ปัจจัยที่มีความสัมพันธ์กับโรคท้องร่วง และการติดเชื้อระบบทางเดินหายใจ ในเด็กอายุต่ำกว่า 5 ปี ในประเทศไทย: การวิเคราะห์ข้อมูลทุติยภูมิจากการสำรวจแบบพหุดัชนีแบบจัดกลุ่มของประเทศไทย ปี พ.ศ. 2549

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FACTORS ASSOCIATED WITH DIARRHEA AND ACUTE RESPIRATORY INFECTIONS AMONG CHILDREN LESS THAN 5 YEARS OLD IN THAILAND: A SECONDARY ANALYSIS OF THAILAND MULTIPLE INDICATOR CLUSTER SURVEY 2006

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A Thesis Submitted in Partial Fulfillment of the Requirements
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คาลิสตัส วิลันดา: ปัจจัยที่มีความสัมพันธ์กับโรคท้องร่วงและการติดเชื้อระบบทางเดินหายใจในเด็กอายุต่ำกว่า 5 ปีในประเทศไทย: การวิเคราะห์ข้อมูลทุติยภูมิจากการสำรวจแบบพหุดัชนีแบบจัดกลุ่มของประเทศไทย ปี พ.ศ. 2549 (FACTORS ASSOCIATED WITH DIARRHEA AND ACUTE RESPIRATORY INFECTIONS AMONG CHILDREN LESS THAN 5 YEARS OLD IN THAILAND: A SECONDARY ANALYSIS OF THAILAND MULTIPLE INDICATOR CLUSTER SURVEY 2006). อ.ที่ปรึกษาวิทยานิพนธ์หลัก: เอเลสซิโอ แพนซา MD., M.C.H., D.T.M. & H., 104 หน้า

การศึกษานี้วิเคราะห์ปัจจัยที่มีความสัมพันธ์กับโรคท้องร่วงและการติดเชื้อระบบทางเดินหายใจในเด็กอายุต่ำกว่า 5 ปีในประเทศไทย โดยใช้ข้อมูลทุติยภูมิจากการสำรวจแบบพหุดัชนีแบบจัดกลุ่มในเดือนธันวาคม พ.ศ. 2548 ถึงเดือนกุมภาพันธ์ พ.ศ. 2549 ใช้วิธีการสุ่มตัวอย่างชั้นภูมิ 2 ระดับ โดยมีจังหวัดเป็นหน่วยชั้นภูมิ กำหนดให้ชุมรุมอาคาร (ในเขตเทศบาล) และหมู่บ้าน (นอกเขตเทศบาล) เป็นหน่วยตัวอย่างขั้นที่หนึ่ง โดยใช้ความน่าจะเป็นแบบสัดส่วนเทียบกับขนาดของแต่ละหน่วยตัวอย่าง และให้ครัวเรือนส่วนบุคคลเป็นหน่วยตัวอย่างขั้นที่สองโดยการสุ่มอย่างเป็นระบบจากในแต่ละชุมรุมอาคารและหมู่บ้าน โดยเก็บข้อมูลจากเด็กจำนวน 9,444 คน มีเด็กจำนวน 9,409 คน ให้ข้อมูลครบถ้วนตามอายุที่สามารถนำมาวิเคราะห์ได้ ใช้การวิเคราะห์แบบตัวแปรคู่ ด้วยการทดสอบไคสแควร์และ แบบฟิชเชอร์ แอคแซคในการวิเคราะห์แบบหลายปัจจัยร่วมกับการวิเคราะห์ถดถอยโลจิสติก

ผลการศึกษาพบว่า ความเสี่ยงที่เพิ่มขึ้นของเด็กต่อการเกิดโรคท้องร่วงในครัวเรือนที่มีเด็กอายุต่ำกว่า 5 ปี 1 คนหรือในหัวหน้าครัวเรือนคนไทยหลายๆคน รวมทั้งในเด็กผู้ชายที่มีผู้สูงอายุเป็นคนดูแล ในเด็กอายุ 6 – 23 เดือน มีการเพิ่มความเสี่ยงต่อโรคท้องร่วงสูงที่สุด จากการใช้ดัชนีชี้วัดความมั่งคั่งของครัวเรือน พบว่ามีความสัมพันธ์กับการเพิ่มความเสี่ยงต่อโรคท้องร่วงในเด็กที่จัดอยู่ในกลุ่มที่มีระดับต่ำ ปานกลาง และลำดับที่ 4 ของดัชนีวัดความมั่งคั่ง เมื่อเทียบกับเด็กในกลุ่มที่จัดอยู่ในระดับที่รวยที่สุด นอกจากนี้การกำจัดอุจจาระของเด็กที่ไม่ถูกวิธีและการไม่เลี้ยงลูกด้วยนมแม่มีความสัมพันธ์กับการเพิ่มความเสี่ยงต่อการเกิดโรคท้องร่วงในเด็กอายุต่ำกว่า 2 ปี การที่อาศัยอยู่ในพื้นที่เขตชนบทในภาคตะวันออกเฉียงเหนือ การมีหัวหน้าครัวเรือนคนไทย 1 คน การเป็นเด็กชายอายุ 13 -23 เดือน การไม่เคยกินนมแม่ ทั้งหมดนี้ล้วนมีความสัมพันธ์กับการเพิ่มความเสี่ยงต่อการติดเชื้อในระบบทางเดินหายใจในเด็กอายุต่ำกว่า 5 ปี ซึ่งการไม่ได้กินนมแม่มีความสัมพันธ์กับการเพิ่มความเสี่ยงต่อการติดเชื้อระบบทางเดินหายใจในเด็กอายุต่ำกว่า 2 ปี

ข้อเสนอแนะจากการศึกษานี้ ได้แก่ การให้การส่งเสริมทักษะในการเลี้ยงดูเด็ก การให้สุขศึกษากับกลุ่มเป้าหมายในการสร้างสุขอนามัยที่ดีในการดูแลเด็ก ให้การดูแลเป็นพิเศษในเด็กผู้ชายช่วงอายุ 6 – 23 เดือน มุ่งเป้าหมายไปยังผู้ดูแลเด็กที่เป็นวัยรุ่นและผู้สูงอายุในการป้องกันการเกิดโรคท้องร่วง และควรมีการศึกษาในระยะยาวถึงการติดเชื้อในระบบทางเดินหายใจและโรคท้องร่วงในเด็กต่อไป

สาขาวิชา: การพัฒนาระบบสาธารณสุข　　**ลายมือชื่อนิสิต** ....

ปีการศึกษา: 2551　　**ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก** ....

5179104253 MAJOR HEALTH SYSTEMS DEVELOPMENT
KEYWORDS: FACTORS/ DIARRHEA/ ARI/ CHILDREN LESS THAN 5 YEARS/ THAILAND

CALISTUS WIILUNDA: FACTORS ASSOCIATED WITH DIARRHEA AND ACUTE RESPIRATORY INFECTIONS AMONG CHILDREN LESS THAN 5 YEARS OLD IN THAILAND: A SECONDARY ANALYSIS OF THAILAND MULTIPLE INDICATOR CLUSTER SURVEY 2006. ADVISOR: ALESSIO PANZA MD, M.C.H., D.T.M. &H., 104pp.

This study examined factors associated with diarrhea and ARI among children aged less than 5 years in Thailand using data from the MICS conducted from December 2005 to February 2006. A stratified two stage sampling technique was used with provinces constituting strata. Primary sampling units were blocks for municipal areas or villages for non municipal areas. Sample selection of blocks/villages was done using probability proportional to size. Secondary sampling units were systematically sampled individual households in each block/village. Data were collected for 9444 children with 9409 children who had complete data on age being included in the analysis. Bivariate analysis was done using Chi square and Fisher's exact tests with multivariate analysis being done using binary logistic regression.

The study found increased risk of diarrhea among children in households with one child under 5 years or with Thai heads. Male children and those with elderly caretakers were also at increased risk of diarrhea. The highest risk of diarrhea was in children aged 6-23 months. Household wealth index quintile also had an association with diarrhea with children in the poor, middle and fourth wealth index quintiles being at increased risk of diarrhea compared to children in the richest wealth index quintile. Unsafe disposal of child's feces and not breastfeeding at all were associated with increased risk of diarrhea in children aged less than 2 years. As for ARI, living in rural areas, living in North East region, having a Thai household head, being a male child, being aged 13-23 months and having never breastfed were associated with increased risk of ARI in children aged less than 5 years. Not being breastfed was associated with increased risk of ARI in children aged less than 2 years.

Continued efforts to promote recommended child feeding practices, providing health education to targeted populations on hygienic practices in child care, special attention in the care of male children and those aged 6-23 months, targeting teenage and elderly child caretakers in diarrhea prevention efforts and longitudinal studies on diarrhea and ARI in children are recommended.

Field of Study: Health Systems Development **Student's Signature:** ....

Academic Year: 2008 **Advisor's Signature:** ....

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LIST OF ABBREVIATIONS

ARI	Acute Respiratory Infections
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
DALYs	Disability Adjusted Life Years lost
DHS	Demographic and Health Survey
DPT	Diphtheria, Pertusis, Tetanus
EBF	Exclusive breast feeding
IQR	Inter-quartile range
LPG	Liquefied Petroleum Gas
MGD	Millennium Development Goals
MICS	Multiple Indicator Cluster Survey
MoPH	Ministry of Public Health
NCHS	National Center for Health Statistics
NSO	National Statistics Office
OR	Odds ratio
OVC	Orphans and Vulnerable Children
SD	Standard deviation
UNICEF	United Nations Children’s Fund
WHO	World Health Organization

CHAPTER I

INTRODUCTION

1.1 Background

Pneumonia and diarrhea are major causes of morbidity and mortality among children aged less than 5 years and account for 19% and 18% respectively of all the global infant deaths annually. Most of these deaths; which are preventable, occur in developing countries. Under nutrition is an underlying cause of an estimated 53% of the 10.6 million yearly deaths in children younger than age 5 years**.** The estimated proportions of deaths in which under nutrition is an underlying cause are roughly similar for diarrhea (61%), and pneumonia (52%) (Bryce, Boschi-Pinto, Shibuya, & Black, 2005).

Acute respiratory infections (ARI) are classified into two groups based on the site of infection; acute lower respiratory infections (ALRI) and acute upper respiratory infections (AURI). Acute lower respiratory infections in children include pneumonia, bronchiolitis, bronchitis, laryngitis, epiglotitis and pharyngotonsilitis (Medindia, 2008; WHO, 2008a). Pneumonia alone is responsible for about 90% of the mortality due to ALRI. Causative organisms may be bacterial or viral, but its not possible to differentiate between the two based on clinical signs or radiology (WHO, 2008a). On the other hand common AURI include nasopharyngitis, pharyngotonsilitis and otitis (Medindia, 2008). ARI are described as 'presumed pneumonia' to better reflect probable cause and the recommended interventions. The definition of ARI used in the Multiple Indicator Cluster Surveys (MICS) is based on mothers' perceptions of a child who has a cough, is breathing faster than usual with short, quick breaths or is having difficulty breathing, excluding children that has only a blocked nose (UNICEF, 2006; WHO, 2008c).

Diarrhea is defined as the passage of 3 or more loose or liquid stools per day, or more frequently than its normal for the individual (WHO, 2008b).

Under nutrition among children is usually determined by assessing the anthropometric status of the child relative to a reference standard. In assessing a child's nutritional status, three types of under nutrition can be distinguished: wasting or insufficient weight for height indicating acute under nutrition; stunting or insufficient height for age indicating chronic under nutrition; and underweight or insufficient weight for age which could be a result of either or both. Wasting, stunting, and underweight for a child are typically determined using a Z-score which is obtained by dividing the difference between the observed value and the median reference value with the standard deviation of a reference population. For international use, the World Health Organization (WHO) recommends the National Center for Health Statistics/Centers for Disease Control (NCHS/CDC) reference as a reference population in calculation of Z-scores (WHO, 1995). Malnutrition is both a risk factor for, and a consequence of diarrhea in children.

There exists a significant association between malnutrition and diarrhea (El Samani, Willett, & Ware, 1988; Scholing, McAuliffe, Iuadora de Souza, & Lguerrant, 1990) and ARI (Coles et al., 2005). Attaining a good nutritional status among children is therefore important in reducing the burden of diarrhea and ARI in this group.

There are three major categories of child feeding practices; exclusive breastfeeding; complementary feeding and replacement feeding. Exclusive breastfeeding refers to breastfeeding while giving no other food or liquid, not even water, with the exception of drops or syrups consisting of vitamins, mineral supplements or medicines. Complementary feeding refers to the process of giving an infant food in addition to breast milk or infant formula, when either becomes insufficient to satisfy the infant's nutritional requirements while replacement feeding refers to the process of feeding a child who is not receiving any breast milk with a diet that provides all the nutrients the child needs until the child is fully fed on family foods (WHO, 2003). Exclusive breastfeeding practice for the first 6 months of a child's life is recommended by the United Nations Children's Fund (UNICEF) and the WHO based on its benefits to the mother and baby. To meet their evolving nutritional needs from 6 months, infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues for up to 2 years of age or beyond (WHO/UNICEF, 2003).

Exclusive breastfeeding has shown to reduce infant malnutrition and mortality due to acute respiratory infections (ARI) and diarrhea (Arifeen et al., 2001), whereas early weaning is associated with high incidence of diarrhea (Melo et al., 2008). In general, the choice of a feeding practice can impact on the child's health.

Maternal socio demographic factors have been associated with the risk of diarrhea and ARI in children. Children with young mothers have increased incidence or prevalence of diarrhea (Ahmed, Saeed, & Al Othman, 2002; Melo et al., 2008) and ARI (Azad, 2009). Low education level of the mother is associated with increased risk of ARI and diarrhea among children (Azad, 2009; Molbak, Jensen, Ingholt, & Aaby, 1997) . Not being taken care of by the mother has also been identified as a risk factor for diarrhea in children (Ahmed et al., 2002; Molbak et al., 1997).

Generally, low socioeconomic status of a household has been identified as a risk factor for ARI and diarrhea in children (Deb, 1998; Hatt & Waters, 2005; Mahalanabis et al., 2002)

A number of demographic factors of a child can play a role in the risk of diarrhea and ARI. These include age, immunization status, sex and birth weight. A higher prevalence of diarrhea has been identified in children over 6 months of age, in those who had no vaccination or follow-up cards (Ahmed et al., 2002). Low birth weight has been identified as a risk factor for community acquired alveolar pneumonia (Coles et al., 2005). Male sex has been associated with suffering higher diarrheal episodes among children (Melo et al., 2008; Molbak et al., 1997)

The WHO notes that, the achievement of the millennium development goal of reducing child mortality by two-thirds from the 1990 rate by 2015 will depend on renewed efforts to prevent and control pneumonia, diarrhea, and under nutrition in all its regions (Bryce et al., 2005).

This study will explore the relationship between house hold and maternal socio-demographic factors, child's demographic factors, feeding practices and nutritional status; as independent variables and diarrhea and ARI as dependent variables in children aged less than 5 years. The study will use data from the Thailand MICS conducted by the National Statistics Office (NSO) with support from UNICEF Thailand, from December

2005 to February 2006. The survey was based on the need to monitor progress towards the goals and targets that emanated from two international agreements; the millennium declaration, adopted by all 191 United Nations Member States in September 2000 and the Plan of Action of “A World Fit for Children” adopted by 189 Member States at the United Nations Special Session on Children in May 2002. Thailand being one of the countries that signed the Millennium Declaration and the Plan of Action of a World Fit for Children therefore committed itself to improving conditions for all children in the country and monitoring progress towards achievement of the goals and objectives set therein.

1.2 Rationale

Diarrhea and ARI are the leading causes of burden of disease in children world wide. The Thailand annual epidemiological surveillance report reveals a high burden of both diarrhea and pneumonia morbidity and mortality among children aged less than 5 years compared to other age groups (Ministry of Public Health, 2008). There is currently limited information on the risk factors of diarrhea and ARI in children in Thailand at national level. The Thailand MICS collected data which is important for monitoring the situation of children in the Kingdom. The final Thailand MICS report already published was based on limited analysis of collected data, leaving a lot of useful information still lying in the data. In this study further analysis of the MICS data was done with the aim of exploring factors associated with diarrhea and ARI in children aged less than 5 years. The results will be useful in making recommendations to public health policy makers and for comparisons with studies conducted elsewhere in the world to strengthen the available information in this field.

