. Number of block census		
	b. Number of sub-block census		
9	Address		
	II. HOUSEHOLD INFORMATION		
1	Head of household name:		
2	Number of household member:		☐☐
3	Number of household member interviewed		☐☐
4	Number of under-five year old children		☐

III. HOUSEHOLD MEMBER DATA

No	Name of household member	Relation-ship with head of house-hold (CODE)	Sex 1. Male 2. Female	Age	Marital status (CODE)	For ≥ 10 years old: Highest educa-tion (CODE)	Occu-pation (CODE)	Female 10-54 years old. Is she pregnant? 1. Yes 2. No	Did you sleep in mosquito net last night? 1. Yes 2. No → Colum 12 8. Don't know → Colum 12	If yes, is the mosque to net with insec-ticide? 1. Yes 2. No 8. Don't know	Verifi-cation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1.		☐	☐	☐☐	☐	☐	☐☐	☐	☐	☐	☐
2.		☐	☐	☐☐	☐	☐	☐☐	☐	☐	☐	☐
3.		☐	☐	☐☐	☐	☐	☐☐	☐	☐	☐	☐
4.		☐	☐	☐☐	☐	☐	☐☐	☐	☐	☐	☐
5.		☐	☐	☐☐	☐	☐	☐☐	☐	☐	☐	☐

Colum 3 code Relationship with head of household		Colum 6 code Marital status	Colum 7 Highest education	Colum 8 code Occupation		Colum 12 code Verification
1 = Head of household 2 = Wife/husband 3 = Child 4 = Son/daughter in law 5 = grandson /grand daughter	6 = parent/mother /father in law 7 = relatives 8 = Housemaid 9 = Other	1. Single 2. Married 3. Divorced 4. Widow	1 = Illiteracy 2 = Not finished 3 Elementary school 3 = Elementary school 4 = Junior high school 5 = Senior high school 6 = College	01 = jobless 02 = student 03 = Housewife 04 = Army/police 05 = Civil servant 06 = Government company employee 07 = Private company employee	08 = Trader 09 = Services 10 = Farmer 11 = Fisherman 12 = Labor 13 = Other	1 = No change 2 = Change 3 = Death 4 = Move 5 = Born 6 = New member 7 = Not in the household sample

	VI. HEALTH FACILITIES ACCESS AND UTILIZATION			
4	Did ever this household utilize integrated health post within the last 3 months?		1. Yes 2. No → P.6	☐
5	If, Yes, what kind of services has received? 1 = Yes 2 = No 7 = Cannot apply			
	a. body weighing ☐	d. Maternal and Chid Health ☐	g. Complementary feeding ☐	
	b. Counseling ☐	e. Family planning ☐	h. Food supplementation (Vit. A, Fe, springkle) ☐	
	c. Immunization ☐	f. Therapy ☐	i. Risk of disease consultation ☐	
7	Did ever this household utilize maternity hut within the last 3 months?		1. Yes 2. No → P.9	☐
8	If, Yes, what kind of services has received? 1 = Yes 2 = No 7 = Cannot apply			
	a. ante natal care ☐	c. post natal care ☐	e. Infant care (1 -11 months) and/or under-five years old (1-4 years) ☐	
	b. delivery ☐	d. neonatal care (< I month) ☐	f. Therapy ☐	
10	Did ever this household ever utilize village drug post within the last 3 months?		1. Yes → VII 2. No	☐
	VII. SANITATION			
1	How much water consumption for household per day?		……..liters/day ☐☐☐☐	
3	Whether around the water source within a radius of <10 meters there are sources of pollution (sewage, pit latrine/ septic tank/waste)		1. Yes 2. No 3. There is no water source	☐
4	Is water for all household needs easily obtained throughout the year?		1. Yes, easy 2. Difficult at dry season 3. Difficult throughout the year	☐
6	The physical quality of drinking water 1 = yes or 2 = No			
	a. cloudy	b. colored	c. tasty	d. frothy e. smelly
7	What kind of water container before boiled?			
	1. Without water container/directly obtain from the water source before cooking/boiling	2. Open container	3. Close container	☐

8	Drinking water treatment before used 1 = Yes or 2 = No				☐
	a. Drink directly ☐	b. Boiled ☐	c. Filtered ☐	d. Chemical ☐	others ☐
9	Waste water collection from bathroom, sink and kitchen				
	1. Closed water containment at the yard	2. Open water containment at the yard	3. Containment out of the yard	4. Without containment (spread on the soil)	5. Directly to the gutter or river ☐
10	Type of water sewage 1. Open channel 2. Close channel 3. Without channel				☐
11	Is there garbage dump out of the yard?		1. Yes 2. No → P.13		☐
12	If yes, what is kind of garbage dump?		a. Open garbage dump		☐
	1 = Yes 2 = No		b. Close garbage dump		☐
13	Is there wet trash bin (organic) inside the house?		1. Yes 2. No → P.15		
14	If yes, what kind is the wet trash bin?		a. Open trash bin		
	1 = Yes 2 = No		b. Close trash bin		☐

