ผลกระทบของโครงการอาหารสะอาดรสชาติอร่อย ต่ออุบัติการณ์การเกิดผู้ป่วยโรคอุจจาระร่วงในประเทศไทย

นายเจริญ หาญปัญจกิจ

วิทยานิพนธ์นี้เป็นสวนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

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IMPACT OF CLEAN FOOD GOOD TASTE PROJECT ON THE INCIDENCE OF DIARRHOEAL DISEASES IN THAILAND

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A Thesis Submitted in Partial Fulfillment of the Requirements
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เจริญ หาญปัญจกิจ:ผลกระทบของโครงการอาหารสะอาดรสชาติอร่อยต่ออุบัติการณ์การเกิดผู้ป่วยโรคอุจจาระร่วงในประเทศไทย. (IMPACT OF CLEAN FOOD GOOD TASTE PROJECT ON THE INCIDENCE OF DIARRHOEAL DISEASES IN THAILAND)
อ.ที่ปรึกษา: ผศ.ดร. ดร. วรเวศม์ สุวรรณระดา อ.ที่ปรึกษาร่วม : ศ. นพ.ภิรมย์ กมลรัตนกุล, 71 หน้า.

กองสุขาภิบาลอาหาร กรมอนามัย กระทรวงสาธารณสุข ได้ดำเนินการโครงการอาหารสะอาดรสชาติอร่อย ตั้งแต่ปีงบประมาณ 2542 เพื่อสนับสนุนความปลอดภัยในอาหาร และ การถูกสุขลักษณะของสถานประกอบการอาหาร

วิทยานิพนธ์ฉบับนี้เป็นการศึกษา โดยใช้รูปแบบการวิจัยเชิงพรรณนาชนิดย้อนหลัง เก็บรวบรวมข้อมูลของประชากร 76 จังหวัด ในประเทศไทย ย้อนหลัง ระหว่างพ.ศ. 2534-2548 วิเคราะห์ผลกระทบของโครงการอาหารสะอาด รสชาติอร่อย ต่ออุบัติการณ์การเกิดโรคอุจจาระร่วงในประเทศไทยทำการเปรียบเทียบวิเคราะห์แนวโน้มของอัตราป่วยของโรคอุจจาระร่วงทั้งหลังและก่อนการดำเนินกางานของโครงการ

วัตถุประสงค์ของวิทยานิพนธ์ฉบับนี้ คือ การวิเคราะห์หาแนวโน้มของอัตราป่วยของโรคอุจจาระร่วงเปรียบเทียบก่อนและระหว่างการดำเนินงานของโครงการ การหาผลกระทบปัจจัยแปรนำด้านสังคมเศรษฐกิจ สิ่งแวดล้อม และนวัตกรรม ต่อแนวโน้มของอัตราป่วยของโรคอุจจาระร่วง และการหาแนวโน้มผลกระทบการดำเนินงานของโครงการต่ออัตราป่วยของโรคอุจจาระร่วงภายหลัง พ.ศ. 2542 การศึกษานี้วัดผลลัพธ์แนวโน้มผลกระทบการดำเนินงานของโครงการต่ออัตราป่วยของโรคอุจจาระร่วง

ผลการศึกษาพบว่า ผลกระทบต่อการมีโครงการอาหารสะอาดรสชาติอร่อย มีแนวโน้มผลกระทบต่ออัตราป่วยของโรคอุจจาระร่วงอย่างแรง การศึกษาผลกระทบภายหลังที่ได้มีการดำเนินงานตามโครงการอาหารสะอาดรสชาติอร่อยตั้งแต่ พ.ศ.2543 เปรียบเทียบจำนวนร้านอาหารและแผงลอยที่ผ่านเกณฑ์ตามมาตราฐานของโครงการ กับอัตราส่วนร้อยละของค่าใช้จ่ายเฉลี่ยรายเดือนเพื่อการซื้ออาหารรับประทานนอกบ้านของครัวเรือนต่อรายได้ทั้งหมดของครัวเรือน แนวโน้มมีผลกระทบต่ออัตราป่วยโรคอุจจาระร่วงเฉียบพลัน ทั้งนี้ผลกระทบของปัจจัยแปรนำด้านสังคมเศรษฐกิจ สิ่งแวดล้อม และสาธารณสุข มีแนวโน้มผลกระทบต่อของอัตราป่วยของโรคอุจจาระร่วง

สาขาวิชา เศรษฐศาสตร์สาธารณสุข ลายมือชื่อนิสิต.....
ปีการศึกษา 2549 ลายมือชื่ออาจารย์ที่ปรึกษา.....
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Food Sanitation Division, Department of Health, Ministry of public Health is introduced public policy the Clean Food Good Taste Project (CFGT) which promote food safety and hygiene in food services in 1999.This is the retrospective observation time series study population of Thailand based on secondary data collected during 1991-2005. This study employed two models which first, analysis impact of introduction CFGT, second analysis impact of expansion CFGT to test for serial correlation in dynamic model using t-test Statistic.

The purpose of this study was to study the impact trend of Clean Food Good Taste Project (CFGT) and socio-economics, environment and intervention factor on the incidence of diarrhoeal diseases in 76 provinces Thailand. The analysis was based on the trend incidence of diarrhoeal diseases before and during adoption expansions the project, the impact trend of socio-economic, environmental and intervention factors on the incidence of diarrhoeal diseases in Thailand, the impacts of project on the incidence of diarrhoeal diseases after 1999.The study outcomes were the impact trend of CFGT on the incidence rate of diarrhoeal diseases.

The results showed that expansion CFGT and food habit culture proxy variable has a likely of relationship with trend impact on incidence rate of acute diarrhoeal disease. And the introduction CFGT and food habit culture proxy variable has a likely of relationship with trend impact on incidence rate of severe diarrhoeal disease. Also socio-economic, environmental and intervention factors have likely of relationship with trend impact on incidence rate of diarrhoeal diseases.

Field of Study Health Economics Student's signature.....
Academic Year 2006 Advisor's signature.....
Co-advisor's signature.....

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ABBREVIATIONS

BPS	Bureau of Policy and Strategy
CDC	Center of Disease Control
CDD	Community Development Department
CFGT	Clean Food Good Taste Project
DOC	Department of Disease Control
DOH	Department of Health
MICT	Ministry of Information and Communication Technology
mm.	Millimeter
MOE	Ministry of Education
MOI	Ministry of Interior
MOPH	Ministry of Public Health
MOPM.	Ministry of Office of the Prime Ministry
MWA	Metropolitan Waterworks Authority
NESDB	Office of the National Economic and Social Development Board
NSO	National Statistical Office
OBEC	Office of the Basic Education Commission
OPS	Office of the Permanent Secretary for Public Health
PWA	Provincial Waterworks Authority
TMD	Meteorological Department

CHAPTER I

INTRODUCTION

1.1 Problem and its significances

The diarrhoeal diseases have be a major public health problem in Thailand with a relatively unchanging incidence in both children and adults. The major health problems are food and water borne diseases especially diarrhoeal diseases as acute diarrhoeal disease, food poisoning dysentery, enteric fever (typhoid and paratyphoid fever), Severe Diarrhoeal Diseases etc. In 2005, the morbidity of acute diarrhoeal disease the incidence rate of 1,837.07 per 100,000 populations and the mortality rate of 0.12 per 100,000 populations. It can be noticed that food poisoning cases have been 140,948 cases and 8 deaths with the morbidity rate of 226.62 per 100,000 populations and the mortality rate of 0.01 per 100,000 populations. The National Study of Diarrhoeal diseases in Thailand 1988 conclude that Diarrhoeal diseases incidence are result of multi-factorial causes ranging from the very basic and personal variable to cultural and practices in associate to environmental sanitation factor.(Yawarat Porapakkham,Porapan Phunyaratabundhy;Somjai ramanpol,1988:56-57) Diarrhoeal diseases have long been a public health problem in Thailand. The diseases commonly found in the country are acute diarrhea, dysentery, food poisoning, enteric fever and severe diarrhea.

1.1.1 Acute Diarrhoeal Disease

From 1991 to 2005, it can be noticed that the reported number of acute Diarrhoeal disease slightly increased since 1993 and varied between 800,000-1,000,000 cases. High number of about 1,000,000 cases was observed in 1995, 1997 and 1998 (Department of Communicable Disease Control, 2001:70-72). However, its mortality rate has steadily declined. During 2000-2005 its morbidity rate has slightly increased. It can be noticed that acute Diarrhoeal disease cases has been steadily increasing from 792,513 cases with the morbidity rate of 1,398.67 per 100,000 populations and 473 deaths the mortality rate of 0.83 per 100,000 populations in the year 1991 to 1,142,581 cases with the morbidity rate of 1,837.07 per 100,000

populations and 77 deaths were reported mortality rate of 0.12 per 100,000 populations in the year 2005. Acute diarrhea is the leading cause of morbidity and its mortality is the second or forth ranks among the top-ten of infectious diseases. About 40% of Diarrhoeal cases were in children under five years old. The 1995 CDD Household survey, using 30 clusters sampling technique, revealed that acute diarrhea was occurred 1.34 episodes per child per year. In regard to seasonal patterns and area distribution of diarrhea, it can be observed that the disease occurs more frequently during the first half of the year (bacterial diarrhea peaks during summer and rotavirus diarrhea peaks during winter) and spread throughout the country but most of the cases found in the southern and central regions. (Figure1.1)

1.1.2 Severe Diarrhoeal Disease

Thailand has included *Vibrio cholerae* O1, EI Tor biotype and *V. cholerae* O139 into severe diarrhea by using syndrome approach based on the causes of severe diarrhoeal illness. This syndrome approach seems to fit with diarrhoeal disease characters and helps to increase sensitivity in early detection of the epidemic and efficient control of the disease. During 1991-2005, it can be noticed that severe diarrhoeal disease cases has been steadily decreasing from 4,615 cases with the morbidity rate of 8.14 per 100,000 populations and no death in 1991 to 279 cases with the morbidity rate of 0.45 per 100,000 populations and no death were reported in 2005 (Figure 2). Severe diarrhoeal disease seemed to be on a decreasing trend, however, a high number of the severe diarrhoeal disease 15,577 and 11,203 cases can be observed in 1993 and 1994. In 2000, a number of 1,328 cases and 5 deaths were reported to have severe diarrhoea. Most of the cases were among the elderly people and children under five years old. The disease peak occurred during May and July. Some investigations traced sources of the disease and found that majority of the cases were from the displaced people along the western and north eastern borders. (Figure1.2)

1.1.3 Food poisoning

Acute food poisoning is another problem in this category. During 1991-2005, it can be noticed that food poisoning cases has been steadily increasing from 59,708 cases with the morbidity rate of 105.38 per 100,000 populations and 16 deaths the mortality rate of 0.03 per 100,000 populations in 1991 to 154,678 cases with the morbidity rate of 247.38 per 100,000 populations and 12 deaths the mortality rate of 0.02 per 100,000 populations in 2004. In the year 2005, total number of 140,948 cases and 8 deaths with the morbidity rate of 226.62 per 100,000 populations and the mortality rate of 0.01 per 100,000 populations were reported to have food poisoning. (Figure 1.3)

1.1.4 Dysentery

Reported number of dysentery cases and deaths during 1991-2005 were observed to decrease steadily from 86,868 cases with the morbidity rate of 153.31 per 100,000 populations and 18 deaths the mortality rate of 0.03 per 100,000 populations in 1991 to 25,768 cases with the morbidity rate of 41.21 per 100,000 populations and no death in 2004. In the year 2005, a total number of 20955 cases with the morbidity rate of 33.69 per 100,000 populations and no death were reported. It was found that *Shigella sonnei.* and *Shigella Flexneri* were the most isolates. (Figure1.4)

1.1.5 Enteric Fever

During 1991-2005, reported numbers of typhoid and paratyphoid or enteric fever were observed to be on a decreasing trend. The number of cases declined from 17,096 cases with the morbidity rate of 30.2 per 100,000 populations and 5 deaths the mortality rate of 0.008 per 100,000 populations in 1991 to 11,356 cases in 2004. However, the number of deaths still fluctuated between 1-7 deaths during the same period. In the year 2005, a number of 7204 cases and 1 death with the morbidity rate of 11.58 per 100,000 populations and the mortality rate of 0.002 per 100,000 populations were reported to have enteric fever. (Figure1.5)

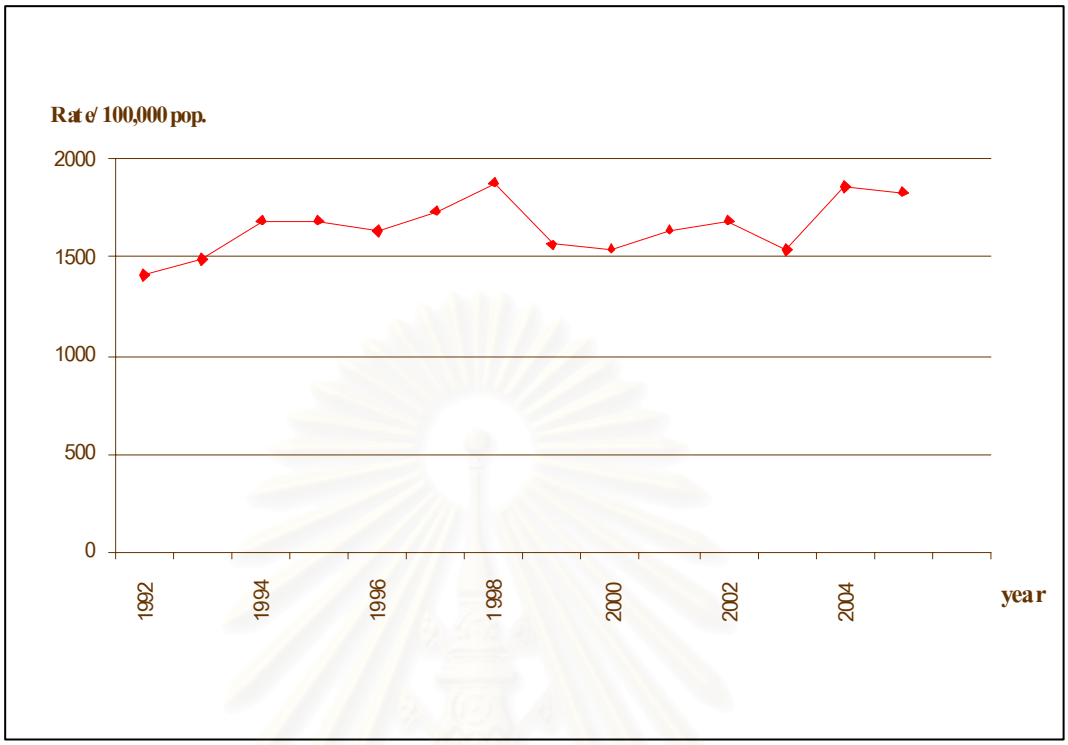

Figure1.1: Acute Diarrhoea: Case Rate per100,000 Pop.ByYear, Thailand,1991-2005.
Source: Bureau of Epidemiology