1.3 Research question

What factors are significantly associated with diarrhea and ARI among children aged less than 5 years in Thailand?

1.4 Statistical hypothesis

1. There is no relationship between household socio-demographic factors and diarrhea and ARI among children aged less than 5 years in Thailand
2. There is no relationship between maternal socio-demographic factors and diarrhea and ARI among children aged less than 5 years in Thailand
3. There is no relationship between child's demographic factors and diarrhea and ARI among children aged less than 5 years in Thailand
4. There is no relationship between feeding practices and diarrhea and ARI among children in Thailand
5. There is no relationship between nutritional status and diarrhea and ARI among children aged less than 5 years in Thailand

1.5 Study objectives

1.5.1 General objective

To find out factors which are significantly associated with diarrhea and ARI among children aged less than 5 years in Thailand.

1.5.2 Specific objectives

1. To explore the relationship between household socio-demographic factors and diarrhea and ARI among children aged less than 5 years in Thailand
2. To explore the relationship between maternal socio-demographic factors and diarrhea and ARI among children aged less than 5 years in Thailand
3. To explore the relationship between demographic factors of children aged less than 5 years and diarrhea and ARI in this age group in Thailand
4. To explore relationship between feeding practices and diarrhea and ARI among children in Thailand
5. To explore the relationship between nutritional status and diarrhea and ARI among children aged less than 5 years in Thailand

1.6 Conceptual framework

Independent variables → Dependent variables

Independent variables

<u>Household socio-demographic factors</u>
- Region
- Residence
- Wealth index quintile
- Language of house hold head
- Ethnic group of house hold head
- Number of children under 5 years
- Main Source of drinking water
- Treatment of drinking water
- Type of toilet facility
- Child's feces disposal method
- Type of fuel used for cooking
- Household's head education level

<u>Maternal/caretaker's socio-demographic factors</u>
- Age
- Gender
- Education level
- Current marital status
- Number of children ever born

<u>Child's demographic factors</u>
- Gender
- Age
- Registration status
- OVC status
- Immunization status

<u>Child's feeding practices</u>
- Ever breastfed
- Exclusive breastfeeding
- Complementary feeding
- Replacement feeding (weaned)

<u>Child's nutritional status</u>
- Height for age z-score
- Weight for age z-score
- Weight for height z-score

Dependent variables

- Diarrhea
- Acute Respiratory Infections

Figure 1: Conceptual framework

1.7 Operational definitions

The variables are mainly defined based on the MICS definitions (Thailand National Statistical Office, 2006; UNICEF, 2006)

1. House hold socio-demographic factors

    a. Region referred to geographic location of the household in Thailand. Grouped into North, North East, Central (including Bangkok) and Southern.

    b. Residence referred to the location of a household, classified as either urban or rural

    c. Household wealth index quintiles were classified as poorest, second, middle, fourth and richest. Calculation of the wealth index quintiles was done by UNICEF and was based on ownership of certain types of assets, materials used for household construction, having electricity in the household, access to drinking water and water for general usage, and nature of sanitation facilities.

    d. Language of the household head referred to the main language spoken by the household head, classified as Thai or other languages.

    e. Ethnic group of the household head refers to either Thai or non Thai.

    f. Number of children under five referred to all children in the household who were aged less than five years.

    g. Main source of drinking water. This was classified into improved and unimproved drinking water supply. Improved drinking water supply included water piped into dwelling or yard/plot, public tap, tube well, protected well, protected rainwater and bottled water. Bottled water was considered improved only if the household uses improved water source for other purposes. Unimproved drinking water supply included unprotected well, unprotected spring, surface water, tanker-truck and others.

h. Treatment of drinking water referred to whether the house hold treats water to make it safe to drink. Classified as yes or no. Drinking water was considered treated if the following methods of treatment were used: boiling, adding bleach or chlorine, using a filter or using solar disinfection. Water strained through a cloth, let to stand and settle and or is treated by other methods was considered not treated.

i. Type of toilet facility was classified as improved or unimproved sanitation facility. Improved facilities included flush/pour toilets connected to a sewage system, septic tanks or pit latrines; and pit latrines with slabs. Unimproved facilities included use of flush or pour flush to rivers or canals, pit latrines without slabs or no facilities (using bush or field)

j. Method of disposal of child's feces referred to what was done to dispose of stool the last time a child passed it. This was classified as safe or unsafe method. Safe disposal methods were having the child use a toilet, putting or rinsing feces into a flush/pour toilet connected to a piped sewer system or into a latrine or pit latrine with slabs. Unsafe methods included putting feces in garbage, burying it or leaving it in the open.

k. Type of fuel used for cooking: This was classified as clean or unclean. Clean fuels included electricity, liquefied petroleum gas and biogas. Unclean fuels included kerosene, charcoal, coal, wood or agricultural crop residue and animal dung.

l. Household head's education level: This referred to the highest level of education completed by the head of a household. This was classified as none, primary and secondary and above.

2. Maternal/caretaker's socio-demographic factors:

   a. Age referred to completed years as at last birthday before the interview
   b. Gender referred to being either male or female
   c. Education level referred to highest level of education completed; classified as none, primary, secondary and beyond
   d. Current marital status was classified as never married/in union, currently married/in union or formerly married/in union.
   e. Number of previous births referred to all the births a mother had had even if the child lived a few minutes

3. Child factors

   a. Child's age referred to age in completed months.
   b. Gender referred to being either male or female
   c. Registration status. This was classified as registered and not registered. A child was considered registered if he/she had a birth certificate or is registered by civil authorities.

d. OVC status. This was classified as orphans, vulnerable and non-OVC. A child was an orphan if one or both of his/her biological parents were dead. A vulnerable child was one whose any one parent has been sick for at least 3 months in the past 12 months (chronically ill) or a child from a household with a chronically ill usual member aged 18-59 years or a child from a household with an adult death after a chronic illness of 3 out of the 12 months preceding the survey.

e. Immunization status referred to the DPT 3 and measles immunization status of a child aged 7-59 and 13-59 months respectively as verified from the immunization card or reported by the mother.

4. Feeding patterns (breastfeeding status was based on mother's or caretaker's reports of children's consumption in the past 24 hours prior to the interview)

   a. Exclusive breastfeeding referred to children who received only breast milk, or breast milk and vitamins, mineral supplements or medicines.

   b. Complementary feeding referred children who receive breast milk and solid or semi solid food

   c. Replacement feeding (weaned) referred to children who were not receiving breast milk

5. Nutritional status.

   a. Weight for age z-score is 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 less than -2 standard deviations (underweight) and -2 or more standard deviations.

b. Height for age z-score is a nutritional status indicator of height and age of a child expressed in standard deviations from the median of the NCHS-CDC reference population. This was classified as less than -2 standard deviations (stunted) and -2 or more standard deviations.

c. Weight for height z-score is a nutritional status indicator of weight and height of a child expressed in standard deviations from the median of the NCHS-CDC reference population. This was classified as less than -2 standard deviations (wasted), -2 to 2 standard deviations (normal) and more than 2 standard deviations (overweight)

6. Diarrhea was defined as passage of 3 or more loose stool a day or blood in the stool in the last two weeks as reported by the caretaker.

7. Children with acute respiratory tract infection were those who had an illness characterized by a cough, accompanied by rapid or difficult breathing and whose symptoms were due to a problem in the chest, or both a problem in the chest and a blocked nose, in the past two weeks preceding the survey as reported by the caretaker.

CHAPTER II

LITERATURE REVIEW

2.1 Household factors associated with diarrhea and ARI in children

A pooled analysis of DHS data from 12 Latin American countries showed that household economic status is an important determinant of diarrhea and ARI morbidity in children (Hatt & Waters, 2005) In a case control study in Bangladesh, income in the uppermost quartile of the study population was independently associated with 41% reduced risk of severe diarrhea compared to the lowest quartile (Mahalanabis, Faruque, Islam, & Hoque, 1996). Poor socioeconomic status has also been identified as a risk factor for pneumonia in children in Bangladesh (Mahalanabis et al., 2002). In a cohort study in India, low socioeconomic status was shown to increase the risk of ARI in children (Deb, 1998).

Lack of access to safe drinking water is associated with an increased risk of diarrheal disease in children (Marino, 2007). In a cohort study of about 1300 children in Guinea Bissau, drinking water from unprotected public supply was independently associated with increased incidence of diarrhea (Molbak et al., 1997)

Poor hygienic practices like indiscriminate disposal of child feces have shown to increase diarrhea in children (Ghosh et al., 1997; Tumwine et al., 2002). Same results have also been demonstrated in a study in 3 East African countries (Tumwine et al., 2002), which also showed and association between household head's education and diarrhea in children.

Use of unclean fuels like kerosene, biomass and charcoal for cooking is a risk factor for ARI in children as has been demonstrated in a study in Tanzania (Kilabuko & Nakai, 2007). A study in Bangladesh (Mahalanabis et al., 2002) showed high risk of pneumonia among children in households that use solid fuels.

A study in Egypt showed higher risk of diarrhea among rural children than in their urban counterparts (El-Gilany & Hammad, 2005). Similar results were found in Philippines (Costello, Lieno, & Jensen, 1996) where researchers found higher prevalence of diarrhea and ARI in rural than in urban children.

2.2 Maternal/caretaker's factors associated with diarrhea and ARI in children

Maternal and caretaker's socio-demographic factors have been shown to be associated with the risk of diarrhea and ARI in children. A cross sectional study in Saudi Arabia demonstrated increased prevalence of diarrhea among children with young mothers, those who were not under the care of their mothers and in those whose mothers were working away from home (Ahmed et al., 2002). Higher diarrhea incidence has also been demonstrated in children with younger mothers in a cohort study in Brazil (Melo et al., 2008). A study in Guinea Bissau showed that lack maternal education was associated with diarrhea in children (Molbak et al., 1997). Mothers education was also associated with diarrhea and ARI in Latin America (Hatt & Waters, 2005) and Philippines (Costello et al., 1996).

An analysis of DHS data in Bangladesh (Azad, 2009) has shown that children of teenage mothers and those with low education level were at higher risk of ARI. The study also showed higher risk of ARI among mothers with low Body Mass Index (BMI).

2.3 Child factors associated with diarrhea and ARI in children

A number of child factors are associated with an increased risk of diarrhea and ARI. These include age, immunization status, birth weight and gender. In Saudi Arabia, a higher prevalence of diarrhea was identified in children aged over 6 months and in those who had no vaccination or follow-up cards (Ahmed et al., 2002). Missed immunizations has been associated with diarrhea in children (Melo et al., 2008). Longitudinal studies in Brazil have found higher incidences of diarrhea among children under 1 year of age (Giugliano, Bernardi, Vasconcelos, Costa, & Giugliano, 1986; Melo et al., 2008). A study in Bangladesh has shown higher risk of ARI among children ages less than 1 year (Azad, 2009). Low birth weight has been identified as a risk factor for community acquired alveolar pneumonia in Israel (Coles et al., 2005). A study in Papua new Guinea identified a strong association between low birth weight and diarrhea in children under 5 years (Bukenya, Barnes, & Nwokolo, 1991). Another study in Pakistan however failed to show the relationship between low birth weight and diarrhea incidence among infants (Cheung, Jalil, Yip, & Karlberg, 2001). Male children have been shown to suffer more diarrheal episodes than their female counterparts (Melo et al., 2008; Molbak et al., 1997). Higher risk of ARI has been demonstrated in male children in Tanzania (Kilabuko & Nakai, 2007).

2.4 Feeding practices in children

The WHO classifies child feeding practices into three categories: Exclusive breastfeeding; supplementary feeding and replacement feeding. Exclusive breastfeeding refers to breastfeeding while giving no other food or liquid, not even water, with the exception of drops or syrups consisting of vitamins, mineral supplements or medicines. Complementary feeding refers to the process of giving an infant food in addition to breast milk or infant formula, when either becomes insufficient to satisfy the infant's nutritional requirements while replacement feeding refers to the process of feeding a child who is not receiving any breast milk with a diet that provides all the nutrients the child needs until the child is fully fed on family foods (WHO, 2003).

Inappropriate feeding practices and their consequences are major obstacles to sustainable socioeconomic development and poverty reduction. Breast milk is the ideal food for healthy growth and development of infants and young children. The WHO and UNICEF recommend exclusive breastfeeding of infants for the first 6 months of life. This is important in achieving optimal growth, development and health. From 6 months, infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues for up to 2 years of age or beyond. Exclusive breastfeeding from birth is possible except for a few medical conditions (WHO/UNICEF, 2003). It is worth noting that the duration of exclusive breastfeeding recommendation by WHO and UNICEF was born out of an expert consultation which recommended exclusive breast feeding for six months, emphasizing that this recommendation applies to populations while recognizing that some mothers will be unable to, or choose not to, follow it (WHO, 2002)

Infants are particularly vulnerable during the transition period when complementary feeding begins. To ensure that their nutritional needs are met thus requires that complementary foods have the following properties (WHO/UNICEF, 2003):

a) Timeliness: Foods should be introduced when the need for energy and nutrients exceeds what can be provided through exclusive and frequent breastfeeding
b) Adequacy : Foods should provide sufficient energy, protein and micronutrients to meet a growing child's nutritional needs
c) Safety: Foods should be hygienically stored and prepared, and fed with clean hands using clean utensils and not bottles and teats
d) Properly fed: Foods should be given consistent with a child's signals of appetite and satiety

Despite this recommendation and the efforts put into promoting breastfeeding, only about 38% of infants in the developing world are exclusively breastfed during the first six months of life (UNICEF, 2007). Complementary feeding frequently begins too early, and foods are often nutritionally inadequate and unsafe (WHO/UNICEF, 2003). This underscores the importance of continued efforts to promote the first six months exclusive breastfeeding and appropriate complementary feeding especially in developing countries where most mothers cannot afford to provide nutritionally adequate complementary and replacement feeds under hygienic conditions.

In a longitudinal study in the UK among 11, 490 infants on the patterns of exclusive breastfeeding, exclusive breastfeeding declined steadily from 54.8% in the first month to 31% in the third, and fell to 9.6% in the fourth month mainly due to the introduction of solids to the infants. In the first 2 months, complementary feeding was used in combination, and declined from 22% in the first month to 16.8% in the second due to a switch to exclusive commercial infant formula feeding. Replacement feeding increased steadily from 21.9% in the first month to 67.1% by the seventh. This obscured the change from exclusive commercial infant formula feeding only to commercial infant formula feeding plus solids/semi-solids, a change which started in the third month and was complete by the fifth (Pontin, Emmett, Steer, Emond, & ALSPAC Study Team, 2007). In another longitudinal study in the UK involving 18,125 singletons born over a 12-month period spanning 2000–01, breastfeeding was initiated for 71% of babies, and by 1, 4 and 6 months of age the proportions being exclusively breast-fed were 34%, 3% and 0.3%, respectively (Kelly & Watt, 2005)

The primary analysis of the Thailand MICS 2006 data revealed that only 7.6 % of infants were exclusively breastfed during the first three months of life with the rate declining even further, to 5.4 % for infants aged 0-5 months. Central Thailand has the lowest level of exclusive breastfeeding (2.4%) while the highest level (10.9%) is found in the North. At age 6-9 months, 42.6% of children were receiving breast milk and solid or semi-solid foods. By age 12-15 months, 31.6% of children were still being breastfed, and by age 20-23 months, 18.7% were still breastfed. The study also found that about half of the mothers initiated breastfeeding within one hour of birth (Thailand National Statistical Office, 2006).

A recent prospective study at a medical college in Bangkok among 210 infants found that rates of exclusive breastfeeding at 3, 4, and 6 months were 48%, 26%, and 11% respectively (Laisiriruangrai, Wiriyasirivaj, Phaloprakarn, & Manusirivithaya, 2008). These findings seem to differ significantly with the Thailand MICS findings.