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DIARRHEA			
B10	In the past 1 month, was [NAME]ever diagnosed as diarrhea by a health provider (doctor/nurse/midwife)?	1. Yes → B12 2. No	☐
B11	In the past 1 month, had [NAME] ever had watery/smooth stool more than 3 times a day?"	1. Yes 2. No→ B13	☐
Cb. OUTPATIENT SERVICES			
Cb01	Within the last 1 year, where were you got the outpatient services?		☐☐
	01. Government hospital 02. Private hospital 03. Maternity hospital 04. Public Health Center/Mobile Health Center/Integrated Health Post 05. Policlinic/private clinic	06. Private practitioners 07. Traditional medicine 08. Other (……) 09. At home 10. Never used outpatient services → Cb10a	
Cb02	How much the cost used for the last outpatient services? Rp…….		☐☐ ☐☐☐ ☐☐ ☐

Cb03	What was the funding source of that outpatient services?		
	a. Out of pocket ☐	e. Private Insurance ☐	Health Card ☐
	b. Civil servant insurance/ASKES ☐	e. Health Fund / JPKM ☐	Reimburse from company ☐
	c. Labor insurance/ASTEK ☐	f. Insurance for the poor ☐	Recommendation letter as the poor ☐
	d. Army Insurance / ASABRI ☐	g. Local government insurance ☐	Other source ……. ☐

D. KNOWLEDGE, ATTITUDE AND BEHAVIOR (≥ 10 years old)				
HYEGENE BEHAVIOR				
D08	Did you wash your hand with soap? 1 = Yes 2 = No			
	a. Before eating ☐		b. After defecate/ clean up baby stool ☐	
	c. Before preparing the food ☐		d. After touch the animal (bird, cat, dog) ☐	
D09	Where did you defecate?			
	1. Latrine	3. River/lake/sea	5. Beach/field/garden/yard	☐
	2.Pond/rice field/gutter	4. Land hole	6. Other……	☐

G. IMMUNIZATION AND GROWTH MONITORING (0 – 59 months / under-five year old)			
G01	a1. Age of (name) in month ☐☐	a2. If the age of (name) less than 1 month, write in day ☐☐	
	Dat of birth: (date-month-year)	☐☐–☐☐–☐☐	
G02	Within the last 6 months, how many times (name) has body weighing? If never, fill code "00" or if don't know, fill code "88" → G04	☐☐ times	☐☐
G03	Where did (name) often has body weighing? Hospital 2. Public Health Center 3. Maternity hut 4. Integrated Health Post 5. Others……		☐
G04	Did (name) received vitamin A within the last 6 months? (Use the model card)	1. Yes 2. No	☐
G05	Did ever (name) received immunization? (The information can be collected from many sources)		
	h. Did (name) received measles immunization, it is usually given at the 9 months of age, injected at the thigh and only once time?	1. Yes 2. No 8. Don't know	☐

<table>
<tr><td>G07</td><td colspan="4">Did (name) has growth chart card?</td></tr>
<tr><td></td><td colspan="2">1. Yes, can show with immunization records
2. Yes, can show without immunizatiuon records → G09</td><td colspan="2">3. Yes, cannot show → G09
4. 4. Doen't has → G09</td><td>☐</td></tr>
<tr><td>G08</td><td colspan="5">Copy from growth chart card the day, month and year when the child get each immunization.
Write "88" at the colum day/month/year, if the immunization is given but no date mention, and write "99" if the child doesn't get immunization</td></tr>
<tr><td></td><td>a. BCG</td><td></td><td>g. DPT 2</td><td colspan="2"></td></tr>
<tr><td></td><td>b. Polio 1</td><td></td><td>h. DPT 3</td><td colspan="2"></td></tr>
<tr><td></td><td>c. Polio 2</td><td></td><td>i. Measles</td><td colspan="2"></td></tr>
<tr><td></td><td>d. Polio 3</td><td></td><td>j. Hepatitis B1</td><td colspan="2"></td></tr>
<tr><td></td><td>e. Polio 4</td><td></td><td>k. Hepatitis B2</td><td colspan="2"></td></tr>
<tr><td></td><td>f. DPT1</td><td></td><td>l. Hepatitis B3</td><td colspan="2"></td></tr>
<tr><td>G11</td><td colspan="4">If they cannot show the growth chart card, who keep that card?</td></tr>
<tr><td></td><td colspan="4">1. Midwife/health worker 2. Health volunteer cadre 3. Others…….</td><td>☐</td></tr>
</table>