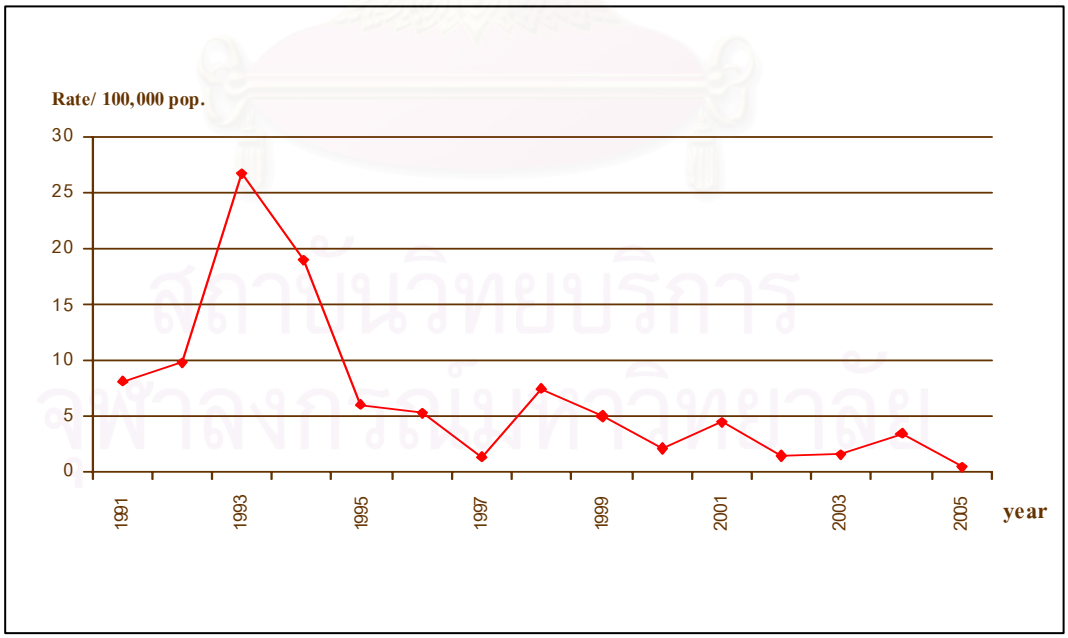

Figure1.2: Severe Diarrhoea:Case Rate per100,000 Pop.ByYear,Thailand,1991-2005.
Source: Bureau of Epidemiology

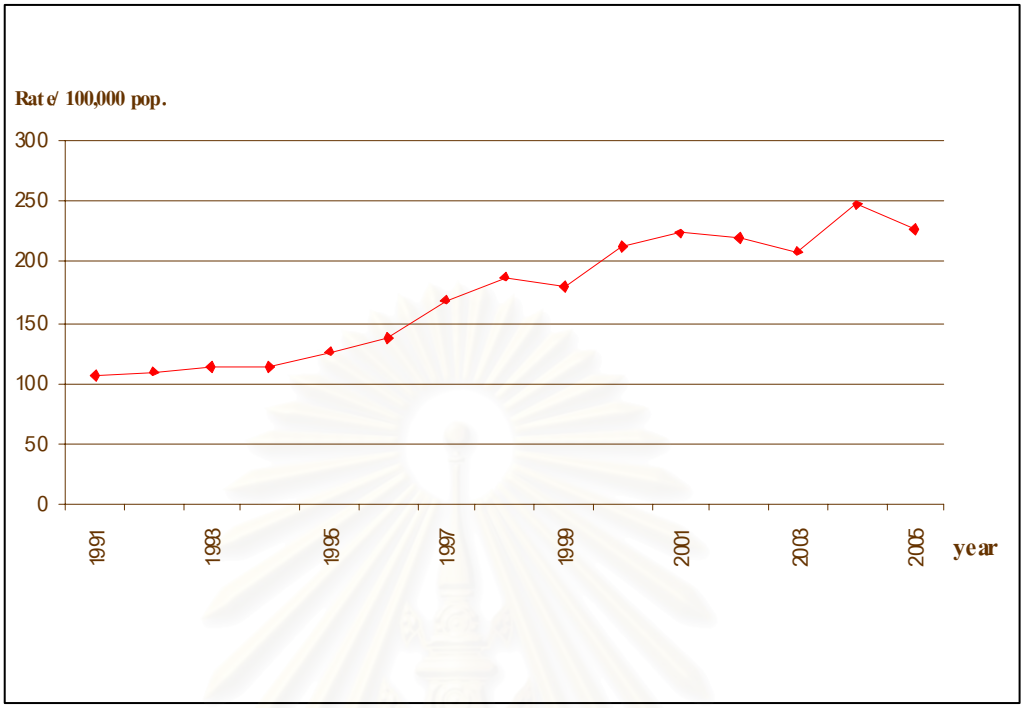

Figure 1.3: Food poisoning: Case Rate per100,000Pop.By Year, Thailand,1991-2005.
Source: Bureau of Epidemiology

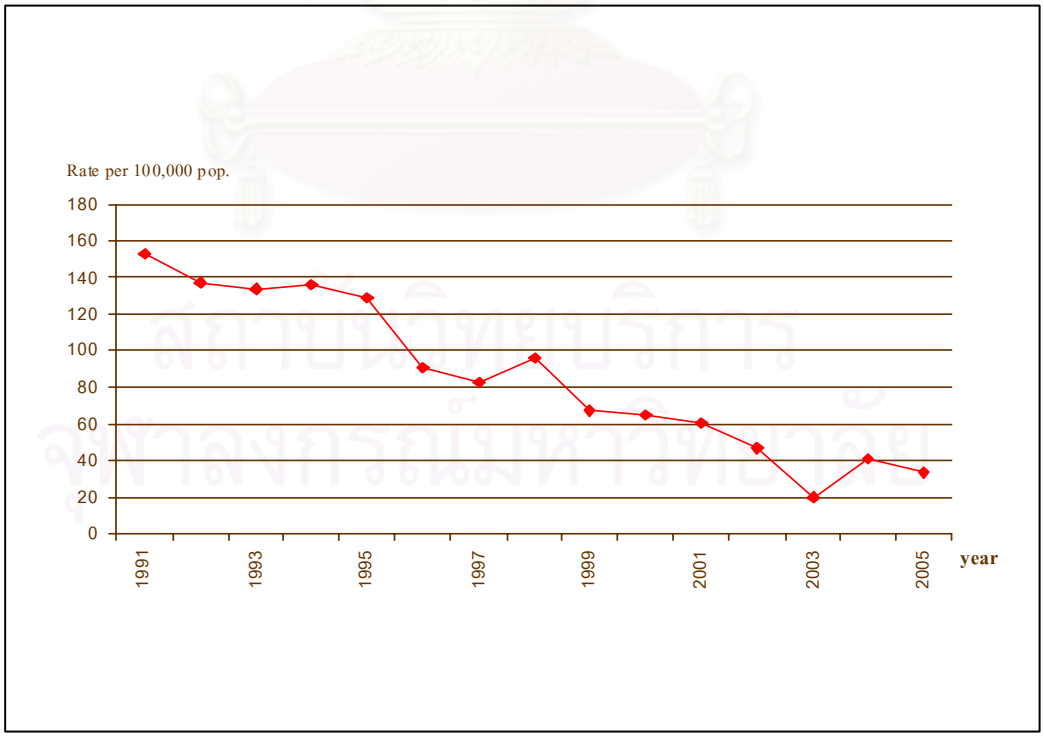

Figure 1.4: Dysentery: Case Rate per100,000 Pop.By Year, Thailand,1991-2005.
Source: Bureau of Epidemiology

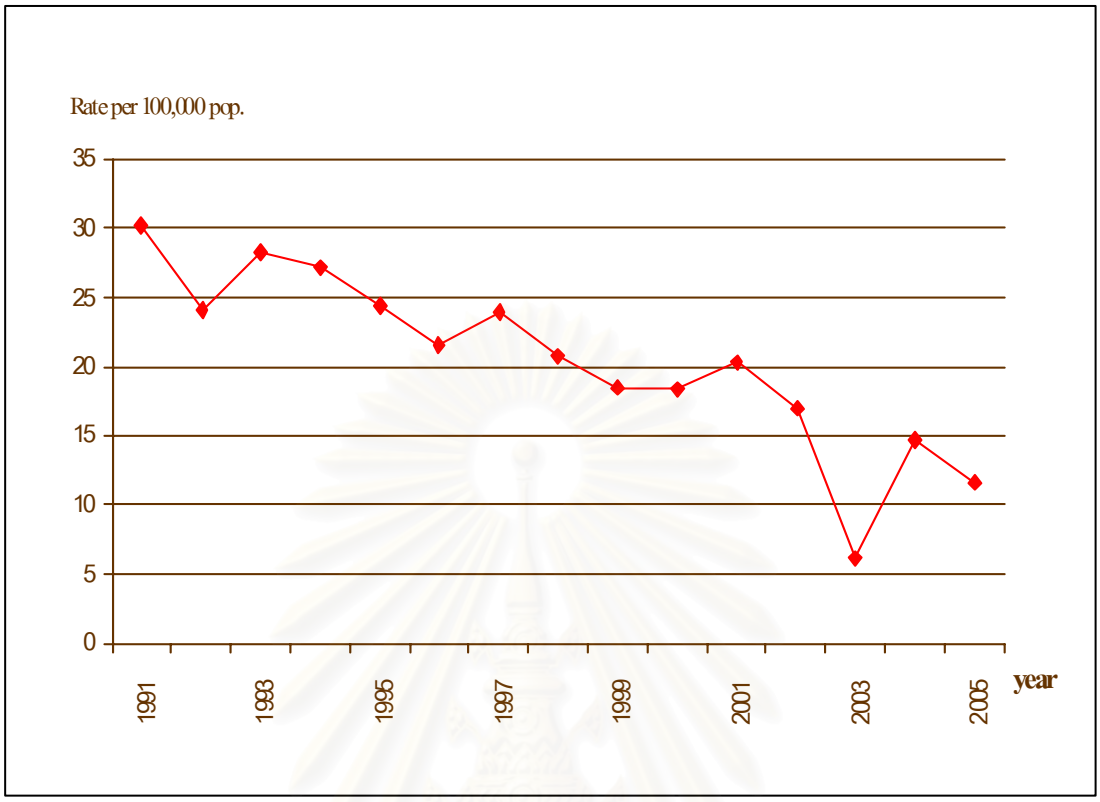

Figure 1.5: Enteric fever: Case Rate per100,000 Pop. By Year, Thailand,1991-2005.
Source: Bureau of Epidemiology

Diarrhoeal disease affects rich and poor, old and young, and those in developed and developing countries alike, yet a strong relationship exists between poverty, an unhygienic environment, and the number and severity of Diarrhoeal episodes especially for children under five (World Bank 1993).

Since 1990 Food Sanitation Division, Department of Health, Ministry of Public Health Thailand, is responsible for standardization and technical development for improving the safety measures to food service establishments. As Street-vended foods, food services and restaurants are significant part of the urban food supply. A 1994 analysis on the situation of food sanitation in food establishments through out the country of Thailand conducted by Food Sanitation Division, Department of Health found that the restaurants, food stalls in schools, market and hospital kitchens that had an improved sanitary condition in accordance with the established standard were 24.7%, 9.36%, 16.8%, and 34.4% respectively(Choocahi Supawongse, Somsak Chunharas; Yuwadee Karkarnklai, 1995:22-25).

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Thai people are not only at risk of consuming dirty food with disease contamination of unhygienic practice of food handlers in foods. The consumer who has eaten contaminated food will eventually have an effect on health. A research study on food processing hygiene of street foods in Bangkok Metropolis (L.S. Rita Hutabara 1994) indicated that 84.4% of the cooked food did not have cover lid protect from flies and dust while 82.25 kept food under inappropriate temperature. Besides, it was found that cooking utensils such as knife, cutting board, pot and pan have been continuously used without cleaning it first. The repetitive contamination of prepared food could be high risk for spread of food poisoning. In addition, the exiting condition of water container was poor. It has no cover lid to protect water from dirty. In regard to personal hygiene of food prepare, only 44.7% wore clean clothes with apron and only 14% had hats or hair bonnet.

It is the purposes of this study to analyze Impacts of Clean Food Good Taste Project (CFGT) on the Incidence of Diarrhoeal Diseases in Thailand after 1999.

1.2 Research Questions

1.2.1 What is the trend incidence of diarrhoeal diseases in Thailand before and during adoption Clean Food Good Taste Project (CFGT)?

1.2.2 What are the impacts of socio-economic, environmental and intervention factors such as income, education, population, culture, climate, health care service, water supply and sanitation on the incidence of diarrhoeal diseases in Thailand?

1.2.3 What are the impacts of Clean Food Good Taste Project (CFGT) on the incidence of diarrhoeal diseases in Thailand after 1999?

1.3 Research Objective

1.3.1 General Objective:

To study the impact of Clean Food Good Taste Project (CFGT) and socio-economic, environment and intervention factor on the incidence of diarrhoeal diseases in Thailand.

1.3.2 Specific Objectives:

1.3.2.1 To analyze the trend of incidence of diarrhoeal diseases in Thailand before and during adoption expansions Clean Food Good Taste Project (CFGT).

1.3.2.2. To analyze the impact of socio-economic, environmental and intervention factors such as income, education, population, culture, climate, health care service, water supply and sanitation on the incidence of diarrhoeal diseases in Thailand.