2.5 Factors affecting child feeding practices

Several factors could play a role in influencing child feeding practices. Results from the Millennium Cohort Study in the UK showed that initiation and exclusive feeding rates were higher among mothers aged 30 or over, who were non-smokers, living in higher income households, who lived with a partner and who were first-time mothers. Women with routine jobs with the least favorable working conditions were more than four times less likely to initiate breastfeeding compared with women in higher managerial and professional occupations and were less likely to exclusively breast-feed their infants at 1 month (Kelly & Watt, 2005)

In a longitudinal study of 3600 children in Australia , researchers found that infants born before 40 weeks had a greater risk of being artificially fed than infants born at or after 40 weeks (Donath & Amir, 2008)

The risk of mother to child transmission of HIV is an important factor that has an influence on child feeding practice. Studies show that exclusively breastfed infants are at lower risk of HIV transmission than mixed fed infants leading to the recommendation by the WHO of the need for adequate replacement feeding for infants born to HIV-positive mothers who choose not to breastfeed. In resource poor settings, six months exclusive breastfeeding followed by replacement feeding is recommended (WHO/UNICEF, 2003).

In a cross sectional study among 130 mothers in Singhburi Province in Thailand, mothers who had higher incomes tended to use artificial feeding more, while those who worked at home tended to exclusively breast feed (Zainal, Isaranurug, Nanthamongkolchai, & Voramongkol, 2004). In another cross sectional study in

Ratchaburi Province in Thailand, maternal self efficacy and lactation problems were found to be independent variables associated with exclusive breastfeeding with low self efficacy and having lactation problems being related to low levels of exclusive breastfeeding (Aung, 2007). A study in Bangkok Thailand has found a significant association between exclusive breastfeeding pattern and the duration mothers are allowed for work absence and their intended time to breastfeed (Laisiriruangrai et al., 2008).

Thailand is one of the countries with the lowest rate of exclusive breastfeeding (UNICEF, 2007). It is thought that one reason for this is that at many hospitals across the country, mothers giving birth receive little or no encouragement to breastfeed from medical staff and no support on proper breastfeeding techniques. The low rate of exclusive breastfeeding is also tied to the country's rapid socioeconomic development. Increasing numbers of mothers are working outside the home, which can make it difficult to continue exclusive breastfeeding (Keenapan, 2008).

2.6 Feeding practices, diarrhea and respiratory infections in children

The relationship between feeding practices and nutritional status of children is well documented in a plethora of studies. Most studies have demonstrated the multiple benefits of breastfeeding generally and particularly exclusive breastfeeding in reducing morbidity in children. These studies have provided the basis upon which the WHO and UNICEF developed recommendations for infant and young children feeding practices (WHO/UNICEF, 2003).

In a longitudinal study of the feeding practices and morbidity from infectious diseases of 153 Peruvian newborns from an underprivileged, peri-urban community, the incidence and prevalence rates of diarrhea in infants younger than 6 months of age were less among those who were exclusively breast-fed compared with those who received other liquids or artificial milks in addition to breast milk. The diarrheal prevalence rates doubled with the addition of these other fluids Infants for whom breastfeeding was discontinued during the first 6 months had 27.6% diarrheal prevalence. During the second 6 months of life, discontinuation of breast-feeding was also associated with an increased risk of diarrheal incidence and prevalence. Upper and lower respiratory tract infections occurred with lesser prevalence among exclusively breastfed younger infants (Brown, Black, de Roma, & de Kanashiro, 1989). In a six months longitudinal study of 170 infants in Mexico, the incidence and prevalence of ARI were significantly lower in fully breast-fed infants than in formula fed infants from birth up to 4 months (Lo´pez-Alarco´n, Villalpando, & Fajardo, 1997).

There are two possible reasons for reduced infection rates among exclusively breastfed infants. One is due to the role of breast milk in immunity and the other explanation is related to the reduced exposure to contaminated replacement or complementary feeds. In conditions with substandard hygienic levels, children are often exposed to contaminated food and water through weaning resulting into increased risk of diarrhea (Molbak et al., 1997). A recent prospective study of 84 children younger than 4 months in Brazil has demonstrated that early weaning among children is associated with suffering a diarrheal episode (Melo et al., 2008). In a cross sectional study among 138 weanlings in North East Thailand, consumption of un-boiled water by weanlings, not covering perishable foods and washing feeding utensils of weanlings without dishwashing detergent were significantly related to reported weanling diarrhea (Cao et al., 2000)

In a 12 month cohort study among 1677 infants who were born in slum areas of Dhaka in Bangladesh, infants who were either partially or not breastfed had a higher risk of post neonatal death than infants who were breastfed exclusively for the first 4 months of life. The hazard ratio estimates for ARI and diarrhea deaths were 2.40 and 3.94 among partially or not breastfed infants, compared with exclusively breastfed infants (Arifeen et al., 2001). A recent cohort study involving 272 mother-infant pairs in Bangladesh has shown that, infants who were exclusively breastfed for six months had an 8.6% lower prevalence of diarrhea and a 20% lower prevalence of ARI than the group who were not exclusively breastfed. The study found a significant association between the lack of exclusive breastfeeding and diarrhea and acute respiratory infection in the groups (Mihrshahi, Oddy, Peat, & Kabir, 2008)

A longitudinal study of 9,942 children in Philippines demonstrated a greater effect of not breastfeeding on diarrhea than on acute lower respiratory infection mortality. In the first 6 months of life, failing to initiate breastfeeding or ceasing to breastfeed resulted in an 8- to 10-fold increase in the rate of diarrheal mortality. However, after age 6 months, the protective effects of breastfeeding dropped dramatically (Yoon, Robert E. Black, Moulton, & Becker, 1996)

These studies highlight the important role of appropriate breastfeeding practices in child survival through reduction of morbidity and mortality.

2.7 Measuring under nutrition in children

Under nutrition in a population can be gauged by comparing children to a reference population. The WHO and UNICEF recommend the use of the WHO/CDC/NCHS reference as a reference population (Thailand National Statistical Office, 2006). There are three types of under nutrition states based on deviation of anthropometric measurements expressed in standard deviations or Z-scores from the median of the reference population. They include wasting, stunting and underweight. Wasting refers to insufficient weight for height indicating acute under nutrition; stunting refers to insufficient height for age indicating chronic under nutrition; and underweight refers to insufficient weight for age which could be a result of either or both acute and chronic under nutrition. The Z-score system is suitable for population use because it is possible to compute summary statistics like the mean and standard deviation. Besides the Z-score system of anthropometry, there is the percentile system which refers to the position of an individual on a given reference distribution. Percentiles are commonly used in clinical setting because their interpretation is straight forward. It is however inappropriate to compute summary statistics with percentiles. In general abnormal anthropometry is statistically defined as an anthropometric value of below -2 standard deviations (less than -2.rd percentile) or above +2 standard deviations (more than 97.7th percentile) relative to a reference median or mean (WHO, 1995).

2.8 The burden of under nutrition in children

Under nutrition in children is highly prevalent in low-income and middle-income countries, resulting in substantial increases in mortality and overall disease burden. Four-fifths of undernourished children live in just 20 countries across four regions - Africa, Asia, western Pacific, and the Middle East. It is estimated that stunting, severe wasting, and intrauterine growth restriction together are responsible for 2·2 million annual deaths and 21% of disability-adjusted life-years (DALYs) for children younger than 5 years. Suboptimum breastfeeding is estimated to be responsible for 1·4 million child deaths and 44 million DALYs, equivalent to 10% of DALYs in children younger than 5 years (Black et al., 2008). With under nutrition being a highly preventable cause of death, investing in programs that tackles it could go along way is saving numerous lives of children world wide.

2.9 Factors associated with under nutrition in children

Under nutrition among children is associated with multiple risk factors as demonstrated in many studies. In a case control study of 6,881 severely malnourished under 5 children hospitalized with diarrhea in Bangladesh, it was found that severely under weight children were more likely to be older than 11 months, non breastfed, have illiterate mothers, lack a sanitary toilet at home, have history of measles preceding 6 months and had dehydrating diarrhea (Chisti et al., 2007).

A cross sectional study of 2-11 years old children in Vietnam revealed that children of rural households, poor households, and ethnic minority backgrounds were significantly more likely to be malnourished than urban residents, children of non poor households, and the majority Kinh population (Thang & Popkin, 2003).

Child stunting has been found to be significantly related to educational level of primary care givers and the size of the household in a cross sectional study of 131 children aged 30-80 months in Guatemala (Sereebutraa, Solomonsc, Aliyub, & Jolly, 2006). In this study, children with illiterate primary caregivers were 5 times more likely to be stunted compared with those whose primary caregivers were literate. Children living in households with 4 or more children were three times more likely to be stunted than children living in less crowded households.

A cross sectional study of 132 children aged 6-23 months in Kenya (Kariuki et al., 2002) showed that having children at an early age was a risk factor for stunting in children.

In South Africa, a cross sectional survey of 868 children aged 3 to 59 months revealed that migrant father, mother's education, literate mother, housing materials, the presence of a toilet, whether the last child was breast-fed, duration of breast-feeding and birth weight were significantly related to under weight for age (Chopra, 2003)

In a hospital based case control study among children aged 6-24 months from low income families in Brazil, increased risks of infant malnutrition were significantly associated with households that had no toilet facilities or refrigerator, high parity for the mother, no breastfeeding of the infant, inadequate vaccination coverage and previous hospitalization for diarrhea and pneumonia (Lima, Motta, Santos, & Pontes da Silva, 2004)

2.10 Relationship between under nutrition, diarrhea and ARI in children

Under nutrition continues to be a primary cause of ill-health and premature mortality among children in developing countries. Under nutrition has been identified as an underlying cause of an estimated 53% of the 10.6 million yearly deaths in children younger than age 5 years**.** The estimated proportions of deaths in which under nutrition is an underlying cause are roughly similar for diarrhea (61%), and pneumonia (52%) (Bryce et al., 2005).

Being underweight or stunted has long been recognized as an important risk factor for increased prevalence and severity of infection and high mortality rates(Tomkins, 2000) . In a prospective study (334 cases and 529 controls) of Bedouin children aged less than 5 years living in Israel, researchers found that under nutrition and diarrhea were risk factors for community acquired alveolar pneumonia (Coles et al., 2005). A study in Brazil has shown that malnutrition, and previous pneumonia were associated factors for suffering diarrheal episodes (Melo et al., 2008). Malnutrition and diarrhea interact in a vicious cycle. There is a close relationship between indicators of malnutrition and diarrhea (El Samani et al., 1988).

On the other side, diarrhea is a risk factor for malnutrition as has been demonstrated in a number of studies (Checkley, Epstein, Gilman, Cabrera, & Black, 2003). This is probably due to nutrient depletion and reduced food intake during diarrhea. In a recent study of multiple-country analysis of the effects of diarrhea on childhood stunting conducted for nine countries and covering a 20 year period, the effect of diarrhea on stunting was found to be similar across all studies. There was an increased odds of stunting at age 24 months with each diarrheal episode, reinforcing the hypothesis that higher cumulative burden of diarrhea increases the risk of stunting (Checkley et al., 2008)

2.11 The global magnitude of diarrheal and respiratory infections among children

According to a fairly recent study on estimation of child mortality in developing countries, approximately 1.87 million children aged less than 5 years die annually from diarrhea, representing 19% of total child deaths globally. WHO African and South-East Asia Regions combined contain 78% (1.46 million) of all diarrhea deaths occurring among children in the developing world; 73% of these deaths are concentrated in just 15 developing countries (Boschi-Pinto, Velebit, & Shibuya, 2008). It is important to note that this study utilized mainly epidemiological studies to estimate the causes of death owing to the fact that in countries that account for 98% of under-5 deaths worldwide, there is very limited or virtually no functioning vital registration system in place to support attribution of causes of deaths.

Morbidity due to diarrhea and pneumonia are significant causes of mortality in children. Pneumonia (excluding neonatal pneumonia or sepsis) and diarrhea are the second and third respective causes of death in children younger than 5 years with pneumonia accounting for 19% and diarrhea for 18% of the 10.6 million annual deaths (Bryce et al., 2005). Under nutrition has been identified as an under-lying cause of more than one half of all deaths in children younger than 5 years (Bryce et al., 2005)

2.12 Diarrhea and pneumonia among children in Thailand

Acute diarrhea and pneumonia remain major causes of morbidity in children younger than 5 years in Thailand. Annual epidemiological surveillance report 2007 reveals that every year, children younger than 5 years experience higher pneumonia and diarrhea morbidity rates than individuals in any other age group. There is also a drastic decline in reported cases of diarrhea and pneumonia from the 0-4 year age group to the 5-9 year age group. This illustrates where the real burden of diarrhea and pneumonia lie and where resources and efforts need to committed to ensure reduced disease burden.

Reported cases of diarrhea in children younger than 5 years have been increasing since 2003. About 7,700 cases of diarrhea per 100,000 population were reported in 2003. The rate increased to about 10,300 per 100, 000 in 2007. The rate was however highest in 2006 where about 10,600 cases per 100,000 were reported.

Figure 2 below summarizes reported cases of diarrhea per 100,000 in Thailand since 2003.

Although diarrhea morbidity in children under 5 years has increased, the mortality rate has not changed so much since 2003. The 2003 rate was 0.46 while the 2007 rate was 0.43 per 100,000. A peak mortality of 0.63 per 100,000 was reported in 2006 (Ministry of Public Health, 2008)..

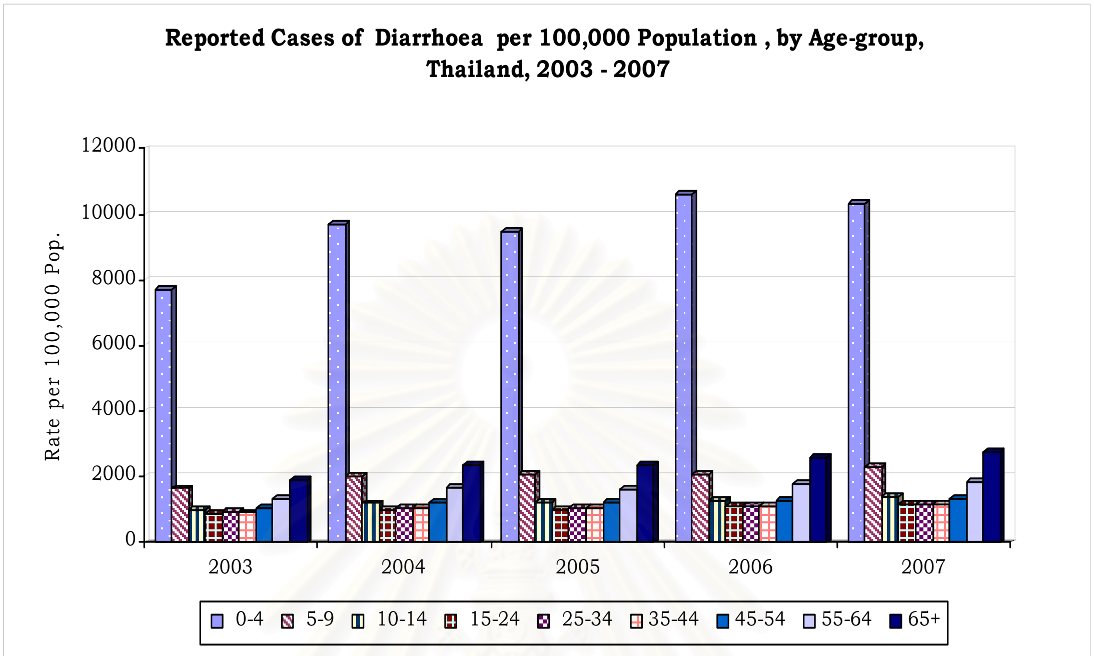

Figure 2: Reported cases of diarrhea per 100,000 population, by age group, Thailand, 2003- 2007 (Source: Ministry of Public Health, 2008)

A slight change in pneumonia morbidity has been observed in children younger than 5 years in Thailand since 2003. In 2003 the rate was about 1,740 per 100,000, while in 2007; the rate was about 1,670 per 100,000. The highest morbidity rate of about 1,920 per 100,000 was reported in 2005 (Ministry of Public Health, 2008). Figure 3 below summarizes reported cases of pneumonia per 100,000 in Thailand since 2003