APPENDIX B

Statistic Central Board NSS 2007 Coded Variables that are not already included into the BHR 2007 and are used in Secondary Analysis Study

NATIONAL SOCIO-ECONOMIC SURVEY 2007

HOUSEHOLD AND HOUSEHOLD MEMBER INFORMATION

[JULY 2007]

Note: the sequential numbers are those originally set by the Statistic Central Board

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II. PLACE INFORMATION			
1	Province		☐☐
2	District/municipality*)		☐☐
3	Sub-district		☐☐☐
4	Village		☐☐☐
5	Village classification	2. Urban 2. Rural	☐
6	b. Number of block census		
	b. Number of sub-block census		
7	Code sample number		☐☐☐☐☐
8	Household sample serial number		☐☐
II. HOUSEHOLD INFORMATION			
1	Head of household name:		
2	Number of household members	0 – 4 years	☐
		5 – 9 years	☐
		10 + years	☐☐
		Number of household members	☐☐

V. INDIVIDUAL INFORMATION ABOUT UNDER-FIVE YEARS CHILDREN HEALTH, EDUCATION, OCCUPATION, FERTILITY AND FAMILY PLANNING		
V.B. UNDER-FIVE YEARS CHILDREN INFORMATION (AGE 0-59 MONTHS)		
11.	a. Age in month:……..month (to R. 12 if the answer 00) c. If R. 11a = 00, age in day: ……day	☐☐ ☐☐
14.	a. Did ever had breastfed? 1. Yes 2. No [R.15.a]	☐☐
	b. If "Yes", duration of breastfeeding: [Fill in day if age < 1 month and in month in age > 1 month]: 1. Duration of breast feeding:…… 2. Only breast milk:…… 3. Breast milk and complementary feeding:……..	☐☐ ☐☐ ☐☐

VI. HOUSING INFORMATION
Type of the wider floor: 1. Earthen floor 2. Not earthen floor
a. Wide of floor……..m2 b. Wide of housing area ……m2
a. Drinking water source: 1. Bottled water 5. Protected well 9. River 2. Tap water with meter 6. Unprotected well 10. Rainfall water 3. Retail tap water 7. Protected Spring 11. Others 4. Pump/drilling well 8. Unprotected spring
Drinking water facility utilization: 1. Household ownership 3. Public facility 2. Sharing 4. There is no drinking water source

8	How to obtain drinking water: 1. Buy 2. Do not buy
9	a. Latrine facility utilization: 1. Household ownership 3. Public facility 2. Sharing 4. There is no latrine b. Type of latrine: 1. Swan neck 3. Pit latrine 2. Pour-flush latrine 4. Do not use latrine c. Feces landfills: 1. Septic tank 4. Ground hole 2. Pond/wetland 5. Beach/yard/garden 3. River/lake/sea 6. Others

APPENDIX C

Time Schedule

Activity		2010					2011					
	Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
	Week	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
1.	Literature review											
2.	Writing thesis proposal											
3.	Submission for proposal exam											
4.	Proposal exam											
5.	Proposal revision											
6.	Ethical Consideration											
7.	Data source collection											
8.	Data analysis											
9.	Thesis and article writing											
10.	Final thesis exam											

APPENDIX D

Budget of Study

Activities	Details	Total (Baht)
Literature review	Stationary and computer supplies	1,500
Data source collection	Transportation to Ministry of Health office, Statistic Center Board office and 6 districts in Banten to get software data base and other key documents	10,000
Data analysis	Stationary and computer supplies	8,500
Report writing	Stationary and computer supplies	12,000
Grand total		32,000

VITAE

Name	**:**	Mrs. Nida Rohmawati
Date of Birth	**:**	August, 18th 1972
Place of Birth	**:**	Yogyakarta, Indonesia
Education	**:**	Medical doctor Medical Faculty of Andalas University, West Sumatra Indonesia, December 1997
Work experiences	**:**	Head of Bentiring Public Health Center North Bengkulu District, Bengkulu Province, Indonesia August 1998 – August 2000
		Head of Anggut Atas Public Health Center Bengkulu City, Bengkulu Province, Indonesia December 2000 – August 2003
		Staff of Under-five Children Health Sub-directorate, Directorate of Family Health, Ministry of Health of Indonesia August 2003 – February 2006
		Head of Standardization Section, Under-five and Preschool Child Health Sub-directorate, Directorate of Child Health, Ministry of Health of Indonesia February 2006 – May 2010