1.3.2.3 To analyze the impact of Clean Food Good Taste Project (CFGT) on the incidence of diarrhoeal diseases in Thailand after 1999.

1.4 Scope of Study

This study is about the impact of Clean Food Good Taste Project (CFGT) on incidence of diarrhoeal diseases in Thailand. However, diarrhoeal diseases have many diseases which in this study using the secondary data from epidemiological surveillance system by Bureau of Epidemiology on 5 diarrhoeal diseases incidence of acute diarrhoeal diseases, severe diarrhoeal diseases, food poisoning, dysentery and enteric fever.

The other factor socio-economics, environment and intervention using proxy variable as dependent variable of economics,culture,population,health care service education,climate,water supply sanitation and intervention factor . Which use sources of secondary data from 5 ministries consist of Ministry of Public Health, Ministry of Office of the Prime Ministry, Ministry of Education, Ministry of Information and Communication Technology and Ministry of Interior.

1.5 Research Hypothesis

The Clean Food Good Taste Project socio-economic, environmental and intervention factors such as income, education, population, culture, climate, health care service, water supply and sanitation can reduce the incidence rate of diarrhoeal diseases in Thailand after 1999.

1.6 Expected Benefit

1.6.1 To understand evolution of Clean food Good Taste project on incidence of diarrhoeal diseases in Thailand during 1999-2005.

1.6.2 To understand impact of socio-economic, environmental and intervention factors such as income, education, population, culture, climate, health care service, water supply and sanitation on the incidence of diarrhoeal diseases in Thailand.

1.6.3 The study can promote the effective development strategy for diarrhoeal diseases prevention programme in Thailand.

CHAPTER II

LITERATURE REVIEW

2.1 Diarrhoeal diseases

Diarrhoeal diseases transmitted from the stool of one individual to the mouth of another which known as fecal-oral transmission. The major Diarrhoeal syndromes exit. they are acute watery diarrhoea, which results in varying degree of dehydration The result, according to the World Health Organization revealed that 3 million people a year still die from Diarrhoeal complications, including 1.9 million children under 5, or 17% of the estimated 11 million deaths in that age group, 1.1 billion people still don't have clean water; 2.6 billion lack a basic toilet (Bronstein, 2006: 38-34).

Diarrhoeal diseases is caused by infectious organisms, including viruses, bacteria, protozoa, and helminthes, that are transmitted from the stool of one individual to the mouth of another, termed Diarrhoeal is caused by infectious organisms, including viruses, bacteria, protozoa, and helminthes, that are transmitted from the stool of one individual to the mouth of another, termed *fecal-oral transmission*. Some are well known, others are recently discovered or emerging new agents, and presumably many remain to be identified. They differ in the route from the stool to the mouth and in the number of organisms needed to cause infection and illness. Among bacteria, the ability to survive stomach acid is an important determinant of the inoculums size required to cause illness. For example, *Shigella spp.* bacteria are resistant to low pH, and a few thousand organisms suffice, which are readily transferred by direct person-to-person contactor through contamination of inanimate objects. In contrast, bacteria readily killed by acid, such as *Vibrio cholerae,* require millions of organisms to cause illness, and therefore must first multiply in food or water to an infectious dose. Some pathogens, such as rotavirus, display a sharp host species preference, and others have a broad host range. Among *Salmonella* bacteria, certain bio-serotypes are adapted to infect animals and pose no threat to

humans, and others are adapted to humans and do not infect animals. The majority, however, are not adapted to a specific host and can infect either humans or domestic animals, thus facilitating transmission of these organisms to humans. Less than a dozen of the more than 2,500 individual *Salmonella* cause the majority of human infections, reflecting the requirement for genes that encode essential virulence factors. The ability to identify virulence genes and their products (Jamison, et al. 1993.).

WHO recently estimated that 88% of all cases of diarrhea globally were attributable to eater, sanitation and hygiene (WHO 2002.). The risk factor was defined as "drinking-water, sanitation and hygiene behaviors", as well as aspects of food safety that are related to water sanitation and hygiene (i.e. food contamination by unsafe water, or the lack of domestic hygiene). Very little disease was transmitted through pathways other than those associated with water, sanitation and hygiene, or food (e.g. airborne transmission), and about 94% (84-98%) of all cases of diarrhea around the world were attributable to the environment, resulting in more than 1.5 million deaths annually, mainly in children. Diarrhoeal, attributable to water and sanitation accounted for 5.3% of deaths and 3.5% of Daly's in European children aged 0-14 (Valent, et al. 2004: 2032-2039).

Comparisons over time of the global burden of Diarrhoeal diseases have revealed secular trends and demonstrated the impact of public health interventions (Bern, et al. 1992: 705–14; Kosek, et al. 2003: 197–204). This steady decline in diarrhoeal diseases mortality, despite the lack of significant changes in incidence, is most likely due to modern case management introduced since the 1980s and to the improved nutrition of infants and children. Strategies for controlling Diarrhoeal diseases have remained substantially unchanged since the 1993 The World Health Organization (WHO 2004) recently reevaluated these interventions to determine the extent to which they have been effectively implemented and their effect. The Diarrhoeal diseases prevention program is focused in the high-risk areas. Public education on Diarrhoeal disease prevention is provided by health care personnel and other authorities involved, emphasizing on hygienic-sanitary cooking utilities, sanitation in food preparing areas, personal hygiene, and appropriate consumption behaviors.Poor personal hygiene can lead to food contamination and diarrhoeal diseases. It is not only those who do the cooking or food preparing processes.Cases of

food poisoning have increased consistently over the past 30 years, a phenomenon brought about by changes in lifestyle, particularly in urban areas where people are more likely to purchase cooked food from street vendors, and good taste and low price have a higher priority than awareness of the hygiene, cleanliness and safety of their food. Food sanitation situation reports 9 found that between 74% to 99% of food shops and 66% to 90% of food markets employed non-hygienic practices, presenting clear evidence of the most likely cause of the increase in the incidence of food poisoning (Theechat Boonyakarnk & Philip A Kingston, 2003: 55-62).

Data from the study by Mead et al. (1999) suggested that the proportion of diarrhoeal illness attributable to food in the United States of America was approximately 35% and estimated 76 million illnesses and 5,000 deaths in the United States each year. Although food borne diseases are common, only a fraction of these illnesses are routinely reported to CDC because a complex chain of events must occur before a food borne infection is reported; a break at any point in the chain will result in a case not being reported. During 1998--2002, a total of 6,647 outbreaks of food borne disease were reported (1,314 in 1998, 1,343 in 1999, 1,417 in 2000, 1,243 in 2001, and 1,330 in 2002). These outbreaks caused a reported 128,370 persons to become ill. Among 2,167 (33%) outbreaks for which the etiology was determined, bacterial pathogens caused the largest percentage of outbreaks (55%) and the largest percentage of cases (55%). Among bacterial pathogens, *Salmonella* serotype Enteritidis accounted for the largest number of outbreaks. In the majority of food borne outbreaks during this period, food was eaten outside the home. Restaurants were the most commonly reported place where food was eaten (Michael et al. 2006: 1-3). Many outbreaks caused by *Salmonella* or norovirus occurred at a school or nursing home. For example, *Salmonella* infection causes an estimated 1.4 million food borne illnesses annually. However, during 1998--2002, a total of 164,044 *Salmonella* infections (approximately 32,000 annually) were reported through the National *Salmonella* Surveillance System which is a passive, public health laboratory-based system. During the same period, 585 recognized outbreaks of *Salmonella* infection resulting in 16,821 illnesses were reported through the Food borne Disease Outbreak Surveillance System, not all of which were necessarily culture-confirmed (Voetsch, 2004: 127-34).

Sometimes several component causes (see Figure 6) may produce similar infection outcomes. As numerous separate faecal–oral illnesses fall under the "umbrella" of infectious diarrhoeal diseases. Their commonality derives from their mode of transmission, in that the source of the pathogen is human (or less commonly, animal) faeces which can cause infection in a new host upon ingestion. The shortest route of transmission is from person-to-person

(hygiene issue), while longer routes include transfer of pathogens to a food crop, as well as to drinking water. This can mean that the introduction of a single intervention in isolation (e.g. the provision of cleaner water supplies) designed to break an infection pathway of diarrhoeal diseases may result in a negligible reduction in overall diarrhoeal diseases (Prüss-Üstün, Fewtrell; Bartram, 2002: 537–542.).

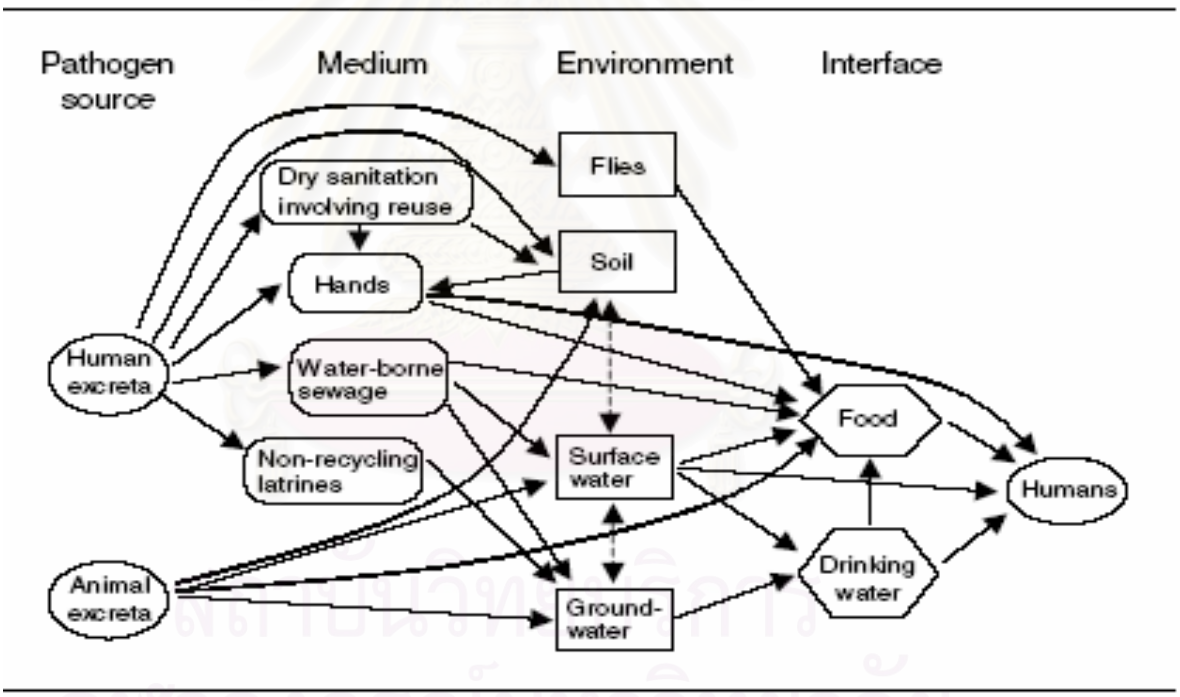

Figure 2.1: Transmission pathways of fecal-oral disease
(Source Prüss-Üstün, Fewtrell; Bartram, 2002: 537–542. Figure 1.)

2.2 Socio-economics

Socioeconomic position is an important distal risk determinant for many health outcomes. While it was not possible (owing to limitations of data and other factors) to directly map socioeconomic position to the diarrheas disease, it was considered possible to map some risk factors by absolute poverty, which is one measure of socioeconomic position .The proportions of the population living on <US$1, on US$1–2 and World Bank estimates of poverty by country. The counterfactual scenario was no absolute poverty in the world (no one living on <US$2 per day).Health status is strongly determined by socioeconomic position. A burgeoning research literature from developed countries demonstrates that all-cause mortality and most causes of death occur at greater rates among groups with lower socioeconomic position (Blakely 2002).

The study revealed to examine the impact of improved water and sanitation in Stockholm from 1878 to1925. the decline in overall and diarrhea mortality among children in overall mortality and of diarrhea mortality and a leveling out of socioeconomic differences in child mortality due to diarrheal diseases, but not of overall mortality. There were probably many causes of the decline in diarrhea mortality Improvements in the provision of water and sanitation, changes in hygienic perception and behavior and socioeconomic improvements. All thought to have been contributing factors. It may be difficult to disentangle the precise role of the different factors that brought about the decline in diarrhea mortality around the turn of the century or what caused the equalization of mortality risks. However, the decline of diarrhea mortality in Stockholm illustrates some features of the relationship between improvements in water and sanitation and the decline of diarrhea (Bo Burström, et al. 2002)**.**

2.2.1 Economics

Thomas McKeown was a rhetorically powerful critic, from the inside, of the medical profession's mid-20th-century love affair with curative and scientific medicine. The importance of economic growth, rising living standards, and improved nutrition as the primary sources of most historical improvements in the health of

developed nations. The thesis attributed the modern rise in the world population from the 1700s to the present to broad economic and social changes rather than to targeted public health or medical interventions. His work generated considerable controversy in the 1970s and 1980s. Economic improvement may contribute to mortality decline. It needs to be translated into specific public health interventions that affect risk factors or causes of mortality. The importance of specific public health interventions (e.g., water and sanitation) rather than just economic. The egalitarian implications of this relationship between improved living standards and reduced mortality were extremely radical (Szreter, 2002).

In the estimates study Valuing Health and Economic Costs of Water Pollution in Thailand are based on costs associated with reported cases of three water pollution related diseases-diarrhea, typhoid, and dysentery. Data from the Thai Annual Epidemiology Surveillance Report (1998) is used in this analysis, which more than 1.1 million cases of diarrhea were registered, leading to 323 cases of premature death (25 percent of which were children below age four), Diarrhea, typhoid and dysentery patients required hospitalization for treatment averaging hospital stays of 2.1, 4.3 and 2.2 days respectively, at a total cost About 112 million baths. The total out-patient and in-patient hospitalization costs for these three water-borne diseases amounted to 209 million baths in 1999 alone. The study suggests that the improvement in public sanitation and personal hygiene and access to clean water are however still main stays to protect people from afflicting the diseases (Siripen, et al 2001).