As with acute diarrhea mortality rate in children, the pneumonia mortality rate has not changed much since 2003. The 2003 rate was 1.43 per 100,000 while the 2007 rate was 1.50 per 100, 000. A peak of 1.81 per 100,000 was likewise reported in 2006 (Ministry of Public Health, 2008)

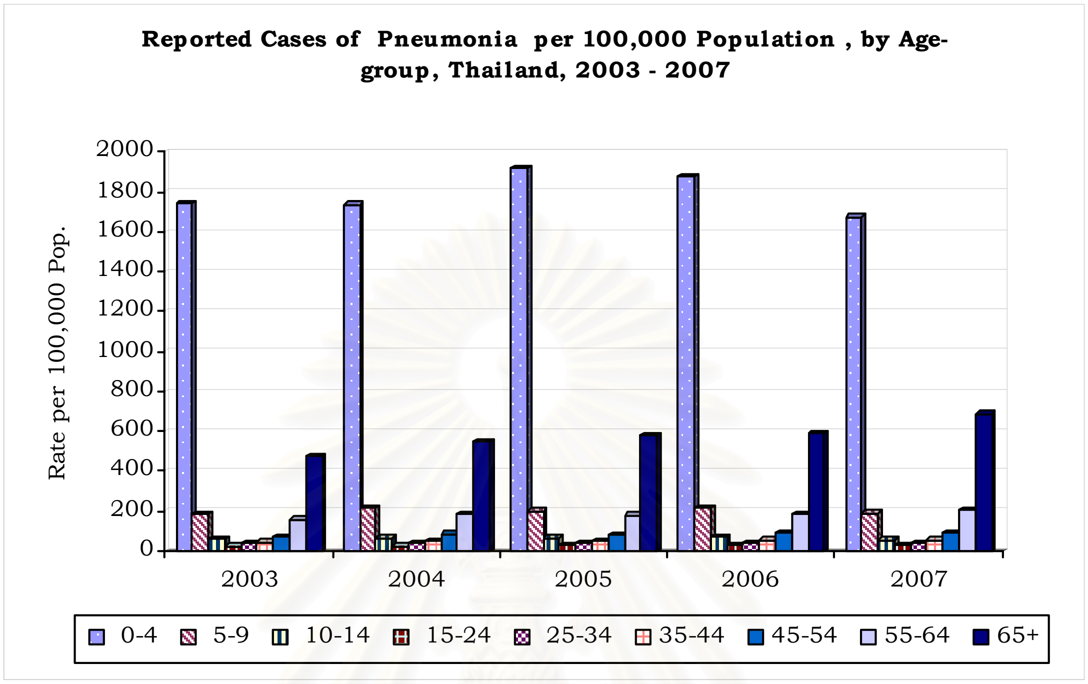

Figure 3: Reported cases of diarrhea per 100,000 population, by age group, Thailand, 2003- 2007 (Source: Ministry of Public Health, 2008)

CHAPTER III

METHODOLOGY

This study utilized data from the MICS conducted in Thailand by the National Statistics Office of the Ministry of Information and Communication Technology with support from UNICEF from December 2005 to February 2006. The research methodology of the survey has been described elsewhere in detail (Thailand National Statistical Office, 2006).

3.1 Study design

A secondary analysis of the Thailand MICS data collected through a cross - sectional study design.

3.2 Study area

Data was collected from all the 76 administrative provinces of Thailand grouped into four geographical regions; North, North East, South and Central (including Bangkok).

3.3 Study population

The study population was children aged less than 5 years.

3.4 Sampling technique

The primary sample units (PSU) consisted of blocks (in municipal areas) or villages (in non-municipal areas).

The Thailand MICS was carried out by a sample survey method that used a stratified two stage sampling technique with provinces constituting strata. Primary sampling units were blocks in municipal areas or villages in non municipal areas. Sample selection of blocks/villages was done by probability proportional to size. The secondary sample units consisted of collective households systematically drawn from a household listing generated from the 'Basic Household Information Survey'. Data on basic household information from the survey was used as the sampling frame.

3.5 Sample size

The MICS national-level report included 1,449 block/village samples. Thirty collective household samples per block/village samples were selected and a total of 43,470 household samples were obtained. Data were collected for a total of 9444 children aged less than five years.

3.6 Measurement tools

Three sets of questionnaires were used in the survey: 1) a household questionnaire which was used to collect information on all *de jure* household members, the household, and the dwelling; 2) a women's questionnaire administered in each household to all women aged 15-49 years; and 3) an under-5 questionnaire, administered to mothers or caretakers of all children under 5 living in the household.

The three set of questionnaires were based on the English version of the MICS model questionnaire. The model questionnaires were translated into Thai. In addition to the administration of questionnaires, fieldwork teams measured the weight and height of children less than 5 years of age using anthropometric equipment recommended by UNICEF

3.7 Data collection

Before data collection, a three-day training program was provided by the NSO MICS coordinators and the MoPH to 145 field staff from the North and Northeast regions in Khon Kaen province, and in Krabi province for 160 field staff from the South and Central (including Bangkok) regions.

In Bangkok, the field work was carried out under the responsibility of the Director of the Data Management Division of the Bangkok Metropolitan Administration (BMA), while Provincial Statistical Officers were responsible for the field work undertaken in the other 75 provinces. In each province, data were collected by three teams of four field staff, three interviewers and one supervisor. The NSO MICS coordinators provided overall supervision, with continuous visits to the field.

The fieldwork began in December 2005 and concluded in February 2006.

3.8 Inclusion and exclusion criteria

All children aged below 5 years were included in this study. Children whose data on age was missing were excluded from analysis.

3.9 Data analysis

Four MICS Thailand data sets (women data set, children data set, household data set and individual household member data set) were obtained from UNICEF. Most independent variables and the two dependent variables were found or computed/recoded directly in the children data set. Variables of interest which were not contained in the children data set were added to the children data set through merging of the children dataset with the data set that contained the variable (s) of interest. The cluster number, household number and individual line number were computed to form a unique person identification numbers in each data set which formed the basis upon which merging was done.

Frequencies and percentages (and mean with SD or median with IQR where applicable), were obtained for each variable. Bivariate analysis was done using Pearson's Chi-square and Fisher's exact tests. Multivariate analysis was done using binary logistic regression and results were presented with beta coefficients, adjusted OR with 95% CI and respective p - values.

Thirty five (0.4%) children whose data on age were missing were excluded from analysis. Four children reported 'don't know' (DK) for diarrhea in the last two weeks and were considered as no diarrhea in bivariate and multivariate analysis

Variables which had p - values of less than 0.2 by bivariate analysis and applied to all children aged less than 5 years were included in multivariate analysis. Although the association between number of children ever born by female caretaker or mother and diarrhea, and the association between maternal/caretaker's marital status and ARI had p - values of less than 2, 11.4% of children missed data on these variables. This was because the two variables applied only to women aged 15-49 leaving out male and female caretakers aged less than 15 or more than 49 years, the variables could therefore not be entered in multivariate analysis. The assessment of these variables was therefore only limited to bivariate analysis. Due to co-linearity between language spoken by household head and ethnicity, only ethnicity was included in multivariate analysis.

As child feeding practices are age dependant, assessment of the relationship between feeding practices and diarrhea and ARI was done only for children aged less than two years. Because EBF is recommended until 6 months and thereafter children are to receive complementary feeds, exclusively breastfed children were combined with children receiving complementary feeds during bivariate analysis. With a significant association between feeding practices and diarrhea and ARI being elicited, it made sense to do a subset multivariate analysis only for children aged less than 2 years to see if the significant association observed in bivariate analysis is maintained after controlling for potential confounders.

P values of less than or equal to 0.05 were considered statistically significant.

3.10 Study period

The primary study took place from December 2005 to February 2006. This secondary study was conducted between December 2008 and April 2009.

CHAPTER IV

RESULTS

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

1. General characteristics which include
    - Socio-demographic characteristics of households and of caretakers of children under 5 years
    - Socio-demographic characteristics, nutritional status and feeding patterns of children aged less than 5 years.
2. Bivariate analysis of factors associated with diarrhea in children using Pearson’s chi square and Fisher’s exact test
3. Multivariate analysis of factors associated with diarrhea in children using binary logistic regression
4. Bivariate analysis of factors associated with ARI in children using Pearson’s Chi square and Fisher’s exact test
5. Multivariate analysis of factors associated with ARI in children using binary logistic regression

4.1 General characteristics of children under 5 years

4. 1.1 Household socio-demographic characteristics.

About 51 % of children that participated in the study were from households located in rural areas. Most of the children were from Central Thailand including Bangkok (34.3%) with northern Thailand having the least number of children (17.7%). A big majority of children (89.9%) belonged to households headed by a Thai speaker or whose head was Thai (97.5%). An almost equal proportion of children; 22.4 % and 22.8%, were from households belonging to the middle and fourth wealth index quintiles respectively while 16.3% belonged to the poorest wealth index quintile households. Majority of children (62.8%) belonged to households whose head had completed primary education with a significant minority (6.6%) belonging to households whose head had no education. Majority of children (91.6%) belonged to household that used drinking water from improved sources. Only 28% of children belonged to households that treat water to make it safe for drinking. A great majority (98.3%) of children belonged to households with improved toilet facility. Among the children under 3 years, most of them (64.7%) belonged to households that dispose child feces using safe methods. Most children (71.2%) belonged to household that use clean fuels for cooking (among households that cook at home). Majority (74.8%) of children belonged to households with only one child under 5 years. The median number of children aged less than 5 years in the households was 1 with an inter-quartile range of 1-2. Table 1 below summarizes household characteristics of children aged less than 5 years in Thailand.

Table 1: Household socio-demographic and economic characteristics of children aged less 5 years in Thailand.

Characteristic	Frequency (N=9409)	%
Area		
Urban	4624	49.1
Rural	4785	50.9
Region		
Central (including Bangkok)	3223	34.3
North	1664	17.7
North East	2470	26.3
South	2052	21.8
Language of household head		
Thai	8459	89.9
Other Languages	950	10.1
Ethnic group		
Thai	9173	97.5
Others	236	2.5
House hold wealth index quintile		
Poorest	1530	16.3
Second	1747	18.6
Middle	2111	22.4
Fourth	2147	22.8
Richest	1874	19.9
Main source of drinking water		
Improved	8621	91.6
Unimproved	788	8.4
Treat water to make safe for drinking		
No	6776	72.0
Yes	2633	28.0
Kind of toilet facility		
Improved	9250	98.3
Unimproved	159	1.7
Number of children under 5 in the household		
1	7039	74.8
>1	2370	25.2
Median (IQR)	1(1-2)	

Table 1 continued: Household socio-demographic and economic characteristics of children aged less 5 years in Thailand.

Characteristic	Frequency	%
Child's feces disposal method* (N = 5658)		
Safe	3658	64.7
Unsafe	2000	35.3
Type of fuel used for cooking (N = 9267)		
Clean	6600	71.2
Unclean	2667	28.8
Household head's education level (N = 9374)		
None	622	6.6
Primary	5905	63.0
Secondary +	2847	30.4

* Children aged less than 36 months

4.1.2 Maternal/caretaker's characteristics of children aged less than 5 years in Thailand.

The mean age of mothers/caretakers was 33.7 years, standard deviation 10.8. Four percent of mothers/caretakers were aged 15-19 years. Four out of 9409 caretakers were aged below 15 years. An almost equal proportion of mothers/caretakers; 36.8% and 36.2%, belonged to the 20-29 and 30-39 age groups respectively. A small number of mothers/caretakers (2.8%) were aged more than 59 years.

A big majority of caretakers were female (98.8%). Care takers who had completed at least secondary education were 47.9% while 4.3% of caretakers had not achieved any education level. Data on marital/union status was collected only from mothers or female care takers aged 15-49 years. Among this group, 94.2% belonged to a marriage/union. A small proportion; (0.7%) had never married. Data on the number of children ever born was also available only for women aged 15-49 years. Among them, 1.1% had never had a child while majority (38.8%) had had 2 children. The median number of children ever born by mothers/caretakers of children aged less than 5 years was 2 with an inter-quartile range of 1-2. Information on maternal/caretaker's socio-demographic characteristics is as shown in Table 2 below.

Table 2: Characteristics of mothers/caretakers of children aged less than 5 years in Thailand.

Characteristic	Frequency	%
Age in years (N= 9409)		
<15	4	0.0
15-19	381	4.0
20-29	3463	36.8
30-39	3408	36.2
40-49	1172	12.5
50-59	713	7.6
>59	268	2.8
Mean(SD)	33.65 (10.77)	
Gender of care taker (N= 9404)		
Male	114	1.2
Female	9295	98.8
Mother's/care taker's highest education level completed (N= 9386)		
None	409	4.4
Primary	4468	47.6
Secondary +	4509	48.0
Current marital/union status*(N= 8332)		
Currently married/in union	7847	94.2
Formerly married/in union	425	5.1
Never married/in union	60	0.7
No. of children ever born* (N= 8332)		
0	93	1.1
1	2974	35.7
2	3230	38.8
3	1369	16.4
>3	666	8.0
Median (IQR)	2(1-2)	

* For mothers/female caretakers aged 15-49 years

4.1.3 Children's demographic characteristics

Male children were slightly more (51.6%) than female children. The mean age of children was 29.43 months with a standard deviation of 17.18. Children aged less than 6 months were 9.3%. There was a general near equal distribution of children in each 12 month age group (about 20%). Almost all the children had received birth registration (99.2%). Only 1.4% and 0.4% of children were orphans and vulnerable respectively.

This study considered DPT 3 immunization status among children aged 7-59 months and measles immunization status of children aged 13-59 months. The immunization status was as verified from the card or reported by the mother where the card was not available. A large majority of children aged 7-59 months (95.6%) had received DPT 3 vaccine. A among children aged 15-59 months; almost all of them (98.2%) had received measles vaccination.

Table 3 below summarizes demographic characteristics of children aged less than 5 years in Thailand.

Table 3: Demographic characteristics of children aged less than 5 years in Thailand

Characteristics	Frequency	%
Sex (N = 9404)		
Male	4857	51.6
Female	4552	48.4
Age in months (N = 9404)		
< 6	873	9.3
6-11	981	10.4
12-23	1932	20.5
24-35	1872	19.9
36-47	1907	20.3
48-59	1844	19.6
Mean (SD)	29.43 (17.18)	
Child registered (N = 9404)		
Yes	9332	99.2
No	77	0.8
OVC status (N = 9404)		
Orphaned	133	1.4
Vulnerable	32	0.4
Not OVC	9244	98.2
DPT3 immunization* (N = 7989)		
Yes	7640	95.6
No	349	4.4
Measles immunization (N = 7065)**		
Yes	6937	98.2
No	128	1.8

* Children aged 7-59 months
** Children aged 13-59 months

4.1.4 Nutritional status of children

Nutritional status was assessed through 3 parameters: height for age, weight for age and weight for height z scores.

Considering height for age z score, 1.8% of children had a z score of less than -3 signaling severe stunting; 9.7% were moderately stunted (z score of -3 to -2.01). The mean of the height for age z score was -0.1 with a standard deviation of 2.3.

As for weight for age z score, 0.6 % of children had a score below -3 (severely underweight) while 8.2% had a score of between -3 and -2.01 (moderately underweight). The mean of weight for age z score was -0.04 with a standard deviation of 2.26.

As for the weight for height, 1.1% of children had z score of less than -3 (severely wasted) with 3.5 % having a z score of between -3 and -2.01 (moderately wasted). About 12% of children had a z score of more than 2(overweight). The mean and standard deviation of the weight for height z score were 0.33 and 2.37 respectively. Table 4 below shows the nutritional status of children based on anthropometric measurements in Thailand.

Table 4: Nutritional status of children aged less than 5 years in Thailand

Characteristic	Frequency (N = 9409)	%
Height for age z score		
<-3	167	1.8
-3 to -2.01	911	9.7
≥-2	8331	88.5
Mean (SD)	-0.1 (2.3)	
Weight for age z score		
<-3	56	0.6
-3 to -2.01	768	8.2
≥-2.00	8585	91.2
Mean (SD)	-0.04 (2.26)	
Weight for height z score		
<-3.00	101	1.1
-3.00 to -2.01	328	3.5
-2.00 to 2.00	7880	83.7
>2.00	1100	11.7
Mean (SD)	0.33 (2.37)	

4.1.5 Feeding practices among children.

About 94.1% of children aged less than 5 years had ever breastfed. Because feeding practices are age dependent, children were divided into three age categories to allow for assessment of feeding practices within each group. Because exclusive breastfeeding is recommended for the first 5 months, thereafter complementary feeding is to proceed up to 2 years and beyond, it was reasonable to look at feeding practices among children aged less than 6 months, 6-23 months and above 23 months. Only 6.1% of children aged less than 6 months are exclusively breastfed. Most children (68%) are complementarily fed during this period. Among children aged 6-23 months, most of them (65.7%) were on replacement feeding (not receiving breast milk at all). A big majority of children aged 24-59 (94.3%) were not receiving breast milk at all. Table 5 below summarizes feeding practices among children aged less than 5 years in Thailand.

Table 5: Feeding practices among children aged less than 5 years in Thailand

Characteristic	**Frequency**	**%**
Ever breastfed (N=9409)		
Yes	8858	94.1
No	530	5.6
Don't know	21	0.2
Feeding practices 0-5 months (N=872)		
Exclusive breastfeeding	53	6.1
Complementary feeding	593	68.0
Replacement feeding	226	25.9
Feeding practices 6-23 months (N= 2907)		
Exclusive breastfeeding	1	0.0
complementary feeding	996	34.3
Replacement feeding	1910	65.7
Feeding practices 24-59 months (N= 5621)		
Complementary feeding	318	5.7
Replacement feeding	5303	94.3

4.1.6 Diarrhea and acute respiratory infections among children

Past two weeks (preceding the survey) prevalence of diarrhea and ARI among children aged less than 5 years in Thailand was 8.2% and 4% respectively as shown in Table 6 below.

Table 6: Diarrhea and ARI in the past two weeks among children aged less than 5 years

Characteristic	Frequency (N=9409)	%
Diarrhea		
Yes	767	8.2
No	8638	91.8
Don't know	4	0.0
Acute respiratory Infection		
Yes	379	4.0
No	9030	96.0

4.2 Bivariate analysis of factors associated with diarrhea in children aged less than 5 years in Thailand

4.2.1 Association between household socio-demographic factors and diarrhea in children in Thailand

There was no statistically significant association between diarrhea in two weeks prior to the survey in children under five years and:

- Residence,
- region of households,
- household's head education level,
- treatment of water to make it safe for drinking ,
- and main source of drinking water and

- kind of toilet facility

For the chi square and p values of the described variables please see details in Table 7 below

Table 7: Household socio-demographic factors with no statistically significant association with diarrhea in children under 5 years

Factor	Diarrhea in the past 2 weeks		χ^2	P value
	Yes	No		
	N (%)	N (%)		
Residence (N = 9409)			0.69	0.410
Urban	366 (7.9)	4258 (92.1)		
Rural	401 (8.4)	4284 (91.6)		
Region (N = 9409)			1.94	0.585
Central (including Bangkok)	264 (8.2)	2959 (91.8)		
North	143 (8.6)	1521 (91.4)		
North East	207 (8.4)	2263 (91.6)		
South	153 (7.5)	1899 (92.5)		
Household head's education level (N = 9374)			4.035	0.133
None	48 (7.7)	574 (92.3)		
Primary	508 (8.6)	5397 (91.4)		
Secondary +	210 (7.4)	2637 (92.6)		
Main source of drinking water (N = 9409)			3.241	0.072
Improved	716 (8.3)	7905 (91.7)		
Unimproved	51 (6.5)	737 (93.5)		
Treat drinking water (N = 9409)			0.411	0.522
Yes	207 (7.9)	2426 (92.1)		
No	560 (8.3)	6216 (91.7)		
Kind of toilet facility (N = 9409)			0.079	0.779
Improved	755 (8.2)	8495 (91.8)		
Unimproved	12 (7.5)	147 (92.5)		

There was statistically significant association between diarrhea and both ethnicity and language spoken by the head of the household. Diarrhea rate among children of Thai speaking household heads was 8.4% against 6.2% among children of non-Thai speaking household heads (p = 0.021). The rate of diarrhea among children whose household heads were of Thai ethnicity was 8.3% compared to 4.2% among children from non-Thai ethnicity household heads (p = 0.026).

There was a highly significant association between household wealth index quintiles and diarrhea in children (p < 0.001). The highest diarrhea rate (9.8%) was among children from the poorest wealth index quintile while the lowest rate (6%) was in children from households with the richest wealth index quintile

The question on method of disposal of child feces applied only in household with children aged less than 3 years. Among these children, child’s feces disposal method was associated with diarrhea (p = 0.001). About 12% of children whose households dispose off child feces unsafely reported diarrhea in the past two weeks compared to 9% among children whose household dispose of child feces safely.

A significant association between the number of children aged less than 5 years in the household and diarrhea among children was demonstrated (p = 0.002). The rate of diarrhea among children with one child under 5 years was 8.7% while the rate among children from households with more than one child under five years was 6.7%.
The details of chi square test with p values of the described variables are as shown in table 2 below

Table 8: Household socio-demographic factors with statistically significant association with diarrhea in children under 5 years

Factor	Diarrhea in the past 2 weeks		χ^2	P value
	Yes	No		
	N (%)	N (%)		
Language of the household head (N = 9409)			5.318	0.021
Thai	708 (8.4)	7751 (91.6)		
Other Languages	59 (6.2)	891 (93.8)		
Ethnicity of the household head (N = 9409)			4.954	0.026
Thai	757 (8.3)	8416 (91.7)		
Others	10 (4.2)	226 (95.8)		
Household wealth index quintile(N = 9409)			23.139	<0.001
Poorest	150 (9.8)	1380 (90.2)		
Second	126 (7.2)	1621 (92.8)		
Middle	194 (9.2)	1917 (90.8)		
Fourth	185 (8.6)	1962 (91.3)		
Richest	112 (6)	1762 (94)		
Child's feces disposal method (N = 5658)			11.715	0.001
Safe	329 (9)	3329 (91)		
Unsafe	237 (11.8)	1763 (88.2)		
Children <5 years in the household (N = 9409)			9.332	0.002
1	609 (8.7)	6430 (91.3)		
>1	158 (6.7)	2212 (93.3)		

4.2.2 Association between maternal/caretaker's demographic factors and diarrhea in children

There was a strong association between caretaker's age and diarrhea in children aged less than 5 years (p= 0.001). The rates of diarrhea were higher among children whose caretakers were aged more 59 years (11.6%), 50-59 (11.2%) and less than 20 years (10.6%). The lowest diarrhea rate was children whose care takers were aged 30-39 years (7.3%).

Although diarrhea rate was higher in children with female care takers (8.2%) than in those with male care takers (6.1%), this difference was not statistically significant.

There was also no statistically significant association between diarrhea and care takers education status, mother's current marital status, and number of children ever born by female caretaker. Table 9 below summarizes maternal/caretaker's socio-demographic factors and diarrhea in children.

Table 9: Association between maternal/caretaker's socio-demographic factors and diarrhea in children

Factor	Diarrhea in the past 2 weeks		χ^2	P value
	Yes	No		
	N (%)	N (%)		
Care taker's age in years (N = 9409)			21.06	0.001
<20	42 (10.9)	343 (89.1)		
20-29	277 (8)	3186 (92)		
30-39	249 (7.3)	3159 (92.7)		
40-49	88 (7.5)	1084 (92.5)		
50-59	80 (11.2)	633 (88.8)		
>59	31 (11.6)	237 (88.4)		
Care taker's gender (N = 9409)			0.624	0.430
Male	7 (6.1)	107 (93.9)		
Female	760 (8.2)	8535 (91.8)		
Mothers/care takers education status (N = 9386)			0.137	0.934
None	35 (8.6)	374 (91.4)		
Primary	361 (8.1)	4107 (91.9)		
Secondary +	370 (8.2)	4139 (91.8)		
Current marital status* (N = 8332)			0.137	0.566
Married/in union	611 (7.8)	7236 (92.2)		
Not married/in union	37 (8.7)	388 (91.3)		
Never married/in union	3 (5.0)	57 (95.0)		
Children ever born * (N = 8332)			3.683	0.159
0-1 (%)	260 (8.5)	2807 (91.5)		
2 to 3 (%)	347 (7.5)	4252 (92.5)		
>3 (%)	44 (6.6)	622 (93.4)		

* For mother/female caretaker aged 15-49

4.2.3 Association between child's demographic factors and diarrhea in children

There was a significant association between child's gender and diarrhea among children (p= 0.01). Diarrhea rate was high among male children (8.9%) than among female children (7.4%). A strong significant association between child's age and diarrhea was observed (p<0.001). Diarrhea rate was lower among children aged 48-59 months (3.6%) and higher among children aged 6-11 months (13.4%); and 12-23 months (12.8%). There was no statistically significant difference in diarrhea rate among OVC and non OVC and among children registered and those not registered.

There was no significant association between diarrhea and DPT 3 immunization among children aged 7-59 months; and measles immunization among children aged 13-59 months

Table 10 below shows the association between child's demographic factors and diarrhea in the past two weeks.

Table 10: Association between child's demographic factors and diarrhea in children

Factor	Diarrhea in the past 2 weeks		χ^2	P value
	Yes	No		
	N (%)	N (%)		
Gender (N = 9409)			6.597	0.010
Male	430 (8.9)	4427 (91.1)		
Female	337 (7.4)	4215 (92.6)		
Age (N = 9409)			156.89	<0.001
< 6 months	43 (4.9)	830 (95.1)		
6-11 months	131 (13.4)	850 (86.6)		
12-23 months	247 (12.8)	1685 (87.2)		
24-35 months	145 (7.7)	1727 (92.3)		
36-47 months	134 (7)	1773 (93)		
48-59 months	67 (3.6)	1777 (96.4)		
Child registered (N = 9409)				
Yes	763 (91.8)	8569 (8.2)	0.907	0.341
No	4 (5.2)	73 (94.8)		
OVC (N = 9409)			0.536	0.464
Yes	16 (9.7)	149 (90.3)		
No	741 (8.1)	8493 (91.9)		
DPT3 immunization* (N = 7389)				
Immunized	644 (8.4)	6996 (91.6)	0.697	0.404
Not immunized	25 (7.2)	324 (92.8)		
Measles immunization (N = 7065)**			0.167	0.683
Immunized	529 (7.6)	6408 (92.4)		
Not immunized	11 (8.6)	117 (91.4)		

* For children aged 7 -59 months

** For children aged 13 – 59 months

4.2.4 Association between nutritional status and diarrhea in children

There was no association between diarrhea and height for age z score; weight for age z score; and weight for height z score in children aged less than 5 years as shown in table 11 below.

Table 11: Association between nutritional status and diarrhea in children

Child factors	Diarrhea in the past 2 weeks		χ^2	P value
	Yes	No		
	N (%)	N (%)		
Height for age z score (N = 9409)			0.386	0.824
<-3	13 (7.8)	154 (92.2)		
-3 to -2.01	79 (8.7)	832 (91.3)		
≥-2	675 (8.1)	7656 (91.9)		
Weight for age z score (N = 9409)			1.186	0.276
<-2.00	59 (7.2)	765 (92.8)		
≥-2	708 (8.2)	7877 (91.8)		
Weight for height z score (N = 9409)			2.638	0.267
<-2	32 (7.5)	397 (92.5%)		
-2 to 2	658 (8.4)	7222 (91.6)		
>2	77 (7)	1023 (93)		

4.2.5 Association between feeding practices and diarrhea in children

Although diarrhea rate was higher in children who had never been breastfed (9.4%) than in children who had ever been breastfed (8.1%), this difference was not statistically significant (p = 0.267)

Because recommended feeding practices in children are age dependant, association between diarrhea and feeding practices was assessed only in children aged less than 2 years. Due to few cases of children being exclusively breastfed, in assessing the relationship between diarrhea and feeding practices, exclusively breastfed children where combined with those on complementary feeding.

Among children aged 0-23 months, the prevalence of diarrhea was 11.1%. In this group, feeding practices had strong association with diarrhea ($p<0.001$). Diarrhea rate was higher among children receiving replacement feeding (13.2%) than among those being exclusively breastfed or receiving complementary feeds (8.3%). The association between feeding practices and diarrhea in children is summarized in table 12 below.

Table 12: Association between feeding practices and diarrhea in children

Factor	**Diarrhea in the past 2 weeks**		χ^2	**P value**
	Yes	**No**		
	N (%)	**N (%)**		
Child ever been breastfed (N = 9409)			1.233	0.267
Yes	717 (8.1)	8162 (91.9)		
No	50 (9.4)	480 (90.6)		
Feeding practices 0-23 months (N = 3779)			22.67	<0.001
EBF or complementary feeding	137 (8.3)	1506 (91.7)		
Replacement feeding (weaned)	283 (13.2)	1853 (86.8)		
Total	420 (11.1)	3359 (88.9)		

4.3 Multivariate analysis of factors associated with diarrhea in children aged less than 5 years in Thailand

Logistic regression analysis was employed to predict the probability that a child aged less than 5 years would suffer from diarrhea. Variables with $p \leq 2$ by bivariate analysis and which applied to all children under 5 years were selected as predictors. They were: Wealth index quintile, nationality of household head, house hold head's education level, main source of drinking water, number of children under 5 in the household, care takers age, child’s gender and child’s age. Due to co linearity between language spoken by household head and ethnicity of the head, only nationality of was included in the model. While adjusting for other variables and employing a 0.05 criterion of statistical significance;

- Household head education level, drinking water source, had no statistically significant effects
- Wealth index quintile, ethnicity of the household head, number of children under 5 years in the household, care takers age, child’s gender and child’s age had significant partial effects.
- Wealth index quintile was significantly associated with diarrhea ($p = 0.001$). Children whose households were in the poorest and middle were index quintiles were about 1.6 times more likely to develop diarrhea than those whose households were in the richest wealth index quintile.
- Having a non Thai household head had a marginal negative association with diarrhea in children ($p = 0.053$). Children of non Thai household heads were about 0.5 times more likely to develop diarrhea than their counterparts with Thai household heads
- The number of children under 5 years in the household was negatively associated with diarrhea with children from household with more than one child being about 0.8 times more likely to develop diarrhea than children from household with only one child under 5 years ($p = 0.01$)

- Maternal/caretakers age had a significant positive association with diarrhea in children ($p = 0.024$).
- Child's gender had a significant association with diarrhea in children ($p = 0.007$) Female children were 0.8 times more likely to develop diarrhea than their male counterparts.
- Child's age had a highly significant association with diarrhea ($p< 0.001$). Children aged 6-12 months were 4.3 times more likely to develop diarrhea than children aged 48-59 months while those aged less than 6 months were only 1.5 times more likely to develop diarrhea than those aged 48-59 months.

Table13 shows the logistic regression coefficients, adjusted odds ratios with their 95% CIs and the Wald test p values of predictor variables.

A model to predict that a child aged less than 5 years would have diarrhea was constructed as:

Logit (having diarrhea) = -2.344 + 0.455(poorest wealth index quintile) + 0.166 (second wealth index quintile) + 0.459(middle wealth index quintile) + 0.385(fourth wealth index quintile)– 0.677(ethnicity of house hold head) – 0.027(house hold head's education level) – 0.266(main source of drinking water) – 0.244 (number of children under 5 in the household) + 0.077(maternal/caretaker's age) - 0.21 (child's gender) + 0.426(<6 child's age) + 1.461(6-12 child's age) + 1.394(13-23 child's age) + 0.824(24-35 child's age) + 0.722(36-48 child's age)

Test for model coefficients was highly significant with $\chi^2 = 208.845$ at 16 df and $P<0.0001$ (results not shown)

Table 13: Multivariate analysis of factors associated with diarrhea in children aged less than 5 years in Thailand

Variables	B	Adjusted OR	95% CI	P value
Wealth index quintile				0.001
Poorest	0.455	1.577	1.126 – 2.207	0.008
Second	0.166	1.180	0.875 – 1.592	0.277
Middle	0.459	1.582	1.221 – 2.050	0.001
Fourth	0.385	1.470	1.141 – 1.893	0.003
Richest®		1		
Ethnic group of household head†	-0.677	0.508	0.255 – 1.010	0.053
House hold head's education level	-0.027	0.974	0.838 – 1.131	0.726
Drinking water source	-0.266	0.766	0.567 – 1.036	0.084
Number of children under 5 in household*	-0.244	0.784	0.651 – 0.943	0.010
Care taker's age	0.077	1.081	1.010 – 1.156	0.024
Child's gender π	-0.210	0.811	0.696 – 0.943	0.007
Child's age				<0.001
<6	0.426	1.531	1.028 – 2.280	0.036
6 to 12	1.461	4.311	3.153 – 5.895	<0.001
13-23	1.394	4.031	3.035 – 5.355	<0.001
24-35	0.824	2.280	1.687 – 3.082	<0.001
36-47	0.722	2.059	1.518 – 2.793	<0.001
48-59®		1		
Constant	-2.344	0.096		<0.001

† Non Thai compared to Thai
* More than 1 compared to 1
π Female compared to male
® Reference group

4.4 Bivariate analysis of factors associated with acute respiratory infections in children in Thailand

4.4.1 Association between household socio-demographic and economic factors and ARI in children

There was no statistically significant association between ARI and main source of drinking water; kind of toilet facility used by the household; child feces disposal method and treatment of drinking water as shown in table 14 below.