When measuring growth we use the growth in Gross Domestic Product (GDP.) per capita. It is reasonable to question whether this is a good measure or not. Different factors like oil crisis, prices of important exports, have contributed to a volatile growth in GDP for Thailand. Nevertheless Thailand has been one of the fastest-growing economies in the world. Between 1961 and 1972 the growth in GDP per year was 11.3%, between 1973 and 79 it was 7.7% and between 80 and 85 5.5% and between 1986 and 89 the economy grew with 10% per year. Between 1992 and 1996 the annual growth was 8.2%. The first Household Socio-Economic Survey was conducted by the National Statistical Office (NSO.) in 1957, known as “The Household Expenditure Survey". This name was changed to the Household Socio-Economic Survey in 1968 - 1969 and the survey was conducted every five years. Due to the rapid economic expansion and the importance of the survey in order to set the

anti-poverty policy, the Ministerial Cabinet had passed an approval on September 8, 1987 for the NSO to carry out the survey every two years. The 2000 survey is the fifteenth survey of this kind. The 1999 was conducted special periodic survey by the cabinet assignment.

2.2.2 Education

The context of people's lives determines their health, and so blaming individuals for having poor health or crediting them for good health is inappropriate. Individuals are unlikely to be able to directly control many of the determinants of health low education levels are linked with poor health, more stress and lower self-confidence. Primary education shows that average years of schooling in the total population over age 25 in Thailand average years of primary schooling increases from 3.196 in 1960 to 4.238 in 1985. Thailand has made significant progress in education. Gross primary enrolment has been above 100% (United Nations country Team in Thailand, 2005). Visiting school and having visitors from outside reduced the risk of shigellosis. Whereas other studies, usually conducted during shigellosis outbreaks, Social gatherings and school contacts increase the risk of shigellosis (Pornthip, et al 2006).

2.2.3 Health Care Service

An intervention is an activity using human, physical, and financial resources in a deliberate attempt to improve health by reducing the risk, duration. or severity of a health problem. The term usually refers to an activity undertaken by health system rather than by an individual. Existing interventions to prevent or treat Diarrhoeal diseases have proven their efficacy in reducing mortality, but a major challenge for the next 10 years will be to scale up these interventions to achieve universal utilization coverage. The CDD program to develop detailed guidelines for their implementation within national primary health care programs and to promote any operational research needed to improve their delivery or impact. First are interventions that clearly shown to be effective feasible and affordable. Second are interventions for which there is good theoretical evidence of effectiveness but in sufficient field experience to predict impacts precisely or to judge feasibility and cost. Third are interventions which are shown to be ineffective, unfeasible or too costly.

These interventions will not be recommended by the CDD program as important elements of Diarrhoeal diseases (Feachem & A. Koblinsky, 1983).

Government intervention in the health care market may be promoted on either efficiency or equity grounds. It can attempt to restore the conditions necessary for the market to work or to limit the undesirable effects of markets and market failure. For example, allocative measures are designed to restore the conditions of perfect competition; and distributive measures are designed to correct an undesirable distribution of economic resources, and then to allow markets to work. Distributive measures may work through the tax system via transfer payments to the poor or negative income taxes; or through price regulation via price support (e.g. minimum wages) or tariffs. Moreover, government intervention can be minimal, limited to that of umpire, referee, information provider or regulator of market fixing by vested interests. Or government can have a more extensive role ranging from the regulation and control of the health care system to the provision of the finance for services to the direct provision of services for all. A fully socialized health care system – meaning. Many of the actions affecting determinants of health come from outside the health sector, which highlights the importance of cooperation between sectors when undertaking activities to reduce the environmental health burden. Also, health-sector costs are increasing, and often demands cannot be met, so without cross-sector cooperation it is unlikely that progress will be sustainable in many health areas (Prüss-Üstün & Corvalan, 2006).

2.3 Environment

2.3.1 Climate

Most climatologists now believe that the Earth's atmosphere is warming, but no one knows how high, or how fast, temperatures may rise. And even though several national and international studies this year predicted that tropical diseases such as malaria and dengue may extend their ranges as the world warms and that disrupted storm and rainfall patterns may raise threats of everything to cholera— no scientific consensus exists on precisely what ecological upsets will hit which countries. Both temperature and surface water have important influences on the infectious disease. Many diarrhoeal diseases vary seasonally, suggesting sensitivity to climate.

In the tropics diarrhoeal diseases typically peak during the rainy season. Both floods and droughts increase the risk of diarrhoeal diseases. Major causes of diarrhoea linked to heavy rainfall and contaminated water supplies are: cholera, cryptosporidium, E.coli infection, giardia, shigella, typhoid. Human exposure to waterborne infections occurs by contact with contaminate drinking water, recreational water, or food. This may result from human actions, such as improper disposal of sewage wastes, or be due to weather events. Rainfall can influence the transport and dissemination of infectious agents, while temperature affects their growth and survival. Heavy rainfall has been associated with an increase in outbreaks of enteric pathogens, usually as a result of a contamination of water supplies. In tropical regions, diarrhoeal diseases typically peak during the rainy season. Temperature is important in the seasonal between year variability of diarrhoeal diseases and seasonality by their direct influence on the abundance or toxicity of *V. cholerae*. The possible mechanisms by which increased sea surface temperatures affect disease transmission from year to year remain poorly understood (Kovats, et al 2003).

2.3.2 Water supply and Sanitation

A review of the published literature on the impact of water supply and/or excreta disposal facilities on diarrhoeal diseases, or on infections related to diarrhoeal diseases, reveals several methodological problems that hamper the drawing of definitive conclusions from these studies.(Deborah Blum and Feachem, 1983: 357-365) This study points out that eight of these methodological problems: lack of adequate control, the one to one comparison, confounding variables, health indicator recall, health indicator definition, failure to analyze by age, failure to record usage, and the seasonality of impact variables. It is suggested that an evaluation of the impact on health of environmental interventions may best be undertaken in opportunistic study.

The diarrhoeal diseases burden from unsafe water, sanitation and hygiene is estimated at the global level taking into account diarrhoeal diseases. The risk factor is defined as including multiple factors, namely the ingestion of unsafe water, lack of water linked to inadequate hygiene, poor personal and domestic hygiene. Unsafe water, sanitation and hygiene is an important determinant in a number of diarrhoeal diseases.Esrey’s multicountry study (1996: 608–623) suggests that a mean reduction

in diarrhoeal diseases 37.5% is possible following the introduction of improved water supply and sanitation .Selected additional studies have suggested ranges of reductions in incidence of diarrhoeal diseases that could be achieved by reducing the transmission of faecal–oral pathogens through the implementation of interventions, such as point of use treatment and disinfection of stored water (Quick, et al 1999; Semenza, et al 1998).

For infectious diarrhoeal diseases, the unsafe water, sanitation and hygiene (WSH) risk factor comprises a number of transmission routes mediated by a complex interaction of water supply and sanitation infrastructure issues, which might affect, for example, microbiological hazards from poor quality drinking water, water availability, microbial risks from inappropriate disposal of faecal wastes and behavioral aspects. The transmission routes interact with the efficiency of interventions such as hygiene within the home, hand-washing and rigorous application of point-of-use treatment within domestic properties.

In the estimates study Valuing Health and Economic Costs of Water Pollution in Thailand are based on costs associated with reported cases of three water pollution related diseases-diarrhea, typhoid, and dysentery. Data from the Thai Annual Epidemiology Surveillance Report (1998) is used in this analysis, which more than 1.1 million cases of diarrhea were registered, leading to 323 cases of premature death (25 percent of which were children below age four), Diarrhea, typhoid and dysentery patients required hospitalization for treatment averaging hospital stays of 2.1, 4.3 and 2.2 days respectively, at a total cost About 112 million baths. The total out-patient and in-patient hospitalization costs for these three water-borne diseases amounted to 209 million baths in 1999 alone. The studies suggest that the improvement in public sanitation and personal hygiene and access to clean water are however still main stays to protect people from afflicting the diseases (Siripen, et al 2001).

The relationship between infectious diarrhoea and transmission of pathogens through water is both plausible and coherent. Isolation and enumeration of specific pathogens in water are often not feasible or very imprecise; thus a more common measure of faecal contamination is derived from the use of indicator bacteria. There have been many studies using such indicator species that have demonstrated the faecal contamination of drinking water sources in both developed and developing countries.

The interventions for reducing diarrhoeal diseases morbidity or mortality by reducing transmission of the pathogenic agents of diarrhoeal diseases. Constructing water supplies that improve the quality and availability of water for domestic purposes, and improved excreta disposal facilities; and providing the necessary educational support to ensure use and maintenance of these new facilities. Personal and domestic hygiene promoting is specific features such as hand-washing by appropriate educational campaigns. Food hygiene promoting which improved practices for the preparation and storage of foods, both commercially and in the home, and especially emphasizing the hygienic preparation of weaning foods. Control of infection of domestic and farm animals by pathogens causing diarrhoeal diseases in man. Control of flies, especially flies breeding in association with human or animal faces. While effective in more controlled settings, the large scale implementation of these interventions in communities is fraught with problems of limited access, lack of effective targeting, inadequate training of health professionals, lack of coordination with other programmes, poor community acceptance, and lack of effective use of services.

2.4 Clean Food Good Taste Project (CFGT)

It has been an economic crisis in Thailand since 1997; the economic problems have expanded and affected business in both government and private sectors. Tourist business, which is one of the highest incomes of Thailand, was also affected from the crisis. There were various plans and activities have been set up to solve the problems. One of the plans was tourist promotion campaign, which included promotion of attractive areas, traditional goods, arts and Thai food. And in the year 1999, the Clean Food Good Taste Project in Support of Tourism and the Thai Economy is introduced to promote food safety and hygiene in food services. As the Department of Health has a role of promotion and protection of health and environment, it is concerned that food safety and control in food services is an important issue to promote safe and wholesome food for tourists. There is a necessity to improve food safety standards in food services to ensure that food does not caused diseases or health hazard after consumption. The project has a collaboration of multi-sectional party, which is the Food Sanitation Division of Health Department Ministry of Public Health, the Ministry of Interior, and the Tourism Authority of Thailand. The project aims to improve safety conditions of food in all food services such as restaurants, street foods,

and other food services. This also provides a means of setting standards and exercising control in food services for the safety of consumer .One object of the project is reducing risk of water and food borne illness from food consumption. including local and foreign tourists via mass media such as TV, radio, papers etc.

Department of Health of the Ministry of Public Health together with Tourism Authority of Thailand and Ministry of Interior who is responsible for all local governments in provinces around the country have joined hands in a project aiming at assuring the good sanitation of all restaurants and street vendors in Thailand. The "Clean Food Good Taste" Project directly benefits the people of Thailand while also reassures tourists that food in Thailand is safe as well as looks and tastes good. The success of the Clean Food Good Taste Project is due to four great strategies which have been applied at all levels: partnerships and co-ownership, quality assurance, sustainability, and public awareness and involvement (Hataya Kongchuntuk, 2002).

According to the food safety policy pursued by the Thai Government: "Safe and Clean Food for All in 2004", the Ministry of Public Health is authorized to be responsible for the Food Safety Programme. This programme has been strictly implemented, aiming at keeping the standard and quality of all foods produced and consumed in Thailand high and able to meet the international food standard, which could consequently lead the country to become the kitchen of the world.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Study Design

This study is the retrospective observation time series study based on secondary data collected during 1991-2005. We afford to answer the following questions.

3.1.1 What are the trend of Incidence of diarrhoeal diseases in Thailand before and during adoption expansions Clean Food Good Taste Project (CFGT) ?

3.1.2. What are the impact of socio-economic, environmental and intervention factors such as income, education, population, culture, climate, health care service, water supply, sanitation on the incidence of diarrhoeal diseases in Thailand?

3.1.3 What is the impact of Clean Food Good Taste Project (CFGT) in Thailand on the incidence of diarrhoeal diseases in Thailand after 1999?

3.2 Methodology

3.2.1 Target Population

Population of Thailand 1991-2005

3.3.2 Unit of Analysis

Incidence of diarrhoeal diseases in 76 provinces Thailand 1991-2005

3.2.3 Intervention

3.2.3.1 Procedure of the Clean Food Good Taste Project

(a) The Ministry of Public Health forms a multi-sectional party by collaboration with the Ministry of Interior, the Tourism Authority of Thailand and private sectors to host the 'Clean Food Good Taste Project in Support of Tourism and the Thai Economy.

(b) MOPH Induce and cooperate with food services to participate in the project and provide free application at the Provincial Health Offices and local government offices.

(c) Health officers inspect, monitor, and certify food services by using food sanitation standard. Inspection of food services includes physical and bacteriological testing. After that food services improve sanitation in their premises to meet the required standard. Bacterial screening test in food, utensils and equipment, and cooks' hands is conducted by using SI-2 test kit. Then the sign of “Clean Food Good Taste” will be given to certified food services those meet the required standard.

(d) MOPH will promote the certified food services to public including local and foreign tourists via mass media such as TV, radio, papers etc. However, the certified food services will be evaluated every 2 months. The sigh will be expired within 1 year.

3.2.3.2 Conditions for attaining the “Clean Food Good Taste” sign

Any food services are able to attain “Clean Food Good Taste” sign if the following condition is meet.

(a) Food services/ Restaurants and Hotels

Meet the required food sanitation standard for food services (15 items) and pass 90% of bacterial screening test (SI-2) of food, utensil & equipment and cooks' hands. Of course monitoring process of food services will be conducted physical and bacterial inspection according to the food sanitation standard for food service in very 2 months.

(b) Food center/ Food court

Meet the required food sanitation standard for food services (15 items) and pass 90% of bacterial screening test (SI-2) of food, utensil & equipment and cooks' hands. Of course monitoring process of food services will be conducted physical and bacterial inspection according to the food sanitation standard for food service in very 2 months.

(b) Street food/ Vender

Meet the required food sanitation standard for food services (12 items) and pass 90% of bacterial screening test (SI-2) of food, utensil & equipment and cooks' hands. Of course monitoring process of food services will be

conducted physical and bacterial inspection according to the food sanitation standard for street food in very 2 months.