Table 14: Household socio-demographic factors without statistically significant association with ARI in children aged less than 5 years in Thailand

Characteristic	ARI in the past 2 weeks		χ^2	P value
	Yes	No		
	N (%)	N (%)		
Main source of drinking water (N = 9409)			0.057	0.812
Improved	346 (4)	8275 (96)		
Unimproved	33 (4.2)	755 (95.8)		
Kind of toilet facility (N = 9409)			0.059	0.809
Improved	372 (4)	8878 (96)		
Unimproved	7 (4.4)	152 (95.6)		
Child's feces disposal method* (N = 5658)			0.019	0.889
Safe	149 (4.1)	3509 (95.9)		
Unsafe	83 (4.2)	1917 (95.8)		
Treat drinking water (N = 9409)			1.984	0.159
Yes	94 (3.6)	2539 (96.4)		
No	285 (4.2)	6491 (95.8)		

* For children aged less than 3 years

There was a statistically significant association between ARI and residence (p = 0.002). The rate of ARI among children from households in rural areas was 4.7% compared to 3.4 % in urban areas.

There a strong association between region of the household and ARI in children (p = 0.001). The rate of ARI was lower among children in Central Thailand (3.1%) and higher in children from North East Thailand (5.5%)

There was a strong association between ARI and language (p<0.001), and ethnicity (p = 0.029) of the household head. The rate of ARI among children from households headed by Thai speakers was higher (4.3%) than the rate among non Thai speakers (2%). The rate of ARI among children belonging to households headed by Thai citizens was higher (4.1%) than the rate among children from households headed by other ethnicities (1.3%).

There was a strong association between household wealth index quintile and ARI in children (p<0.001). The rate of ARI was highest (6%) in children from households with the poorest wealth index quintile and lowest (2.8%) among children from households with the richest wealth index quintile.

The education level of the household head had a significant association with ARI in children (p=0.017). The highest rate of ARI (4.5%) was reported among children whose household heads had primary level education while the lowest level (3.2%) was reported in children whose household heads had no education

There was a significant association between number of children aged less than 5 years in the household and ARI in children (p = 0.019). The rate of ARI was lower in households with more than one child (3.2%) than in households with only one child under five years (4.5%).

There was a strong association between type of fuel used for cooking and ARI in children (p<0.001). The rate of ARI among children whose households use clean fuels for cooking was lower (3.5%) than among children whose households use unclean fuels (5.5%).

Statistically significant associations between household socio-demographic factors and ARI in children are as shown in table 15 below.

Table 15: Household socio-demographic factors with statistically significant association with ARI in children aged less than 5 years in Thailand

Factor	**ARI in the past 2 weeks**		**χ^2**	**P value**
	Yes	**No**		
	N (%)	**N (%)**		
Residence (N = 9409)			10.071	0.002
Urban	156 (3.4)	4468 (96.6)		
Rural	223 (4.7)	4562 (95.3)		
Region (N = 9409)			27.402	<0.001
Central including Bangkok	99 (3.1)	3124 (96.9)		
North	77 (4.6)	1587 (95.4)		
North East	137 (5.5)	2333 (94.5)		
South	66 (3.2)	1986 (96.8)		
Language of household head (N = 9409)			11.243	<0.001
Thai	360 (4.3)	8099 (95.7)		
Other Languages	19 (2)	931 (98)		
Ethnicity of household head (N = 9409)			4.759	0.029
Thai	376 (4.1)	8797 (95.1)		
Other	3 (1.3)	233 (98.7)		

Table 15 continued: Household socio-demographic factors with statistically significant association with ARI in children aged less than 5 years in Thailand

Factor	ARI in the past 2 weeks Yes N (%)	No N (%)	χ^2	P value
Household wealth index quintile (N = 9409)			24.326	<0.001
Poorest	92 (6)	1438 (94)		
Second	76 (4.4)	1671 (95.6)		
Middle	81 (3.8)	2030 (96.2)		
Fourth	77 (3.6)	2070 (96.4)		
Richest	53 (2.8)	1821(97.2)		
Household head's education level (N = 9374)			8.141	0.017
None	20 (3.2)	602 (96.8)		
Primary	265 (4.5)	5640 (95.5)		
Secondary +	94 (3.3)	2753 (96.7)		
Children <5 years in the household (N = 9409)			5.528	0.019
1	303 (4.3)	6736 (95.7)		
>1	76 (3.2)	2294 (96.8)		
Type of fuel used for cooking (N = 9267)			20.942	<0.001
Clean	228 (3.5)	6372 (96.5)		
Unclean	147 (4.5)	2520 (94.5)		

4.4.2 Association between maternal/caretaker's socio-demographic factors and ARI in children

There was a significant association between maternal/caretaker's age and ARI in children (p = 0.004). Children whose care takers were aged more than 59 years had the highest rate of ARI (6.7%) with those with caretakers aged 30-39 years having the lowest rate (3.1%).

There was no association between ARI and maternal/caretaker's gender, marital status and children ever born. The association between maternal/care taker' socio-demographic factors ad ARI in children is as presented in table 16 below.

Table 16: Association between maternal/care taker’s socio-demographic factors and ARI in children

Factor	ARI in the past 2 weeks		χ^2	P value
	Yes	No		
	N (%)	N (%)		
Maternal/care taker's age in years (N = 9409)			17.364	0.004
<20	19 (4.9)	360 (95.1)		
20-29	150 (4.3)	3313 (95.7)		
30-39	104 (3.1)	3304 (96.7)		
40-49	57 (4.9)	1115 (95.1)		
50-59	31 (4.3)	682 (95.7)		
>59	18 (6.7)	250 (93.3)		
Care taker’s gender (N = 9409)				0.631*
Male	3 (2.6)	111 (97.4)		
Female	376 (4)	8919 (96)		
Maternal/caretaker’s education status N = 9386)			2.574	0.276
None	12 (2.9)	397 (97.1)		
Primary	193 (4.3)	4275 (95.7)		
Secondary +	174 (3.9)	4335 (96.1)		
Maternal/caretaker’s marital status (N = 8332)			4.276	0.118
Married/in union	302 (3.8)	7545 (96.2)		
Not married/in union	24 (5.6)	401 (94.4)		
Never married/in union	1 (1.7)	59 (98.3)		
Children ever born (N = 8332)			1.308	0.520
<2	130 (4.2)	2937 (95.8)		
2 to 3	173 (3.8)	4426 (96.2)		
>3	24 (3.6)	642 (96.4)		

***** Fisher’s exact test

4.4.3 Association between child's demographic factors and ARI in children

There was no significant association between ARI and child's gender; registration status and OVC status. There was also no significant association between ARI and DPT 3 immunization status among children aged 7-59 months; and measles immunization among children aged 13-59 months.

There was however a strong association between age and ARI among children ($p<0.001$). The rate of ARI was highest within children aged 12-23 months (5.7%) and lowest in children aged less than 6 months (1.3%) as shown in table 17 below

Table 17: Association between child's demographic factors and ARI in children

Factor	ARI in the past 2 weeks		χ^2	P value
	Yes	No		
	N (%)	N (%)		
Gender (N = 9409)			3.317	0.069
Male	213 (4.4)	4644 (95.6)		
Female	166 (3.6)	4386 (96.4)		
Age in months (N = 9409)			32.879	<0.001
< 6	11 (1.3)	862 (98.7)		
6-11	38 (3.9)	943 (96.1)		
12-23	110 (5.7)	1822 (94.3)		
24-35	73 (3.9)	1799 (96.1)		
36-47	82 (4.3)	1825 (95.7)		
48-59	65 (3.5)	1779 (96.5)		
Child registered (N = 9409)				
Yes	378 (4.1)	8954 (95.9)		0.375*
No	1 (1.3)	76 (98.7)		
OVC (N = 9409)			2.122	0.225
Yes	3 (1.8)	162 (98.2)		
No	376 (4.1)	8868 (95.9)		
DPT3 immunization (N = 7989)**			0.146	0.227
Immunized	345 (4.5)	7275(95.5)		
Not immunized	11 (3.2)	338 (96.8)		
Measles immunization† (N = 7065)			2.463	0.117
Immunized	307 (4.4)	6630 (95.6)		
Not immunized	2 (1.6)	126 (98.4)		

* Fisher's exact test

** Children aged 7 – 59 months

† Children aged 13 - 59 months

4.4.4 Association between nutritional status and ARI in children

There was no significant association between ARI and height for age z score; weight for age z score; and weight for height z score as shown in table 18 below

Table 18: Association between nutritional status and ARI in children aged less than 5 years in Thailand

Characteristic	ARI in the past 2 weeks		χ^2	P value
	Yes N (%)	No N (%)		
Height for age z score (N = 9409)			0.603	0.740
<-3	7 (4.2)	160 (95.8)		
-3 to -2.01	41 (4.5)	870 (95.5)		
≥-2	331 (8.1)	8000 (91.9)		
Weight for age z score (N = 9409)			0.023	0.881
<-2.00	34 (4.1)	790 (95.9)		
≥-2	345 (4)	8240 (96)		
Weight for height z score (N = 9409)			0.034	0.983
<-2.00	18 (4.2)	411 (95.8)		
-2 to 2	317 (4)	7563 (96)		
>2	44 (4)	1056 (96)		

4.4.5 Association between feeding practices and ARI in children

There was a strong association between having ever breastfed and ARI in children (p=0.001). The rate of ARI in children who had ever breastfed (3.9%) was lower than the rate in children who had never breastfed (6.8%).

As for the case with diarrhea, because breastfeeding practices are age dependent and because of few cases of exclusively breastfed children, association between feeding practices and ARI was assessed only in children aged 0-23 months with children who were exclusively breastfed being combined with those on complementary feeding.

Among children aged 0 - 23 months, there was a strong association between feeding practices and ARI ($p<0.001$). The rate of ARI was lower in children receiving complementary feeds (2.4%) than in weaned children feeds (5.6%). The prevalence of ARI in this age group was 4.2%. Table 19 below summarizes the association between feeding practices and ARI in children

Table 19: Association between feeding practices and ARI among children with selected age groups in Thailand

Factor	ARI in the past 2 weeks		χ^2	P value
	Yes	No		
	N (%)	N (%)		
Ever breastfed (N = 9409)			11.102	0.001
Yes	343 (3.9)	8536 (96.1)		
No	36 (6.8)	494 (93.2)		
Feeding practices* (N = 3779)			24.25	<0.001
EBF or complementary feeding	39 (2.4)	6104 (97.6)		
Replacement feeding (weaned)	120 (5.6)	2016 (94.4)		
Total	159 (4.2)	3620 (95.8)		

* Children aged 0 – 23 months

4.5 Multivariate analysis of factors associated with ARI in children aged less than 5 years.

Binary logistic regression was employed to predict the probability that a child under 5 years old would suffer from ARI. Based on results of bivariate analysis, variables which had a $p \leq 2$ and applied to every child under 5 years were selected as predictors. Variables which met these criteria were wealth index quintile, residence and region of house hold, household head ethnicity and education level, treatment of drinking water, number of children under five in the household, caretaker's age, child's gender, child's age and child ever breastfed. While controlling for other factors and employing 0.05 criterion of statistical significance:

- Wealth index quintile, house hold head education level, treatment of drinking water, type of fuel used for cooking, caretakers age, had no statistically significant effect on ARI in children
- Rural residence had a significant positive association with ARI ($p = 0.036$). The OR suggests that children in rural areas were 1.3 times more likely to develop ARI than their urban counterparts.
- Being from a household headed by a non Thai had significant negative association with ARI ($p = 0.036$). From the OR, children whose household heads were of non Thai ethnicity were about 0.3 times more likely to develop ARI than those whose household heads were Thai.
- There was a statistically significant affect of region on ARI ($p = 0.004$). The odds OR suggest that children in Central and northern Thailand were likely as children in Southern Thailand to develop ARI while those children in North East Thailand were about 1.6 times more likely to develop ARI than those in the South.
- Child's gender had a statistically significant effect on ARI ($p = 0.\ 046$). The OR suggests that female children were about 0.8 times more likely to suffer from ARI than their male counterparts.
- Child's age had a high statistically significant effect on diarrhea ($p < 0.001$). The OR suggest that children aged less than 6 months were about 0.4 times more likely to suffer from ARI than children aged 48-59 months, while children aged

12-23 years were about 1.6 times more likely to suffer from ARI than children aged 48-59 months .

- Breastfeeding had a strongly significant effect on ARI (p = 0.001). From the OR, children who had never been breastfed were about 1.8 times more likely to develop ARI than those who had ever been breastfed.

A model to predict that a child aged less than 5 years would suffer from ARI was constructed as:

Logit (having ARI) = - 2.668 + 0.393(poorest wealth index quintile) + 0.124(second wealth index quintile) + 0.130(middle wealth index quintile) + 0.182(fourth wealth index quintile) + 0.118(residence) – 1.239(ethnicity of household head)– 0.035(Central Thailand region) + 0.320(North Thailand) + 0.484(Northeast Thailand) - 0.029 (household head education level) - 0.047 (treatment of drinking water) - 0.250 (number of children under 5 in house hold) +0.042(type of fuel used for cooking) - 0.035 (caretaker's age) - 0.214(child's gender) -1.030(< 6 moths child's age) + 0.097(6-12 months child's age) + 0.480(13-23 months child's age) + 0.092(24-35 months child's age) + 0.164 (36-47months child's age + 0.598(child ever breastfed). The model coefficients were significant with χ^2 = 100.379 at 21 df, P value of <0.001 (not shown)

Table 20 below shows the logistic regression coefficient, adjusted odds ratio and its 95% CI and the Wald test p value of predictor variables.

Table 20: Multivariate analysis of factors associated with ARI in children aged less than 5 years in Thailand

Variables	B	Adjusted OR	95% CI	P value
Wealth index quintile				0.432
Poorest	0.393	1.482	0.929 – 2.363	0.099
Second	0.124	1.132	0.743 – 1.725	0.563
Middle	0.130	1.138	0.779 – 1.664	0.503
Fourth	0.182	1.200	0.833 – 1.728	0.327
Richest®		1		
Residence†	0.118	1.284	1.020 – 1.617	0.034
Region				0.004
Central including Bangkok	-0.035	0.966	0.698 – 1.335	0.832
North	0.320	1.377	0.959 – 1.978	0.083
North East	0.484	1.623	1.150 – 2.290	0.006
South®		1		
Ethnicity of household head *	-1.239	0.290	0.091 – 0.925	0.036
House hold head education level	-0.029	0.972	0.785 – 1.203	0.791
Treat water to make safe for drinking	-0.047	0.954	0.747 – 1.218	0.704
No. of children under 5 in household	-0.250	0.779	0.600 – 1.011	0.060
Type of fuel used for cooking	0.042	1.043	0.752 – 1.446	0.800
Care taker's age	-0.035	0.966	0.878 – 1.062	0.472
Child's gender π	-0.214	0.807	0.655 – 0.996	0.046
Child's age				<0.001
<6	-1.027	0.358	0.187 – 0.686	0.002
6 to 12	0.097	1.102	0.729 – 1.665	0.645
13-23	0.480	1.616	1.176 – 2.221	0.003
24-35	0.092	1.096	0.778 – 1.544	0.600
36-47	0.164	1.178	0.841 – 1.649	0.340
48-59®		1		
Ever breastfed‡	0.598	1.819	1.261 – 2.623	0.001
Constant	-2.688	0.068		0.001

†Rural compared to urban residence
* Non Thai compared to Thai
π Female compared to male
‡ No compared to yes
® Reference group

CHAPTER V

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. Discussion

This study examined factors associated with diarrhea and ARI among children aged less than 5 years in Thailand using data from the MICS conducted from December 2005 to February 2006.