3.3 Conceptual Frame Work

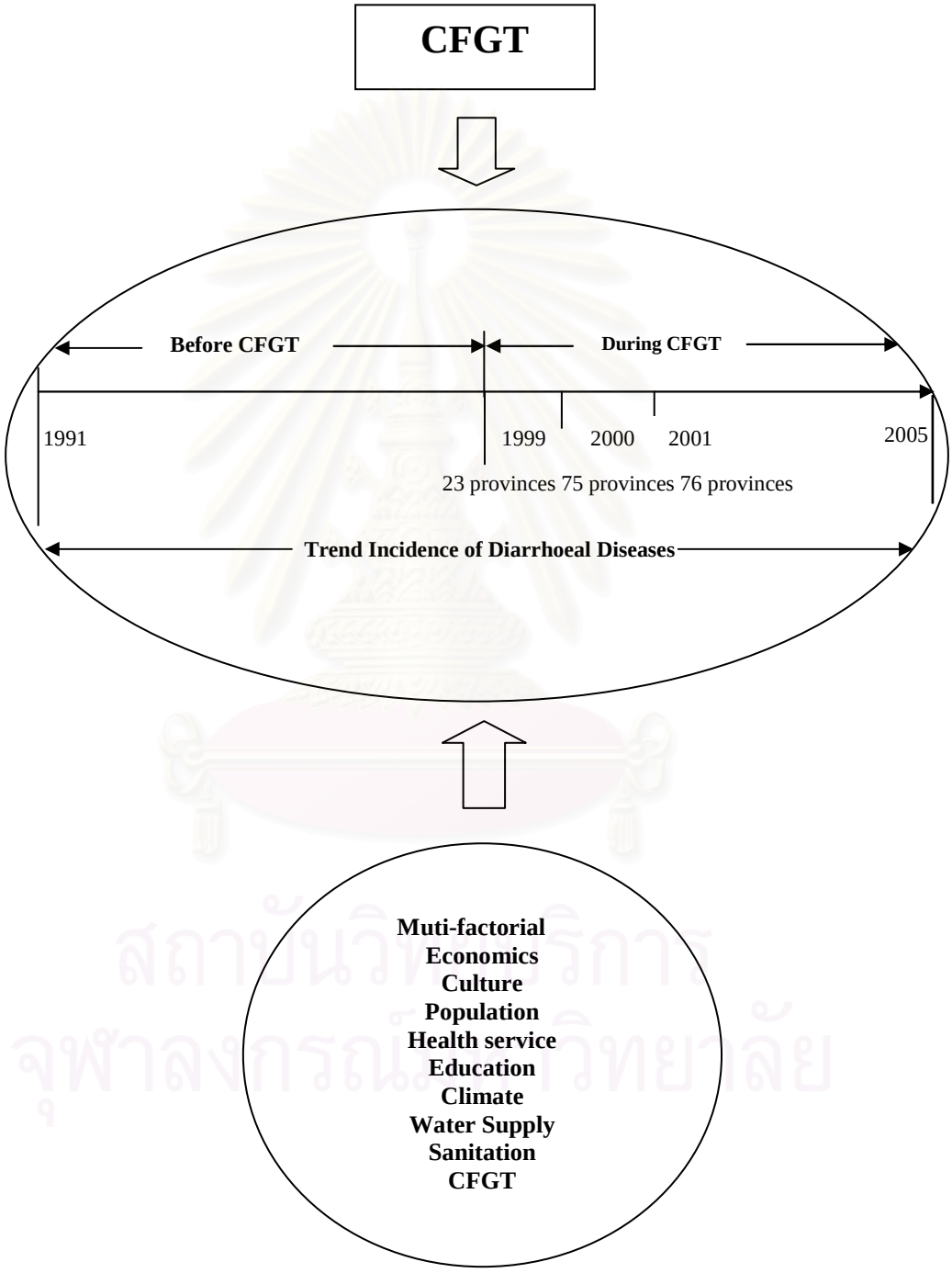

Figure 3.1: Conceptual Frame Work

3.4 Model

3.4.1 Analysis Impact of Introduction Clean Food Good Taste Project

We analyze the impact of the introduction the CFGT project by estimating the following panel data regression model. The direction of impact of CFGT on the incidence of 5 diarrhoeal diseases is the sign of "introduction of CFGT dummy variable's coefficient."

$$y_{ijt} = a + bx_{kjt} + c\ (\textit{Introduction CFGT dummy variable}) + \varepsilon_{ijt}$$

- ***y*** is the dependent variable
- ***i*** is Incidence of 5 Diarrhoeal Diseases ***i***=1, 2 …..5
  1=Acute Diarrhoeal Diseases, 2= Severe Diarrhoeal Diseases,
  3= Food Poisoning,4= Dysentery,5= Enteric Fever
- ***j*** are indices for provinces, ***j*** =1,2…..76
- ***t*** are indices in time, ***t*** = 1991-2005
- ***x*** is the independent variable
- ***k*** are indices for socio-economic, environmental and intervention factors
  k =1, 2…..8
  1=Economics, 2= Culture, 3= Population, 4= Health care service,
  5= Education, 6= Climate,7= Water Supply 8=Sanitation
- Introduction of CFGT dummy variable = 0, if before introduction year(1999)
  = 1, if during adoption(2000-2005)
- ***a*** , ***b*** and ***c*** are coefficients.
- ***εijt,*** is the error

3.4.2 Analysis Impact of Expansion Clean Food Good Taste Project

During the adoption CFGT project, the expansion of project to more food services may decrease the incidence of diarrhoeal diseases. Thus, we incorporate such variable into the econometric model. We use the number of certified CFGT restaurants and street food venders by provinces as the proxy of CFGT project expansion.

$$\ln(y_{ijt}) = d + e\ln(x_{kjt}) + f\ln(\textit{No. of certified CFGT Restaurants and Street food Vendors}_{jt}) + \gamma ijt$$

- y is the dependent variable
- i is Incidence of 5 Diarrhoeal Diseases i=1, 2 …..5
  1=Acute Diarrhoeal Diseases, 2= Severe Diarrhoeal Diseases,
  3= Food Poisoning,4= Dysentery,5= Enteric Fever
- j are indices for provinces, j =1,2…..76
- t are indices in time, t = 1999-2005
- x is the independent variable
- k are indices for socio-economic, environmental and intervention factors
  k =1, 2…..8
  1=Economics, 2= Culture, 3= Population, 4= Health care service,
  5= Education, 6= Climate,7= Water Supply 8=Sanitation
- Expansion of CFGT No. of certified CFGT Restaurants and Street food Vender.
- d , e and f are coefficients.
- γijt, is the error
- **ln** = Natural logs

To estimate the coefficients of econometric model, we use a technique called Ordinary Least Squares (OLS.) by using software computer program EViews 5.

3.5 Operational Definition and Hypothesis

Table 3.1: Data Sources

Variables	Indicator	Duration	Source
Diseases	Incidence of Diarrhoeal Diseases	1991-2005	Bureau of Epidemiology
Economics	GPP per Capita	1991-2005	NESDB
Culture	Average monthly expenditures food eaten away from home and total income per household ratio.	Every 2 year from 1994	National Statistical Office.
Population	Children less than 4 years	1991-2005	Ministry of public Health
Health Care Service	Doctor to population Ratios	1991-2005	Bureau of Policy and Strategy.
Education	Compulsory Student Retention Rate	1991-2005	The Community Development Department
Climate	Amount of annual Rainfall	1991-2005	The Meteorological Department.
Water Supply	Drinking Water	1991-2005	The Community Development Department.
	Urban water supply Population coverage	1991-2005	The Metropolitan Waterworks Authority, The Provincial Waterworks Authority.
Sanitation	Latrine household coverage	1991-2005	The Community Development Department.
Intervention	Number of certified CFGT Restaurants and Street food Vender	1999-2005	Food Sanitation and Water Supply Division.

The socio-economic, environment and intervention factors will be incorporated into the econometric model by using the indicators shown in Table 3.1. Each indicators are expected theoretically to affect the incidence of diarrhoeal diseases as following.

3.5.1 GPP per Capita

Expected sign is ambiguous. The economics with higher income is linked to better health. But the greater the gap between the richest and poorest people will be the greater the differences in health problems. Unfortunately, the poor should be as risk factor for diarrhoeal diseases in the working and living conditions.

3.5.2 Average monthly expenditures food eaten away from home and total income per household ratio.

Expected sign is ambiguous. Personal behavior in food habit

of people will change to eating outside home from food services if average monthly total income per household increasing. In case of the food services, that have to improve food safety standards in to ensure that food does not caused diarrhoeal diseases or health hazard after consumption, expected sign should be positive. In contrast, in case of food services which unhygienic practice of food handlers in foods are important at risk of consuming dirty food with diarrhoeal diseases contamination expected sign should be negative.

3.5.3 Children less than 4 years.

Expected sign should be positive because Diarrhoeal disease affects young especially for children under four whom the risk group from take care of mother's hygiene. Diarrhoeal disease has been shown to be associated with weaning practices or milk feeding, in particular among severely malnourished children. Children cared for in day-care centers have been shown to have a higher risk for diarrhoeal disease than children who are cared for at home.

3.5.4 Doctor to population Ratios

Expected sign should be positive because health care services access and use of services that prevent and treat disease influences.

3.5.5 Compulsory Student Retention Rate

Expected sign should be negative because education which high education levels are linked with good health but low education levels are linked with poor health, more stress and lower self-confidence.

3.5.6 Amount of annual Rainfall

Expected sign should be positive because rainfall patterns may raise threats of everything to diarrhoeal diseases which increasing surface water have important influences on the infectious disease. Many diarrhoeal diseases vary seasonally, suggesting sensitivity to climate.

3.5.7 Drinking Water

Expected sign should be negative because safe drinking water contribute to good health. And improved safe drinking water decline in overall and diarrhea mortality and morbidity.

3.5.8 Urban water supply Population coverage

Expected sign should be negative because urban water supply which constructing water supplies that improve the quality and availability of water for domestic purposes and chlorination of urban water supply decline in diarrhea morbidity.

3.5.9 Latrine household coverage

Expected sign should be negative because improved sanitation will decrease the incidence of diarrhoeal diseases. Unsafe sanitation and hygiene is an important determinant the incidence of diarrhoeal diseases. That one of the most powerful forces to decrease diarrhoeal diseases was the separation human excrement from contaminate to food and water by using latrine intervention.

3.5.10 Number of certified CFGT Restaurants and Street food Vender

Expected sign should be negative **because** the food services that have to improve food services safety standards in to ensure that food do not caused diarrhoeal diseases or health hazard after consumption. Clean Food Good Taste Project is introduced to promote food safety. There is a necessity to improve food safety standards in food services and hygiene in food services to ensure that food does not caused diarrhoeal diseases or health hazard after consumption.

Table3.2: Comparative Diarrhoeal Diseases definition between R.506and ICD10

R.506	Name of Disease	ICD10
01	Severe Diarrhoeal Diseases (Cholera) :Organism type 1 *Vibrio cholerae* Eltor Inaba 2 *Vibrio cholerae* Eltor Ogawa 3 *Vibrio cholerae* Eltor Hikojima 6 *Vibrio cholerae* O139 9 Unknown	ICD10
02	Acute diarrhea , Diarrhea, Infantile diarrhea , Gastroenteritis , Enteritis , Summer Diarrhea	A000 -A009
03	Food poisoning , Foodborne disease , Foodborne intoxication , Acute foodborne infection Organism type : 1 Vibrio parahaemolyticus (V.P) 2 Salmonella *spp.* 3 Staphylococcus 4 Botulism (*Clostridium botulinum*) 5 *Clostridium perfringens* (*C. welchii*) 9 Unknown	A09
04	Dysentary*, Unspecified dysentary, Entero-colitis, Colitis	A053,A029,A050 A051,A052 A059 and A629
05	Bacillary dysentary, shigellosis	A09
06	Amoebic dysentary, Amoebiasis	A030 - A039
07	Enteric fever	A060 - A061
		A010- A014

Note : *Dysentery include Dysentary Unspecified dysentery Entero-colitis, Colitis (04), Bacillary dysentery shigellosis (05, and Amoebic dysentery, Amoebiasis (06).

3.6 Definitions and Sources of Data

3.6.1 Dependent variable

Incidence of 5 diarrhoeal diseases in Thailand 1991-2005 using data derived from reported case of diarrhoeal diseases by province in 1991-2005 for 4 diseases acute diarrhoeal diseases, food Poisoning, dysentery and enteric fever . Which severe diarrhoeal disease data derived from reported case of severe diarrhoeal disease 1991-2003 and using digital data reported case of severe diarrhoeal disease 2004-2005from Annual Epidemiological Surveillance Report 2004-2005 by Bureau of Epidemiology, Department of Disease Control (DOC), Ministry of Public Health (MOPH).

Incidence of Diarrhoeal Diseases = Reported case of Diarrhoeal Diseases by province in a year x100,000
Total mid – year population in Thailand

3.6.2 Independent variable

(a) Economics

GPP per capita Gross Provincial Products per capita at current market prices (Baht) using data derived digital data from Office of the National Economic and Social Development Board (NESDB), Ministry of Office of the Prime Ministry, (OPM). Which average monthly income per household (Baht) derived from Report of the 1994, 1996, 1998, 2000, 2002, and 2004 Household Socio-Economic Survey by National Statistical Office, (NSO), Ministry of Information and Communication Technology (MICT).

(b) Culture

Average expenditure for household for food eaten away from home (Baht) using data derived from Report of the 1994, 1996, 1998, 2000, 2002, and 2004 Household Socio-Economic Survey by NSO, MICT.

(c) Population

Mid – year population in Thailand 1991-2005 and population children less than 4 year using data derived report of mid – year population Thailand 1992-2003 (Thai) and digital data of Mid – year population in Thailand 2004-2005 by Office of the Permanent Secretary for Public Health (OPS),Bureau of Policy and Strategy (BPS), Ministry of Public Health (MOPH).

Children age less than 4 years ratio (%) = Population children less than 4 year x100
Total mid – year population in Thailand

(d) Health Care Service

Population per Doctor Ratio 1991-2005 using data derived from Report of Health Resources 1991-2005 (Thai) by Office of the Permanent Secretary for Public Health (OPS),Bureau of Policy and Strategy (BPS), Ministry of Public Health (MOPH).

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Population per Doctor Ratio = Total mid – year population in province.
Total of Doctor in province.

(e) Education

Student Compulsory Retention Rate using data derived from Student Retention Rate 1991-2001 Basic Minimum Need Indicator (BMN Indicator) 6-11 years old children obtain compulsory education and Student Compulsory Retention Rate 2002-2005 use Basic Minimum Need Indicator (BMN Indicator) 6-15 years old children obtain compulsory education by Community Development Department, Ministry of Interior. Which Student Compulsory Retention Rate of Bangkok using estimation data.

Student Retention Rate* = number of children obtain compulsory education x100.
Population 6-11years*.

*primary gross enrolment 1991-2001 Population 6-11years and2002-2005 Population 6-14years

(f) Climate

Annual Rainfall use amount of annual Rainfall in millimeter (mm.) using data derived from digital data by The Meteorological Department, (TMD) Ministry of Information and Communication Technology (MICT).Estimate provinces that have not synoptic stations which World Meteorology Organization recommend using near synoptic stations in 150 kilometers radius.

Table 3.3 : Estimate provinces have not synoptic stations by using near synoptic

Province has no rain synoptic station	Province near rain synoptic station
1.UTHAI THANI	NAKHON SAWAN
2.YALA	PATTANI
3.SA KAEO	PRACHINBURI
4.SINGBURI	LOP BURI
5.CHAI NAT	SUPHAN BURI
6.ANG THONG	SUPHAN BURI
7.SAMUT SAKHON	BANGKOK METROPOLIS
8.NAKHON PATHOM	BANGKOK METROPOLIS
9.NONTHABURI	BANGKOK METROPOLIS
10.PHRA NAKHON SRI AYUTHAYA	SUPHAN BURI

(g) Water Supply

Drinking Water use Basic Minimum Need Indicator (BMN Indicator) household has safe water sufficient to drink (%) using data derived from report of Basic Minimum Need Thailand 1991-2005 by CDD. MOI.

Water supply in urban for 73 Provinces using data derived from The Operation's report of The Provincial Waterworks Authority by The Provincial Waterworks Authority (PWA), (MOI).Which Urban Water Supply for Bangkok, Nonthaburee and Samutprakan Province estimate by data in annual report the Metropolitan Waterworks Authority (1991-2005) and the Metropolitan Waterworks Authority, (MWA), MOI.

$$\text{Water Supply in Urban} = \frac{\text{Estimate customer population x 100}}{\text{Total mid – year population in province.}}$$

(h) Sanitation

Latrine use household has Latrine and use in % of household coverage using data derived from Basic Minimum Need Indicator (BMN Indicator) report of Basic Minimum Need Thailand 1991-2001 by CDD, MOI. Which Latrine 2002, 2004 data derived from safe sanitation comprises of private or shared flush latrine, private or shared molded latrine-private report of the 2002, and 2004 Household Socio-Economic Survey by NSO MICT and Latrine 2003, 2005 use estimation data from report of the Household Socio-Economic Survey. Latrine in Bangkok using data derived from Report of the 1994, 1996, 1998, 2000, 2002 and 2004 Household Socio-Economic Survey and Preliminary report of the 2006 Household Socio-Economic Survey NSO, MICT.

(i) Intervention

Number of certified CFGT restaurants and street food vender in 1999-2005 from Clean Food Good Taste Project using digital data derived from Food Sanitation and Water Supply Division, DOH, MOPH.

Table 3.4 : Province dummy variable

NORTHERN	NORTH EASTERN	SOUTHERN	EASTERN	WESTERN	CENTRAL	BANGKOK AND VICINITIES
KHON KAEN	CHIANG MAI	PHUKET	CHON BURI	RATCHABURI	SARABURI	BANGKOK METROPOLIS
UDON THANI	LAMPANG	SURAT THANI	CHACHOENG SAO	KANCHANA BURI	SINGBURI	SAMUT PRAKAN
LOEI	UTTARADIT	RANONG	RAYONG	PHACHUAP KHIRI KHAN	CHAI NAT	PATHUM THANI
NONG KHAI	MAE HONG SON	PHANGNGA	TRAT	PHETCHABURI	ANG THONG	SAMUT SAKHON
MUKDAHAN	CHIANG RAI	KRABI	CHANTHA BURI	SUPHAN BURI	LOP BURI	NAKHON PATHOM
NAKHON PHANOM	PHRAE	CHUMPHON	NAKHON NAYOK	SAMUT SONGKHRAM	PHRA NAKHON SRI AYUTHAYA	NONTHABURI
SAKON NAKHON	.LAMPHUN	NAKHON SI HAMMARAT	PRACHINBURI			
KALASIN	NAN	SONGKHLA	SA KAEO*			
NAKHONRAT CHASIMA	PHAYAO	SATUN				
CHAIYA PHUM	NAKHON SAWAN	YALA				
YASOTHON	PHITSANULOK	TRANG				
UBON RATCHATHA NI	KAM PHAENG PHET	NARATHI WAT				
ROI ET	UTHAI THANI	PHATTHA LUNG				
BURI RAM	SUKOTHAI	PATTANI				
SURIN	TAK					
MAHA SARAKHAM	PHICHIT					
SI SA KET	PHETCHABUN					
NONG BUA LAM PHU*						
AM NAT CHAREON*						
19 provinces	**17 provinces**	**14 provinces**	**8 provinces**	**6 provinces**	**6 provinces**	**6 provinces**

Note: 1991 -1993 Thailand has73 province

1994 Thailand has76 province

* Province in 1994

Table 3.5: Variable descriptions

Indictor	variable	Variable Definition	Variable descriptions
Diarrhoeal Diseases	Acute	Incidence rate of Acute Diarrhoeal Diseases	Number of morbidity case per 100,000 populations
	Severe	Incidence rate of Severe Diarrhoeal Diseases (Cholerae)	Number of morbidity case per 100,000 populations
	Food Poisoning	Incidence rate of Food Poisoning	Number of morbidity case per 100,000 populations
	Dysentery	Incidence rate of Dysentery	Number of morbidity case per 100,000 populations
	Enteric	Incidence rate of Enteric Fever	Number of morbidity case per 100,000 populations
Economics	GPP.	Gross Provincial Products per Capita.	Gross Provincial Products per Capita at current market prices(Baht.)
	INCOME	Average monthly total income per household	Average monthly total income per household (Baht.)
Culture	EXPENSE FOOD AWAY HOME RATIO	average monthly expenditures food eaten away from home and total income per household ratio.	average monthly expenditures food eaten away from home and total income per household ratio. (%)
Population	CHILD	Children less than 4 years Rate ratio	Number of child less than 4 years per populations (%)
Education	STUDENT	Student Compulsory Retention Rate.	Children obtain Compulsory education (%)
Health care service	DOCTOR	Population per Doctor Ratio	Number of population per doctor

Table 3.5: Variable descriptions (con')

Indictor	variable	Variable Definition	Variable descriptions
Climate	RAIN	Amount of annual rainfall	Amount of annual rainfall (mm.)
Water Supply	DRINK	Safe drinking water	Household has safe water sufficient to drink (%)
	WATER	Urban Water supply	Estimate population customer per population (%)
Sanitation	LATRINE	Latrine household coverage	Household has and use latrine (%)
Intervention	CFGT	Clean Food Good Taste Project	Number of certified CFGT Restaurants and Street food Vender
	CFGT	Dummy variable	Province started CFGT=1,otherwise=0
Region	NORTHEAST	Dummy variable	Province in northeastern=1,otherwise =0
	NORTH	Dummy variable	Province in northern=1,otherwise=0
	SOUTH	Dummy variable	Province in southern=1,otherwise=0
	EAST	Dummy variable	Province in eastern=1,otherwise=0
	WEST	Dummy variable	Province in western=1,otherwise=0
	CENTRAL	Dummy variable	Province in central=1,otherwise=0
	BANGKOK AND VINCINITIES	Dummy variable	Bangkok and Province in vicinities=1,otherwise=0

CHAPTER IV

RESULTS AND DISCUSSION

4.1 Results

In the previous chapter, this study employed 2 models which firstly, analysis impact of introduction Clean Food Good Taste Project using panel data regression model and secondly, analysis impact of expansion Clean Food Good Taste Project using double log equation model. The panel regression model to work with pooled Data with variables held in single series to create a pool workfile term such data pooled time series, that has annual data ranging from 1991 to 2005.The model analyzed the Impact of Clean Food Good Taste Project (CFGT) on the incidence of diarrhoeal diseases in Thailand. This study provided an empirical analysis estimating in the double-log equation, accounts for simultaneity expansions CFGT impact on incidence Rate of 5 diarrhoeal diseases Model between CFGT (restaurants and Street food vender number of certified) and eaten away from home and average monthly income ratio variable that time-series 1999-2005.

The estimation results are reported in this chapter, which is classified in three sections. Firstly, we show the trend of the incidences of diarrhoeal diseases. Secondly, impact of introduction CFGT which was used dummy variable for CFGT to analyze the Impact of Clean Food Good Taste Project (CFGT) on the incidence of diarrhoeal diseases in Thailand between 1991 and 2005, will be shown estimation results are presented in the table in term of coefficient explanatory variables with estimated t-statistic in parentheses and important statistical values of equations model. Third, the estimation result of the Impact of implement CFGT which was used number of certified restaurants and street food vender those meet the required standard of Ministry of Public Health for CFGT implement stage to analyze the result of Clean Food Good Taste Project (CFGT) on the incidence of diarrhoeal diseases in Thailand between 2000 and 2005 will be reported.

4.1.1 Trend of the incidences of diarrhoeal diseases

Figure 4.1 show, the trend of the incidences of diarrhoeal diseases in Thailand. The incidence rate of acute diarrhoeal disease and food poisoning slightly increased between 1991 and 2005. The trends show that, three diseases severe diarrhoeal diseases, dysentery diseases and enteric fever their incidence rate has steadily declined between 1991 and 2005.

The incidence rate of acute diarrhoeal disease slightly increased since 1993. However, its incidence rate has steadily declined after 1998. However, the incidence rate of acute diarrhoeal disease has slightly increased between 2000 and 2005

Whereas the incidence rate of severe diarrhoeal diseases has been steadily decreasing after a high number of the severe diarrhoeal disease peak from in 1993. The incidence rate of severe diarrhoeal disease seemed to be on a decreasing trend from1994 to 2005, especially after August 2004 Thailand started to report as cholerae again.

The incidence rate of food poisoning has been steadily increasing between 1991 and 2003 but reported cases food poisoning has been slightly decreasing after 2004 to 2005.The incidence rate of dysentery diseases were observed to decrease steadily during 1991-2005. It was found that *Shigella sonnei.* and *Shigella Flexneri* were the most isolates cause for reported number of dysentery cases. Finally, the incidence rate of enteric fever reported as numbers of typhoid and paratyphoid or enteric fever were observed to be on decreasing trend between 1991 and2005.

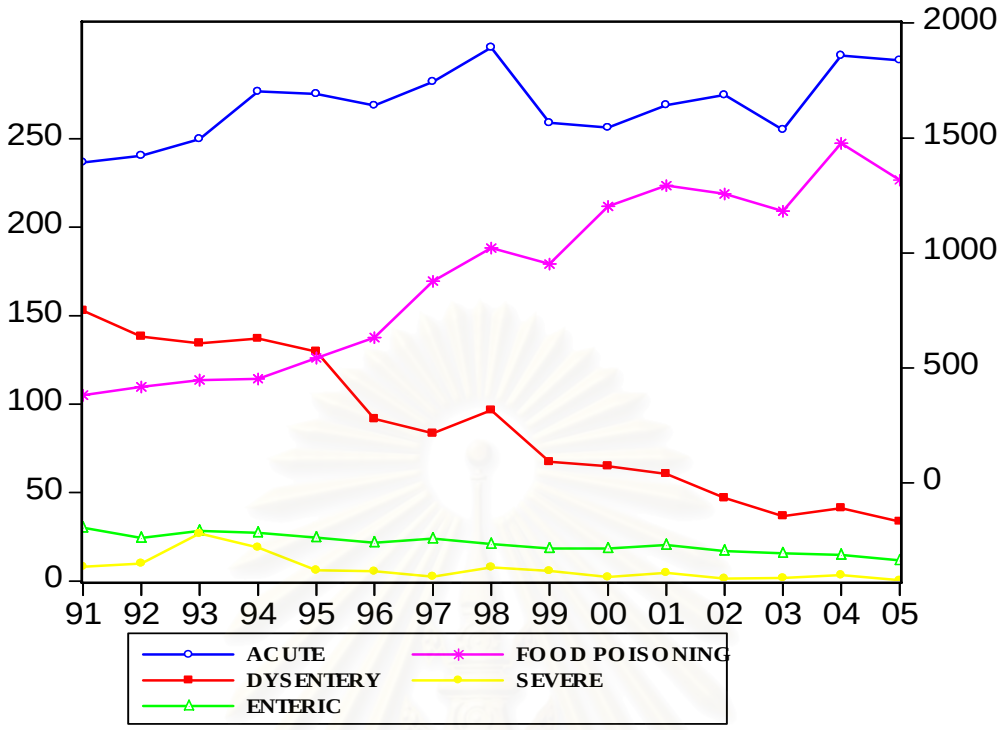

Figure4.1: Trend of 5 diarrhoeal diseases Thailand 1991-2005

4.1.2 Impact of introduce CFGT

This study estimates an econometric panel regression model that accounts for simultaneity impact between CFGT and incidence rate of 5 diarrhoeal diseases incorporates various factors for all the Thailand's people in 76 provinces over a 15-year period from 1991 to 2005. For estimation, we used the method of OLS and analyzed by software Eviews version 5.