The results of this study will be discussed under the following parts

5.1.1. Prevalence of diarrhea and ARI in children

5.1.2. Association between household socio-demographic factors and diarrhea and ARI in children in Thailand

5.1.3. Association between caretakers socio-demographic factors and diarrhea and ARI in children in Thailand

5.1.4. Association between child's demographic factors and diarrhea and ARI in children in Thailand

5.1.5. Association between child's nutritional status; feeding practices, and diarrhea and ARI in children in Thailand

5.1.1 Prevalence of diarrhea and ARI in children

The prevalence of diarrhea was 8.2% (767 out of 9409 children) while that of ARI was 4 % (379 out of 9409 children). This prevalence of diarrhea and ARI is lower than the results from a pooled analysis of 12 DHS (which uses similar methodology as MICS) from Latin American countries which revealed that 16.9% and 40.8% of children aged less than 5 years had developed diarrhea and ARI respectively in the period of 2 weeks preceding the surveys (Hatt & Waters, 2005). Analysis of DHS data from Bangladesh also showed a higher rate of ARI (21.3%) among children aged less than 5 years. This could mean that the prevalence of ARI in Thailand is lower than in many developing countries.

Data from the MoPH in Thailand suggests that there tends to be two peak periods in the number of reported cases of pneumonia in Thailand. The greater peak is between July and September while the lesser one is in January with December and May tending to have the lowest number of reported cases of pneumonia. As for acute diarrhea, there seems to be no obvious peak period but the lowest number of cases is reported in December (appendix F). Although this MoPH data covers all age groups, children aged less than five years account for big majority of reported cases of pneumonia and acute diarrhea (Ministry of Public Health, 2008). Therefore these patterns are likely to apply to children aged less than 5 years as well. With the MICS survey having been conducted from December to February, there is therefore a possibility that seasonal variations resulted into increased number of reported cases of ARI but not diarrhea during the survey. This should however be taken cautiously because the MoPH surveillance data is collected using different methodology and the case definition of pneumonia used by MoPH is different from the case definition for ARI in MICS survey. The data however is very important in understanding the pattern of reported cases of pneumonia and diarrhea over the year and hence helpful in interpreting the prevalence of diarrhea and ARI observed in MICS survey.

Under reporting of child morbidity and recall bias have been reported in demographic and health surveys (Boerma, Black, Somerfelt, Rutstein, & Bicego, 1991; Manesh, Sheldon, Pickett, & Carr-Hill, 2008). Whereas the question to ascertain whether a child had had and an acute diarrhea was straight forward, deciding on whether a child had had an ARI in the past two weeks involved asking the caretaker a series of questions which might further worsen the recall bias. This could therefore mean that the prevalence of diarrhea and ARI reported here is not the worst case scenario.

5.1.2 Association between household socio-demographic factors and diarrhea and ARI in children

Household socio-demographic factors can bear significant impacts on diarrhea and ARI morbidity in children. Being a non Thai speaker can result into lower access to all types of public services (especially those related to preventive behaviors) due to communication barrier. The disadvantage of being a non Thai citizen is lower access to all types of public services due to lack of rights under Thai laws. Lack of access to preventive health messages and limited rights to access services can be risk factors of morbidity in the affected population. This study found significant association between diarrhea and household head's language and ethnicity by bivariate analysis. Only ethnicity was included in multivariate analysis and it maintained a significant association with ARI but the association with diarrhea was marginally lost. Children from households headed by non Thai ethnicities were less likely to develop diarrhea and ARI than children whose household heads were of Thai ethnicity. A possible explanation for this unexpected observation could be related to feeding practices. A further analysis of the MICS data revealed significant differences in feeding patterns between children born in non Thai headed households and those born in Thai headed households. The percentage of children not receiving any breast milk (replacement feeding) was higher in Thai (79.5%) than in non Thai headed households (64.5%) - appendix C. Because feeding practices are age dependent, they could therefore not be controlled for in children aged less than 5 years during multivariate analysis, however, a subset analysis for children aged less than 2 years (appendices D and E) where feeding patterns were controlled for revealed no association between ethnicity of the household head with both ARI and diarrhea.

Wealth index quintile had significant association with diarrhea after adjusting for other factors. This finding is consistent with several studies which have found significant association between household economic status and diarrhea in children (Boadi & Kuitunen, 2005; Hatt & Waters, 2005; Ketema & Lulseged, 1997). Generally, children living in poor households have higher diarrhea rates than their wealthier counterparts, probably due to inadequate access to sanitary facilities, unsanitary environments in the home and poor child hygiene.

Although studies using DHS data in some countries have shown that children from households with lower wealth were at higher risk of ARI than those in wealthier households (Azad, 2009; Hatt & Waters, 2005), this study did not show significant association between household wealth and ARI after controlling for confounding factors. This unexpected observation of the relationship between ARI and wealth deserves further investigation.

Unsafe disposal of child’s feces is a family behavioral practice that has shown to increase the risk of diarrhea in children. In this study, method of disposal of child feces was significantly associated with diarrhea but not with ARI, by bivariate analysis. This variable could however not be included in multivariate analysis for children aged less than 5 years. However a subset multivariate analysis done to assess the effect of feeding practices on diarrhea in children aged less than 2 years (see appendix D), child feces disposal method being one of the control variables maintained significant association with diarrhea. Unsafe methods of disposal of child feces were strongly associated with diarrhea in children aged less than 2 years. Other studies (Dikassa et al., 1993; Ghosh et al., 1997; Tumwine et al., 2002) have demonstrated similar results. Unsafe disposal of child feces can lead to contamination of food and water and predispose children to fecal-oral transmission of diarrheal pathogens.

Type of fuel used for cooking was significantly associated with ARI in children by bivariate analysis; with clean fuels (electricity, LPG and biogas) being linked to less diarrhea and ARI in children. After adjusting for other factors, this significance was lost among children aged less than five years. This finding contradicts with a case control study conducted in India which found an association between ARI and solid fuel use among children aged 2-35 months (Mahalanabis et al., 2002) and another study conducted in Tanzania using DHS survey data that found a significant association between ARI in children under five years and use of biomass, charcoal and kerosene in households (Kilabuko & Nakai, 2007). The lack of association between type of fuel used and ARI among children aged less than 5 years should however be interpreted cautiously because a subset analysis of MICS data for children aged less than 2 years showed a positive association between use of unclean fuels and ARI (appendix D). It is however important to note that in Thailand, only 28.8% of households use unclean fuels (solid fuels and kerosene) for cooking, and among those who use unclean fuels, a majority (95.4%) either use closed stoves or open stoves with chimneys or hoods therefore reducing indoor air pollution and exposure of children to smoke.

This study found significant association between number of children under 5 years in the household and diarrhea and ARI by bivariate analysis. This significance was maintained for diarrhea but lost for ARI in multivariate analysis. The number of children under 5 years in the household was negatively associated with diarrhea. A possible explanation to this observation is that mothers with more than one child under 5 years in the household are more experienced in child care and in observance of hygienic practices.

Although a study in Egypt found that children in rural areas were at a greater risk of developing diarrhea than their urban counterparts (El-Gilany & Hammad, 2005), this study did not show a significant association between diarrhea and residence (rural or urban). There were also no regional differences in distribution of diarrhea in children. These could be important findings as it might mean equality in health outcomes in terms of diarrhea among children across the country despite the chronic disparities in urban-rural health care provision (UNICEF, 2005) and other socio-demographic and economic characteristics.

There was however an association between ARI and both region and residence of the household by bivariate analysis with both variables maintaining significance in multivariate analysis. Children in rural areas were more likely to develop ARI than their urban counterparts. Similar results were obtained in a similar study in the Philippines (Costello et al., 1996). This could be related to differences in socio-demographic factors between rural and urban dwellers. However, this observation can be investigated further.

This study showed that North (4.6%) and North East (5.5%) Thailand had the highest rates of ARI compared to other parts of the country. This pattern is different from MoPH's epidemiological surveillance data which show that from 2002 to 2006, Northern Thailand had the highest rate of reported cases of pneumonia followed by the Southern region, with central Thailand - including Bangkok, having the lowest rate (Ministry of Public Health, 2008). The disparities in these data could be related to differences in data collection methodology and case definition of ARI (which in this case is presumed pneumonia) and pneumonia.

Although one would anticipate the education level of the household head to have an association with diarrhea and ARI in children, this study failed to show such a relationship after controlling for confounding factors. The finding on association between diarrhea and education level of the household head contradict what has been found in a study conducted in three East African States (Tumwine et al., 2002) and another one in Egypt which found lower diarrhea in children of paternal low educational level (El-Gilany & Hammad, 2005). Education level of a household head can influence other socio-demographic factors and health practices which can have an impact of morbidity in children. However this was not the case in this study.

Treatment and main source and of drinking water were not associated with both diarrhea and ARI in children. Whereas 91.6% of households have access to safe drinking water, only 72% of household treat water to make it safe for drinking. Further analysis of the MICS data revealed that; among those who use unimproved sources of drinking water (8.4%), 75% don't treat the water. A case control study done in Tanzania showed no association between different water sources and diarrhea in children (Gascón et al., 2000). This observation in Thailand could mean that water from sources considered unimproved is generally safe for drinking especially in dry seasons (same period during which this MICS was conducted). However this can change during rainy seasons as such water sources can easily become contaminated and predispose children to infections.

This study did not show an association between kind of toilet facility used by the household and both diarrhea and ARI in children. Use of unimproved toilet facilities is related to poor hygienic practices which can result into food and water contamination leading to infections in children. This seams not to be the case for Thailand where about 98% of households use improved toilets.

5.1.3. Association between maternal/caretaker's socio-demographic factors and diarrhea and ARI in children

Caretaker's age was significantly associated with both diarrhea and ARI by bivariate analysis. However, in multivariate analysis, only the association with diarrhea was maintained. It is important to note that this association was not completely linear. Categorical analysis by chi square showed that children with caretakers aged less than 20 years were at a greater risk of getting diarrhea, but the risk dropped in mothers aged 20-

49 years only to rise again in caretakers aged above 49 years. A possible explanation for this observation is that younger mothers are less experienced in baby care. A majority of children whose caretakers are aged above 49 years may not be getting care from or staying with their biological parents. A study has shown that not being taken care of by the mother is a risk factor for developing diarrhea in children (Molbak et al., 1997). This could be mediated through behavioral practices related to hygiene and feeding practices. This can explain why children with caretakers aged above 49 years have a higher risk of diarrhea.

About 1.2 % of children had male caretakers. No association was found between caretaker's gender and both ARI and diarrhea probably be due to the small number of children with male caretakers.

As with household's head education level, this study did not show an association between maternal/caretaker's education level and both diarrhea and ARI in children. The findings are in contrary to studies in other countries which have shown that mothers education is associated with ARI (Azad, 2009) and diarrhea (Molbak et al., 1997; Nguyen, Le Van, Le Huy, Nguyen, & Weintraub, 2006) in children. Educated mothers/caretakers are more exposed to the importance of hygiene, better childcare and feeding practices, and are more aware of disease causation factors and preventive measures. However findings of this study could mean that a big majority of mothers/caretakers in Thailand have adequate information on child care irrespective of level of education. Further studies should be done to explore this hypothesis.

Mother's marital status and number of children ever born did not have an association with both diarrhea and ARI in children by bivariate analysis. These findings concur with results from a similar study in Philippines (Costello et al., 1996).

5.1.4. Association between child's demographic factors and diarrhea and ARI in children

Male children accounted for 51.6% of children surveyed. This slightly differs with the 2004 population data derived from birth registration records which puts male children in Thailand at 51% (Alpha Research, 2006). A significant association was found between child's gender and both diarrhea and ARI after adjusting for confounders. The study found that male children were more likely to suffer from diarrhea and ARI than their female counterparts. The results on diarrhea concur with a studies done in Guinea Bissau (Molbak et al., 1997), Nigeria (Adegunloye, 2006) and Brazil (Melo et al., 2008) that have showed higher risk for diarrhea among male children. The study in Brazil however did not control for confounding factors. The findings on ARI agree with results of a study done in Tanzania using DHS data which showed that male children were at higher risk of developing ARI than their female counterparts (Kilabuko & Nakai, 2007). The higher risk of diarrhea and ARI in boys than girls as observed in this study could be attributed to their tendency of greater environmental exposure than girls.

Birth registration is crucial for realization of a child's rights. Without registration children can have restricted access to health care which might impact on their health status. This study however did not find an association between child registration and diarrhea and ARI morbidity. This could probably be due to the high rate of child registration (99.2%) therefore obscuring any differences between registered and unregistered children who mainly belong to ethnic minority groups and illegal immigrants. Parents with unregistered children may also be unwilling to participate in surveys because of their illegal presence in Thailand.

This study found a strong association between child's age and both diarrhea and ARI after controlling for confounders. This study found the higher risk of diarrhea among children aged 6-23 months (with the highest risk being among children aged 6-12 months). The highest risk of ARI was found in children aged 13-23 months. This curvilinear relationships between age and child morbidity was also observed in a study in the Philippines (Costello et al., 1996). A possible explanation for this is that children aged less than six months have less contact with the environment and are taken care of cautiously. They also benefit from the protective effect of breast milk (if breastfeeding). Protective effects of breast milk have been shown to drop dramatically after 6 months of a child's age (Yoon et al., 1996). From 6 months, children are introduced to a variety of foods besides becoming increasingly mobile thereby increasing their chances of contamination and infection (especially for diarrhea), bearing in mind that their immune system is still under developed. But as children become older, their adaptive immune system becomes strengthened resulting into fewer infection rates. This study also concurs with a study in which Turkey found higher diarrhea incidences in children aged 6-11 months (Bozkurt , Özgür, & Özçİrpİcİ, 2003). While grouping children ages differently, another study found higher diarrhea incidence in children under 1 year (Melo et al., 2008). A study in Bangladesh (Azad, 2009) found higher ARI prevalence in younger children.

Poorer health outcomes have been documented among orphans and vulnerable children (Watts et al., 2007). This study however did not find an association between OVC status and both diarrhea and ARI in children. This should however be interpreted cautiously given that only 1.8% of children were OVCs. It could be that, past two weeks prevalence of ARI and diarrhea are indicators which are not sensitive enough in detecting differences between OVCs and non – OVCs. A better indicator could be the incidence of diarrhea and ARI obtained through cohort studies. Most orphaned children in Thailand receive substitute care and support from their extended families (Isaranurug & Chompikul, 2009). If orphaned children receive good care from the extended family system, their health status can be maintained (Sarker, Neckermann, & Müller, 2005).

Immunization of children with DPT vaccine is protective against diphtheria, tetanus and pertusis. Pertusis can result into ARI in children. Because DPT3 vaccine is administered to children at 6 months in Thailand (WHO, 2005), to assess the association between DPT3 immunization and diarrhea and ARI, children aged 7 to 59 months were considered. Data from the MoPH show that, among children aged less than 5 years, only 13 and 19 cases of pertusis were reported in 2005 and 2006 respectively (Ministry of Public Health, 2008). This low rate of pertusis coupled with a high DPT 3 immunization coverage of 95.6% as observed in this study could explain the lack of association between DPT 3 immunization and ARI among children aged 7-59 months. The lack of association between DPT 3 immunization status and diarrhea was however anticipated as DPT 3 immunization is not known to be directly protective against diarrhea.