This section chooses the model of form1 from table 4.1-4.5 result presentation. The estimation results, show impact of introduce CFGT public policy stage, presented in the table to show the estimated result in term of coefficient explanatory variables which estimated t-statistic in parentheses and important statistical values of equations model. The table show the impact of introduce with public policy Clean Food Good Taste Project (CFGT) on the incidences of diarrhoeal diseases in Thailand during 1991-2005 with impact trend of various factors effects on diarrhoeal diseases. (Table 4 .1– 4.5)

Table 4.1: Introduction of CFGT on Incidence rate of Acute Diarrhoeal disease Model (estimated t-statistic in parentheses)

Variable	Form 1	Form 2	Form 3
C	**2184.29** (2.46)*	**2191.28** (2.39) *	**488.88** (1.36)
GPP	**0.003** (5.35) *	**0.003** (5.23) *	**0.003** (8.35) *
INCOME		**-0.001** (-0.10)	
EXPENSE FOOD AWAY HOME		**0.031** (0.98)	
EXPENSE FOOD AWAY HOME RATIO	**1.93** (0.47)		
CHILD	**59.50** (1.76)	**60.16** (1.71)	**57.48** (2.88) *
DOCTOR	**-0.04** (-3.57)	**-0.04** (-3.48)	**-0.03** (-4.95)
STUDENT	**-5.38** (-0.96)	**-5.29** (-0.93)	**-1.21** (-1.810)
RAIN	**0.006** (0.31)	**0.007** (0.32)	**0.01** (0.82)
DRINK	**2.72** (0.61)	2.58 (0.57)	**6.69** (3.34)
WATER	**-6.55** (-3.26) *	-6.58 (-3.15) *	**-5.27** (-4.31)*
LATRINE	**-8.34** (-1.571)	**-8.37** (-1.57)	**-0.29** (-0.1)
CFGT	**-53.86** (-0.64)	**-54.05** (-0.64)	**-52.18** (-0.97)
NORTHEAST	**584.57** (3.25) *	**584.52** (3.04)	**589.92** (5.43)
NORTH	**611.47** (3.51) *	**613.51** (3.18) *	**751.08** (7.06) *
SOUTH	**707.43** (3.91) *	**701.39** (3.84) *	**777.9** (7.26) *
EAST	**550.77** (3.5) *	555.61 (3.33) *	**568.08** (5.87) *
WEST	**396.08** (2.24) *	399.26 (2.167) *	**406.18** (3.77) *
CENTRAL	**411.20** (2.31) *	**416.72** (2.21) *	**362.52** (3.32) *
R-squared	0.20	0.20	0.20
Adjusted R-squared	0.17	0.17	0.19
Mean dependent variable	1942.29	1942.29	1864.06
S.D. dependent variable	690.43	690.43	669
Number of observations	456	456	1130

***** = significant t-statistic

Table 4.2: Introduction of CFGT on Incidence rate of Severe Diarrhoeal disease Model (estimated t-statistic in parentheses)

Variable	Form 1	Form 2	Form 3
C	**7.11** (0.35	**24.78** (1.21)	**3.31** (0.33)
GPP	**1.88E-05** (1.49)	**2.04E-05** (1.64)	**4.76E-06** (0.52
INCOME		**-0.001** (-3.72) *	
EXPENSE FOOD AWAY HOME		**0.003** (4.69) *	
EXPENSE FOOD AWAY HOME RATIO	**0.20** (2.09) *		
CHILD	**0.33** (0.43)	**-0.34** (-0.44)	**2.33** (4.18) *
DOCTOR	**-0.001** (-2.91) *	**-0.001** (-3.47) *	**-0.001** (-4.17) *
STUDENT	**0.06** (0.45)	**0.01** (0.08)	**-0.01** (-0.61)
RAIN	**0.001** (1.21)	**0.001** (1.21)	**0.001** (0.96)
DRINK	**-0.01** (-0.10)	**0.02** (0.23)	**0.07** (1.27)
WATER	**-0.08** (-1.71)	**-0.04** (-0.85)	**-0.05** (-1.43)
LATRINE	**0.13** (1.04)	**0.17** (1.45)	**0.05** (0.70)
CFGT	**-10.47** (-5.42) *	**-10.20** (-5.41) *	**-6.57** (-4.37) *
NORTHEAST	**-11.67** (-2.84) *	**-16.76** (-3.91) *	**-19.79** (-6.51)
NORTH	**-14.21** (-3.57) *	**-20.16** (-4.69) *	**-17.25** (-5.79) *
SOUTH	**-11.05** (-2.67)	**-13.56** (-3.33)	**-21.53** (-7.19) *
EAST	**-7.45** (-2.07)	**-11.00** (-2.96) *	**-12.79** (-4.72) *
WEST	**-14.55** (-3.60) *	**-18.08** (-4.41) *	**-19.13** (-6.35)
CENTRAL	**-15.86** (-3.88) *	**-19.78** (-4.71)	**-19.46** (-6.37) *
R-squared	0.22	0.26	0.18
Adjusted R-squared	0.19	0.23	0.17
Mean dependent variable	7.35	7.35	7.96
S.D. dependent variable	15.99	15.99	18.47
Number of observations	456	456	1130

* = significant t-statistic

Table 4.3: Introduction of CFGT on Incidence rate of Food Poisoning Model (estimated t-statistic in parentheses)

Variable	Form 1	Form 2	Form 3
C	**-109.9** (-0.76	**-66.4** (-0.44)	**-101.74** (-1.81)
GPP	**0.001** (6.02) *	**0.001** (6.22)	**0.0004** (9.75)
INCOME		**-0.002** (-1.01)	
EXPENSE FOOD AWAY HOME		**-0.008** (-1.61)	
EXPENSE FOOD AWAY HOME RATIO	**-0.89** (-1.32)		
CHILD	**-7.88** (-1.42)	**-10.00** (-1.74)	**-0.06** (-0.03)
DOCTOR	**-0.004** (-2.55) *	**-0.01** (-2.81)	**-0.01** (-4.67)
STUDENT	**1.00** (1.09)	**0.84** (0.9)	**-0.02** (-0.17)
RAIN	**0.01** (1.475)	**0.005** (1.41)	**0.006** (2.18)
DRINK	**1.21** (1.65)	**1.34** (1.82)	**1.04** (3.30)
WATER	**-1.06** (-3.21) *	**-0.94** (-2.74)	**-0.94** (-4.9)
LATRINE	**0.23** (0.27)	**0.376** (0.43)	**0.74** (1.92)
CFGT	**30.99** (2.24) *	**31.61** (2.29)	**30.1** (3.58)
NORTHEAST	**261.46** (8.88) *	**248.13** (7.89)	**230.28** (13.56)
NORTH	**151.877** (5.32) *	**135.10** (4.28)	**146.48** (8.80)
SOUTH	**34.09** (1.15)	**29.68** (0.99)	**23.62** (1.41)
EAST	**155.09** (6.01) *	**143.29** (5.26)	**141.20** (9.33)
WEST	**71.54** (2.47) *	**60.19** (2.00)	**60.40** (3.59)
CENTRAL	**38.28** (1.31)	**25.35** (0.82)	**38.93** (2.28)
R-squared	0.44	0.45	0.44
Adjusted R-squared	0.42	0.426	0.43
Mean dependent variable	192.57	192.57	178.49
S.D. dependent variable	135.61	135.61	125.161
Number of observations	456	456	1130

* = significant t-statistic

Table 4.4: Introduction of CFGT on Incidence rate of Dysentery Model (estimated t-statistic in parentheses)

Variable	Form 1	Form 2	Form 3
C	**478.56** (4.29) *	**520.91** (4.52)	**95.76** (1.93)
GPP	**1.52E-05** (0.22)	**2.65E-05** (0.38)	**4.60E-05** (1.02)
INCOME		**-0.002** (-1.45)	
EXPENSE FOOD AWAY HOME		**0.001** (0.23)	
EXPENSE FOOD AWAY HOME RATIO	**-0.13** (-0.24)		
CHILD	**28.56** (6.71) *	**26.74** (6.03)	**22.95** (8.31)
DOCTOR	**-0.005** (-3.77) *	**-0.005** (-3.98)	**-0.004** (-4.28)
STUDENT	**-2.91** (-4.11) *	**-3.05** (-4.27)	**-0.19** (-2.05)
RAIN	**6.07E-05** (0.023)	**0.004** (1.69)	**0.004** (1.69)
DRINK	**-1.59** (-2.82) *	**-1.49** (-2.62)	**-0.70** (-2.54)
WATER	**-0.01** (-0.06)	**0.089** (0.34)	**0.10** (0.58)
LATRINE	**-1.98** (-2.97) *	**-1.86** (-2.77)	**-1.48** (-4.30)
CFGT	**4.11** (0.39)	**4.73** (0.45)	**-10.70** (-1.44)
NORTHEAST	**73.28** (3.24) *	**60.74** (2.51)	**93.37** (6.20)
NORTH	**84.36** (3.84) *	**69.20** (2.85)	**108.16** (7.33
SOUTH	**-69.86** (-3.07) *	**-75.15** (-3.27)	**-52.57** (-3.54)
EAST	**23.42** (1.18)	**13.61** (0.65)	**29.10** (2.17)
WEST	**-0.367** (-0.02)	**-9.97** (-0.43)	**13.19** (0.88)
CENTRAL	17.32 (0.77)	**6.53** (0.28)	**25.19** (1.67)
R-squared	0.41	0.408	0.38
Adjusted R-squared	0.38	0.38	0.37
Mean dependent variable	88.97	88.97	96.48
S.D. dependent variable	100.79	100.79	105.21
Number of observations	456	456	1130

* = significant t-statistic

Table 4.5: Introduction of CFGT on Incidence rate of Enteric fever Model (Estimated t-statistic in parentheses)

Variable	Form 1	Form 2	Form 3
C	**47.45** (6.52) *	**495.60** (6.59)	**66.10** (2.21)
GPP	**-4.29E-06** (-0.09)	**1.61E-06** (0.04)	**1.88E-06** (0.07)
INCOME		**-0.001** (-1.12)	
EXPENSE FOOD AWAY HOME		**0.001** (0.33)	
EXPENSE FOOD AWAY HOME RATIO	**0.06** (0.18)		
CHILD	**4.20** (1.52)	**3.30** (1.14)	**6.29** (3.79)
DOCTOR	**-0.001** (-1.25)	**-0.001** (-1.43)	**-0.001** (-2.37)
STUDENT	**-0.97** (-2.10) *	**-1.04** (-2.22)	**-0.04** (-0.80)
RAIN	**0.0003** (0.18)	**0.0002** (0.14)	**0.002** (1.70)
DRINK	**-0.41** (-1.11)	**-0.35** (-0.94)	**0.20** (1.20)
WATER	**-0.19** (-1.16)	**-0.14** (-0.81)	**-0.14** (-1.39)
LATRINE	**-3.58** (-8.25) *	**-3.52** (-8.05)	**-1.19** (-5.78)
CFGT	**14.99** (2.16) *	**15.35** (2.21)	**8.47** (1.89)
NORTHEAST	**-10.69** (-0.73	**-16.99** (-1.08)	**0.05** (0.01)
NORTH	**28.94** (2.02) *	**21.37** (1.35)	**47.304** (5.34)
SOUTH	**-14.58** (-0.98)	**-17.00** (-1.13)	**2.66** (0.30)
EAST	**-4.18** (-0.32)	**-9.09** (-0.67)	**-0.01** (-0.001)
WEST	**-12.05** (-0.83)	**-16.73** (-1.11)	**-2.57** (-0.29)
CENTRAL	**-7.88** (-0.54)	**-13.33** (-0.86)	**-0.92** (-0.10)
R-squared	0.29	0.30	0.12
Adjusted R-squared	0.27	0.27	0.18
Mean dependent variable	26.84	26.84	27.57
S.D. dependent variable	60.30	60.30	55.29
Number of observations	456	456	1130

* = significant t-statistic

4.1.2.1 Regional of Impact of introduction CFGT on incidence rate of diarrhoeal diseases

The impact of introduction of CFGT on incidence rate of acute diarrhoeal disease model, this study confirms the significant difference of the regional dummy variable. The rank is as follows, southern, northern, northeastern, eastern, central, western to minimize Bangkok its vicinities respectively. (Table 4.6)

In case of severe diarrhoeal disease, the results are different from the case of acute diarrhoeal disease. The magnitudes of regional dummy variable areranked as Bangkok its vicinities, eastern, southern, northeastern, northern, western to minimize central respectively.

. In case of food poisoning, the results are different from the case of acute diarrhoeal disease. The magnitudes of regional dummy variable are ranked as northeastern, eastern, northern, western, central, southern and Bangkok its vicinities.

In case of Dysentery, the results are different from the case of acute diarrhoeal disease. The magnitudes of regional dummy variable are ranked as northern, northeastern, Bangkok its vicinities to minimize southern with t-statistic significant but eastern, central and western t-statistic insignificance.

In case of enteric fever, the results are different from the case of acute diarrhoeal disease. The magnitudes of regional dummy variable are ranked as northern, Bangkok its vicinities eastern, central northeastern,, western, southern.

Table 4.6: Summary regional of Impact of introduction CFGT on incidence rate of diarrhoeal diseases Model (estimated t-statistic in parentheses)

RANK	Acute Diarrhoeal disease	Severe Diarrhoeal disease	Food Poisoning	Dysentery	Enteric fever
1	**SOUTH** **707.43** (3.91) *	**C** **7.11** (0.35)	**NORTHEAST** **261.46** (8.88) *	**NORTH** **84.36** (3.85) *	**NORTH** **28.94** (2.025) *
2	**NORTH** **611.47** (3.51) *	**EAST** **-7.45** (-2.07) *	**EAST** **155.09** (6.01) *	**NORTHEAST** **73.28** (3.24) *	**C** **474.5407** (6.52) *
3	**NORTHEAST** **584.57** (3.25) *	**SOUTH** **-11.05** (-2.67) *	**NORTH** **151.88** (5.319)*	**EAST** **23.42** (1.18)	**EAST** **-4.18** (-0.32)
4	**EAST** **550.77** (3.50) *	**NORTHEAST** **-11.67** (-2.84) *	**WEST** **71.54** (2.47) *	**CENTRAL** 17.32 (0.79)	**CENTRAL** **-7.88** (-0.54)
5	**CENTRAL** **411.20** (2.301) *	**NORTH** **-14.21** (-3.57) *	**CENTRAL** **38.28** (1.31)	**C** **478.56** (4.29) *	**NORTHEAST** **-10.69** (-0.73)
6	**WEST** **396.08** (2.24) *	**WEST** **-14.55** (-3.60) *	**SOUTH** **34.09** (1.15)	**WEST** **-0.37** (-0.02)	**WEST** **-12.04612** (-0.83)
7	**C** **2184.29** (2.47) *	**CENTRAL** **-15.86** (-3.88) *	**C** **-109.90** (-0.76)	**SOUTH** **-69.86** (-3.07) *	**SOUTH** **-14.57972** (-0.98)

Note : Summary table from table 4.1-4.5
* = significant t-statistic

4.1.2.2 CFGT and culture factor (food eaten away from home)

This study found that the coefficient of CFGT impact on incidence rate of acute diarrhoeal disease which the sign on the CFGT variable is negative. While, the coefficient of food eaten away from home and average monthly income ratio variable is positive. Unfortunately, the results are not significant. (Table 4.7)

Nonetheless, the sign of coefficient on CFGT variable is negative impact on incidence rate of severe diarrhoeal disease. While, the coefficient of food eaten away from home and average monthly income ratio variable is positive. There are t-statistic significant for both variables.