Lack of measles immunization within the first 12 months of life is a risk factor for pneumonia in children (Rudan, Boschi-Pinto, Biloglav, Mulhollandd, & Campbelle, 2008) as measles virus is an etiological agent for ARI (WHO, 2009). Diarrhea is often one of the complications of measles infection (Deivanayagam, Mala, Ahamed, & Shankar, 1994). Immunization of children against measles can hence result into reduction in measles related diarrhea. This study however, did not show a significant association between measles immunization status and diarrhea in children. A possible explanation is that 98.2% of children aged 13-59 months had received measles immunization. Besides this, about 0.04% and 0.03% of children developed measles in 2005 and 2006 respectively in Thailand (Ministry of Public Health, 2008). The high immunization coverage and low rate of reported measles in the years during which the survey was conducted, could therefore explain the lack of association between measles immunization and diarrhea and ARI in children.

5.1.5 Association between nutritional status and diarrhea and ARI in children

Under nutrition is a risk factor for diarrhea and ARI as has been demonstrated in several cohort studies (Coles et al., 2005; El Samani et al., 1988; Scholing et al., 1990). This study however failed to show an association between any of the three indicators of nutrition (weight for age, weight for height and height for age) with diarrhea and ARI by bivariate analysis. The associations were too weak to allow for inclusion in multivariate analyses. These findings were unexpected given that 11.5% of children were stunted, 8.8% under weight and 4.6% wasted. Findings on associations between nutritional status and diarrhea agree with findings from a cohort study done in Guinea Bissau (Molbak et al., 1997). This study suggests that in Thailand diarrhea and ARI in children are associated with factors other than the nutritional status of a child. More studies should be done to clarify this unanticipated observation.

5.1.6 Association between feeding practices and diarrhea and ARI in children

This study found that children who had ever breastfed were less likely to develop ARI by multivariate analysis. However, having ever breastfed did not have an association with diarrhea children. This could imply that breastfeeding is more effective in protecting children against ARI than it is against diarrhea. The findings on the effect of having ever breastfed on ARI concur with findings from studies in Brazil (Victora, Fuchs, Flores, Fonseca, & Kirkwood, 1994; Victora et al., 1999).

Only 6.1% of children aged less than 6 months were exclusively breastfed. This contrasts with a hospital based study done in Bangkok which found exclusive breastfeeding rates to be 26% and 11% at 4 and 6 months respectively (Laisiriruangrai et al., 2008). This rate in Thailand is lower than in most comparable lower middle income countries (World Bank, 2008). The rate is also lower than the average rate (43%) in the East Asia and Pacific region (UNICEF, 2009). A study in Thailand has shown higher tendency to use artificial feeds among high income mothers (Zainal et al., 2004). Intended time to breastfeed among working mothers is limited by the amount of time they are allowed for work absence (Laisiriruangrai et al., 2008). The low levels of breastfeeding have also been blamed on health care providers who are not doing much in encouraging mothers to breastfeed (Keenapan, 2008).

Breastfeeding has shown to lower the frequency and duration of diarrhea and ARI in children aged less than 6 months (Lo´pez-Alarco´n et al., 1997). A cohort study showed increased risk of diarrhea in weaned children (Molbak et al., 1997). Among children aged 0-23 months, there was strong association between feeding practices and both diarrhea and ARI by bivariate analysis. This significance was maintained after controlling for confounders (appendices D and E). Children receiving either complementary feeds or being exclusively breastfed were less likely to suffer from diarrhea and ARI than those not receiving any breast milk at all (replacement feeding). Findings of this study confirm the hypothesis that breast milk is protective against morbidity in children. This is probably mediated through strengthened immune system. The fact that diarrhea rate was lower in children receiving complementary feeds or being exclusively breastfed than in weaned children could also imply high standards of hygienic practices in handling complementary feeds among mothers or caretakers of children.

5.2 Conclusion and Recommendations

Findings from cross-sectional studies are important, as they provide potential directions for further investigation in poorly understood areas and can be used for policy making and problem identification. This study provides a picture of factors associated with diarrhea and ARI at national level and can therefore be useful for policy making at this level.

The study found increased risk of diarrhea among children in households with one child under 5 years or with Thai heads. Male children and those with teenage or elderly caretakers were also at increased risk of diarrhea. Considering age, the highest risk of diarrhea was in children aged 6-23 months. An association between diarrhea and household wealth index quintile was observed with children in the poor, middle and fourth wealth index quintiles being at increased risk of diarrhea compared to children in the richest wealth index quintile. Unsafe disposal of child's feces and not breastfeeding at all were associated with increased risk of diarrhea in children aged less than 2 years.

As for ARI, living in rural areas, living in North East region, having a Thai household head, being a male child, being aged 13-23 months and having never breastfed were associated with increased risk of ARI in children aged less than 5 years. Not being breastfed at all was associated with increased risk of ARI in children aged less than 2 years.

Limitations of this study include:

1. Whereas there may be Thai language publications on diarrhea and ARI in children, due to language limitation, only articles or documents published in English were reviewed. This might have limited the depth and breadth of literature review and discussion.
2. Being a study done using data collected through a cross sectional study design, only associations can be made without inferring causality.

3. Because diarrhea and ARI morbidity was for the past two weeks preceding the survey as reported by the caretaker, there is potential for recall bias on these variables.

Based on the findings of this study, the following recommendations can be made:

1. Continued efforts to promote recommended child feeding practices through suitable strategies and policies.
2. Health education to targeted populations to promote hygienic practices in child care e.g. proper disposal of child's feces.
3. Health education to families using unclean fuels and without chimneys or hoods to minimize exposure of under 2 years children to smoke
4. Although the association between diarrhea and wealth index quintile was not perfectly linear (i.e. diarrhea reducing as wealth index quintiles raise), the study showed that children in the poorest wealth index quintile had the highest risk of diarrhea. Diarrhea prevention efforts should target this group in addition to further studies to explain the observed association.
5. Because male children and those aged 6-23 months have higher risk of getting diarrhea and ARI, they should receive special attention in prevention efforts.
6. Interventions which are known to prevent ARI in children should be emphasized more in Northern and Northeastern Thailand an in rural areas
7. Programs targeting teenage mothers/caretakers and elderly caretakers to build their capacity in good child care practices.

8. Further research, in the form of longitudinal studies, is needed to understand the complete dynamics of diarrhea and ARI morbidity and associated factors

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APPENDICES

APPENDIX A

TIME SCHEDULE

	Time frame (month)							
Activity	Sep 08	Oct 08	Nov 08	Dec 08	Jan 09	Feb 09	Mar 09	Apr 09
1.Literature review								
2. Writing thesis proposal								
3. Submission for proposal exam								
4. Proposal exam								
5. Proposal revision								
6. Data analysis								
7. Thesis and article writing								
8. Final thesis exam								
9. Submission of article for publication								
10. Submission of thesis								

APPENDIX B

BUDGET

Item	**Quantity**	**Unit cost**	**Amount (Thai Baht)**
Stationery			5,000
Photocopy	4000 pages	2	8,000
Printing	1000 pages	10	10,000
Binding proposal	15 pieces	100	3,000
Communication	200 minutes	5	1,000
Binding Thesis	20 copies	100	2,000
Article publication	8 pages	1000	8,000
Transport	100 trips	60	6,000
Total			44,000

APPENDIX C

Feeding practices of under 5 children by ethnicity of the household head

Feeding practice	Ethnic group of household head	
	Thai N (%)	Non Thai N (%)
EBF/Complementary feeding	1878 (20.5)	83 (35.5)
Replacement feeding	7288 (79.5)	151 (64.5)
Total	9166 (100)	234 (100)

APPENDIX D

Association between feeding patterns and diarrhea in under 2 years old children while controlling for confounders

Variables	B	Adjusted OR	95% CI	P value
Wealth index quintile				<0.001
Poorest	0.622	1.862	1.170 – 2.964	0.009
Second	0.169	1.184	0.778 – 1.803	0.431
Middle	0.683	1.980	1.381 – 2.839	<0.001
Fourth	0.496	1.642	1.152 – 2.340	0.006
Richest ®		1		
Ethnicity of household head	-0.122	0.885	0.395 – 1.981	0.766
House hold head's education level	0.013	1.013	0.825 – 1.243	0.904
Drinking water source	-0.379	0.684	0.449 – 1.043	0.078
Child's feces disposal method*	0.360	1.433	1.157 – 1.775	0.001
No. of children under 5 in household	-0.176	0.839	0.652 – 1.079	0.172
Care taker's age	0.065	1.067	0.971 – 1.171	0.176
Child's gender	-0.205	0.815	0.661 – 1.004	0.055
Child's age				<0.001
<6	-0.917	0.400	0.280 – 0.571	<0.001
6 to 12	0.085	1.088	0.856 – 1.383	0.489
13-23®		1		
Feeding pattern**	0.320	1.377	1.082 – 1.752	0.009
Constant	-2.826	0.059		<0.001

* Improved compared to unimproved
**Replacement feeding compared to EBF/Complementary feeding
® Reference group

APPENDIX E

Association between feeding patterns and ARI in children under 2 years old while controlling for confounders

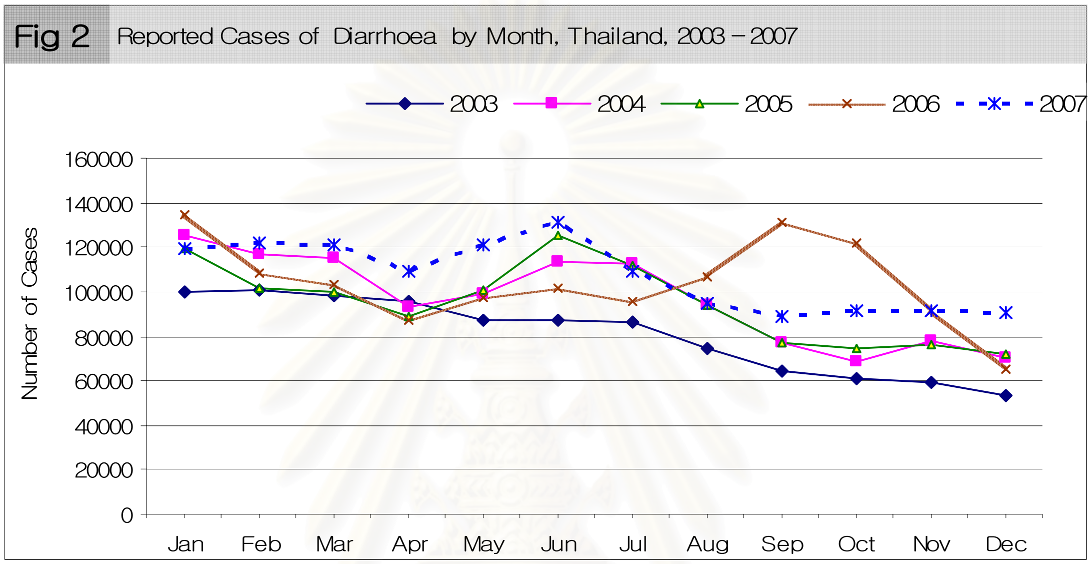
Variables	B	Adjusted OR	95% CI	P value
Wealth index quintile	0.058	1.060	0.894 – 1.258	0.502
Region				0.011
Central including Bangkok	-0.266	0.766	0.460 – 1.277	0.307
North	-0.101	0.904	0.503 – 1.625	0.737
North East	0.464	1.590	0.940 – 2.688	0.083
South®		1		
Residence	0.109	1.115	0.780 – 1.594	0.550
Ethnicity of household head	-1.044	0.352	0.048 – 2.608	0.307
House hold head education level	-0.097	0.908	0.657 – 1.255	0.559
Treat drinking water	-0.100	0.905	0.624 – 1.313	0.600
No. of children under 5 in household*	-0.425	0.653	0.426 – 1.003	0.052
Type of fuel used for cooking**	0.509	1.663	1.016 – 2.724	0.043
Care taker's age	-0.074	0.928	0.803 – 1.072	0.312
Child's gender***	-0.438	0.645	0.463 – 0.900	0.010
Child's age				0.001
<6	-1.214	0.297	0.155 – 0.571	0.000
6 to 12	-0.253	0.777	0.527 – 1.146	0.202
13-23®		1		
Feeding pattern ****	0.704	2.022	1.347 – 3.035	0.001
Constant	39.227	0.000		0.998

* > 1 compared to 1
** Unclean compared to clean
*** Female compared to male
**** Replacement feeding compared to EBF/complementary feeding
® Reference group

APPENDIX F

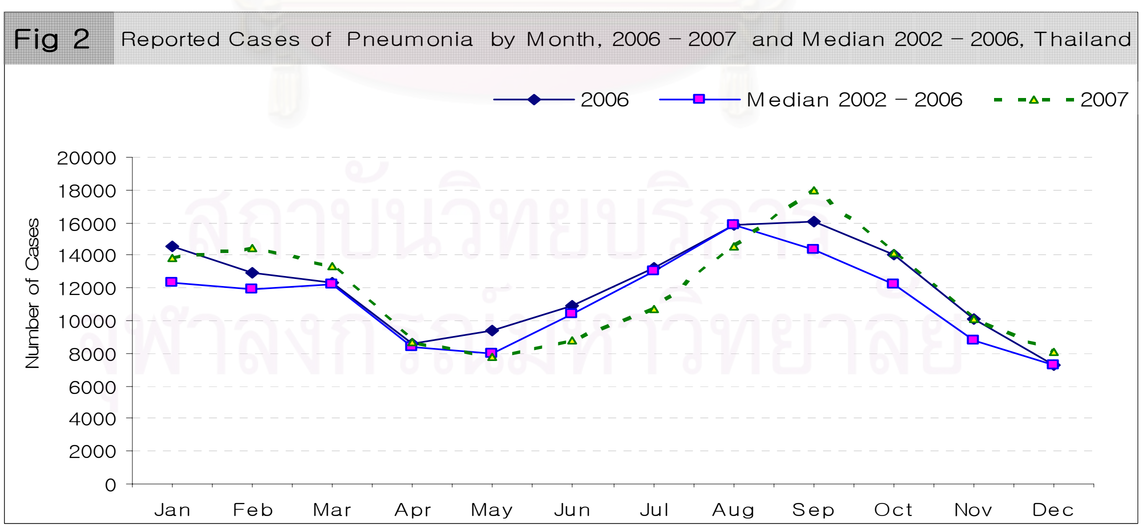
Reported cases of acute diarrhea and pneumonia by month, Thailand

1. Acute diarrhea



Source: Thailand Ministry of Public Health, 2008

2. Pneumonia



Source: Thailand Ministry of Public Health, 2008

APPENDIX G

Background information on Thailand Multiple Indicator Cluster Survey

Thailand is one of the countries that signed the Millennium Declaration, and the Plan of Action of A World Fit for Children. In signing these international agreements, the Thai government committed itself to improving conditions for all children in Thailand and to monitoring progress towards that end. The Thailand MICS was therefore developed and used as a tool to monitor progress towards set objectives and to provide standard information and data on children in Thailand that can be studied and compared internationally.

Before the survey, indicators on the situation of children in Thailand were incomplete, and data were obtained from various sources using different methods of collection and definitions. Therefore, the data could not be integrated. As a result, these indicators could not be used to assess and monitor the development of children effectively. In addition, Thailand lacked sub-level and otherwise disaggregated data, especially at the provincial level, which are needed for designing policies and measures to appropriately and directly address the situation of children.

The Thailand MICS was carried out by the NSO with support from UNICEF Thailand. Other Thai ministries supporting children's overall development also took part in the survey. These included the Ministries of Social Development and Human Security, Education and Public Health. Data at both the national and the provincial (26 provinces) levels were collected. The Thailand MICS emphasized monitoring the situation relating to indicators reflecting the goals of the Plan of Action of A World Fit for Children, the

MDG and other goals from commitments between international organizations and the committed countries. The findings from the survey will be a large and important source of data for monitoring outcomes towards achievement of the MDG-plus Goals for Thailand.

Survey objectives

The Thailand MICS primary objectives included:

- providing up-to-date information for assessing the situation of children and women in Thailand;
- furnishing data needed for monitoring progress toward goals established by the MDG, the goals of A World Fit for Children (WFFC) and other internationally agreed upon goals, as a basis for future action at national and provincial level; and
- contributing to the improvement of data and monitoring systems on the situation of children and women in Thailand and strengthening technical expertise for the design, implementation, and analysis of such systems.

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