The sign of coefficient on CFGT variable impact on incidence rate of food poisoning disease is significantly positive sign. While, the coefficient of food eaten away from home and average monthly income ratio variable is negative with t-statistic insignificance.

The sign of coefficient on CFGT variable impact on incidence rate of dysentery is positive sign. While, the coefficient of food eaten away from home and average monthly income ratio variable is negative. There is t-statistic insignificant for both variables.

The coefficient sign of CFGT variable impact on incidence rate of enteric fever is significantly positive sign. While, the coefficient of food eaten away from home and average monthly income ratio variable is negative with t-statistic insignificant.

Table 4.7: Summary of Impact of Introduction of CFGT on Incidence rate of diarrhoeal diseases model by CFGT with culture proxy variable (Estimated t-statistic in parentheses)

Variable	Acute Diarrhoeal disease	Severe Diarrhoeal disease	Food Poisoning	Dysentery	Enteric
CFGT	**-53.86** (-0.64)	**-10.47** (-5.42) *	**30.99** (2.24)	**4.11** (0.39)	**15.00** (2.16) *
EXPENSE FOOD AWAY HOME RATIO	**1.93** (0.47)	**0.20** (2.09) *	**-0.89** (-1.32)	**-0.12** (-0.24)	**0.06** (0.18)

Note: Summary table from table 4.1-4.5
* = significant t-statistic

4.1.2.3 Socio-economics factor

(a) Economics factor

This study confirms the positive impact on the coefficient sign of gross provincial product (GPP) impact on incidence rate of acute diarrhoeal disease, food poisoning disease which the sign of the GPP variable are is significantly positive. Both severe diarrhoeal disease and dysentery disease, the sign of the GPP variable is positive and it is insignificant. The enteric fever, the sign of the GPP variable is negative. But it is insignificant. (Table4.8)

(b) Population factor

This study found that the coefficient sign of child less than 4 years (CHILD) impact on incidence rate of acute diarrhoeal disease, severe diarrhoeal disease and enteric disease are positive. But they is insignificant for all. The coefficient sign of CHILD variable impact on dysentery is significantly positive sign. The coefficient sign of CHILD variable impact on food poisoning is negative but it is insignificant.

(c) Health care service factor

We found that the coefficient sign of Population per Doctor Ratio (DOCTOR) impact on incidence rate of acute diarrhoeal disease, severe diarrhoeal disease and enteric disease are positive. But it is insignificant for all. The coefficient sign of DOCTOR variable impact of dysentery, on the DOCTOR variable is significantly positive. The coefficient sign of DOCTOR variable impact on food poisoning is negative. But it is insignificant.

(d) Education factor

This study confirms that finds the coefficient sign of Compulsory Student Retention Rate (STUDENT) impact on incidence rate of acute diarrhoeal disease is negative sign. But it is insignificant. The coefficient sign of STUDENT variable impact of dysentery and enteric fever are significantly negative. The coefficient sign of STUDENT variable impact on food poisoning is positive but it is insignificant.

Table 4.8: Summary of Impact of Introduction of CFGT on Incidence rate of 5 diarrhoeal diseases Model by socio-economics variable (estimated t-statistic in parentheses)

Variable	Acute diarrhoeal disease	Severe diarrhoeal disease	Food poisoning	Dysentery	Enteric fever
GPP	**0.003** (5.35) *	**1.88E-05** (1.49)	**0.001** (6.02) *	**1.52E-05** (0.22)	**-4.29E-06** (-0.09)
CHILD	**59.50** (1.76)	**0.33** (0.43)	**-7.88** (-1.42)	**28.56** (6.71) *	**4.20** (1.51)
DOCTOR	**-0.04** (-3.57) *	**-0.001** (-2.91) *	**-0.004** (-2.59) *	**-0.005** (-3.77) *	**-0.001** (-1.25)
STUDENT	**-5.38** (-0.96)	**0.06** (0.45)	**1.00** (1.09)	**-2.91** (-4.11)	**-0.97** (-2.10) *

Note: Summary table from table 4.1-4.5
* = significant t-statistic

4.1.2.4 Environment

(a) Climate factor

This study found that that the coefficient sign of amount of annual rainfall (RAIN) impact on incidence rate of 5 diarrhoeal diseases are positive. However, the coefficient of RAIN variable is not significant in any estimation. (Table4.9)

(b) Safe drinking water

This study found that the coefficient sign of Safe drinking water (DRINK) impact on incidence rate of acute diarrhoeal disease and food poisoning are positive and significant. The coefficient sign of DRINK variable impact on dysentery is significantly negative. The coefficient sign of DRINK variable impact on severe diarrhoeal disease, and enteric fever are negative but it is insignificant.

(c) Water supply in urban

This study found that the negative impact of water supply in urban per population coverage (WATER) impact on incidence rate of 5 diarrhoeal diseases. The results are all significant.

(d) Sanitation factor

This study found that the coefficient sign of latrine household coverage (LATRINE) impact on incidence rate of dysentery and enteric fever of LATRINE variable is significantly negative. The coefficient sign of LATRINE variable on acute diarrhoeal disease is negative. But it is insignificant. The coefficient sign of Latrine variable impact on severe diarrhoeal and food poisoning is positive. But it is insignificant.

Table 4.9: Impact of Introduction of CFGT on Incidence rate of diarrhoeal diseases Model by climate, water and sanitation variables

Variable	Acute diarrhoeal disease	Severe diarrhoeal disease	Food Poisoning	Dysentery	Enteric fever
RAIN	**0.01** (0.31)	**0.001** (1.21)	**0.005** (1.47)	**6.07E-05** (0.02)	**0.0003** (0.18)
DRINK	**2.72** (0.61)	**-0.01** (-0.10)	**1.21** (1.65)	**-1.59** (-2.82) *	**-0.410** (-1.11)
WATER	**-6.55** (-3.26) *	**-0.08** (-1.71)	**-1.06** (-3.21)*	**-0.01** (-0.06)	**-0.19** (-1.15)
LATRINE	**-8.34** (-1.57)	**0.13** (1.04)	**0.23** (0.27)	**-1.98** (-2.97) *	**-3.58** (-8.25) *

Note: Summary table from table 4.1-4.5
* = Significant t-statistic

4.1.3 Expansion of CFGT Impact on Incidence Rate of 5 Diarrhoeal Diseases Model

This study also estimates an econometric analysis impact of expansion Clean Food Good Taste Project using double log equation model that time-series for 2000, 2002, 2004, 2000 -2002 and 2002-2004 accounts for simultaneity expansions Clean Food Good Taste Project (CFGT) impact on incidence Rate of 5 Diarrhoeal Diseases Model between CFGT number of certified restaurants and Street food Vender and eaten away from home and average monthly income ratio variable. The meaning of the slope coefficient is the magnitude of the percentage change of the incidence rate of diarrhoeal diseases according to the percentage change of the CFGT

(restaurants and Street food Vender number of certified) dependent variable, holding the other independent variables in the equation constant. (Table4.10-4.14)

Table 4.10 : Expansion of CFGT Impact on Incidence Rate of Acute Diarrhoeal Diseases Model(estimated t-statistic in parentheses)

Variable	2000	2002	2004	2000-2002	2002-2004
C	**12.44** (1.56)	**4.77** (0.36)	**40.11** (1.01)	**14.17** (2.71)	**4.37** (0.37)
LnGPP	**0.26** (2.66) *	**0.12** (1.22)	**0.13** (1.50)	**0.23** (3.56) *	**0.10** (1.61)
LnEXPENSE FOOD AWAY HOME RATIO	**0.088** (1.16)	**0.42** (2.22) *	**0.05** (0.73)	**0.15** (2.24)	**0.09** (1.45)
LnCHILD	**0.52** (0.78)	**0.59** (1.32)	**0.39** (0.94)	**-0.07** (-0.35)	**0.47** (1.72)
LnDOCTOR	**0.13** (1.23)	**0.15** (1.21)	**0.12** (1.10)	**0.18** (2.53)	**0.12** (1.55)
LnSTUDENT	**-0.80** (-0.78)	**1.20** (0.39)	**-13.79** (-1.56)	**-0.80** (-0.87)	**0.99** (0.35)
LnRAIN	**0.02** (0.12)	**-0.02** (-0.14)	**-0.14** (-0.96)	**0.04** (0.36)	**-0.15** (-1.41)
LnDRINK	**0.44** (0.56)	**-0.09** (-0.11)	**-0.47** (-0.38)	**0.26** (0.49)	**0.19** (0.300)
LnWATER	**0.18** (1.33)	**0.21** (1.29)	**-0.01** (-0.04)	**0.22** (2.40)	**0.04** (0.39)
LATRINE	**-2.07** (-1.79)	**-1.24** (-0.98)	**6.82** (1.96)	**-2.02** (-2.73)	**-0.95** (-0.88)
LnCFGT	**0.01** (0.26)	**-0.09** (-1.80)	**-0.09** (-1.58)	**-0.02** (-0.74)	**-0.03** (-1.24)
NORTHEAST	**0.47** (1.86)	**0.69** (2.83)	**0.42** (1.84)	**0.66** (3.98)	**0.48** (2.80)
NORTH	**0.61** (2.63)	**0.87** (3.80)	**0.30** (1.40)	**0.70** (4.55)	**0.57** (3.68)
SOUTH	**0.50** (1.91)	**0.50** (2.24)	**0.21** (1.00)	**0.68** (4.89)	**0.41** (2.64)
EAST	**0.38** (1.95)	**0.55** (2.70)	**0.45** (2.42)	**0.53** (4.15)	**0.53** (3.80)
WEST	**0.45** (1.97)	**0.62** (2.77)	**0.31** (1.493)	**0.56** (3.72)	**0.36** (2.35)
CENRAL	**0.53** (2.49)	**0.75** (3.26)	**0.22** (1.10)	**0.64** (4.34)	**0.41** (2.71)
R-squared	0.383	0.40	0.34	0.32	0.23
Adjusted R-squared	.20	0.24	0.17	0.24	0.14
Mean dependent variable	7.43	7.51	7.57	7.47	7.54
S.D. dependent variable	0.32	0.35	0.32	0.34	0.34
Number of observations	74**	76	76	150**	152

* = Significant t-statistic **Omitted Pichit and Uttraladit Province

Table 4.11: Expansion of CFGT Impact on Incidence Rate of Severe Diarrhoeal Diseases Model (estimated t-statistic in parentheses)

Variable	2000	2002	2004	2000-2002	2002-2004
C	**-62.66** (-0.43)	**-159.05** (-0.533)	**-1817.65** (-4.17) *	**56.05** (0.63)	**-400.59** (-2.00) *
LnGPP	**0.75** (1.19)	**1.00** (1.69)	**0.50** (1.04)	**0.74** (1.93)	**0.75** (2.09) *
LnEXPENSE FOOD AWAY HOME RATIO	**0.22** (0.32)	**0.07** (0.06)	**0.53** (1.62)	**-0.22** (-0.45)	**0.30** (0.93)
LnCHILD	**5.93** (1.25)	**3.25** (0.81)	**3.87** (1.77)	**2.01** (1.34)	**2.37** (1.30)
LnDOCTOR	**-0.17** (-0.19)	**-0.24** (-0.33)	**-0.49** (-0.96)	**-0.22** (-0.47)	**-0.43** (-1.05)
LnSTUDENT	**-1.72** (-0.07)	**36.62** (0.53)	**408.44** (4.09) *	**-2.23** (-0.12)	**90.65** (1.96)
LnRAIN	**0.05** (0.05)	**1.89** (1.80)	**0.85** (1.15)	**0.49** (0.73)	**1.00** (1.63)
LnDRINK	**6.11** (0.90)	**2.67** (0.39)	**-9.73** (-1.55)	**5.32** (1.28)	**0.48** (0.12)
LnWATER	**0.17** (0.14)	**2.05** (1.55)	**1.44** (2.18)	**0.60** (0.79)	**1.15** (1.91)
LATRINE	**4.87** (0.19)	**-13.49** (-0.57)	**-8.61** (-0.54)	**-19.20** (-1.58)	**-8.73** (-0.82)
LnCFGT	**0.19** (0.55)	**0.35** (0.96)	**0.33** (1.05)	**0.17** (0.79)	**0.09** (0.52)
NORTHEAST	**-0.52** (-0.32)	**1.47** (1.04)	**1.03** (0.92	**0.31** (0.33)	**1.28** (1.42)
NORTH	**1.93** (1.05)	**2.99** (1.68)	**3.42** (2.76)	**1.50** (1.40)	**2.21** (2.31)
SOUTH	**-1.15** (-0.65)	**1.53** (1.10)	**1.50** (1.43)	**0.06** (0.07)	**1.59** (1.96)
EAST	**0.15** (0.12)	**2.43** (2.24)	**0.03** (0.03)	**1.16** (1.56)	**0.91** (1.39)
WEST	**-0.51** (-0.33)	**2.44** (1.73)	**0.66** (0.62)	**0.34** (0.37)	**0.93** (1.12)
CENRAL	**0.54** (0.37)	**1.5** (0.85)	**0.63** (0.68	**0.49** (0.53)	**0.35** (0.45)
R-squared	0.25	0.53	0.58	0.28	0.38
Adjusted R-squared	-0.09	0.22	0.40	0.12	0.26
Mean dependent variable	0.21	-0.09	0.42	0.07	0.20
S.D. dependent variable	1.60	1.62	1.62	1.61	1.64
Number of observations	52**	42**	56**	94**	98**

* = Significant t-statistic

**Omitted provinces have not severe diarrhoeal diseases case

Table 4.12: Expansion of CFGT Impact on Incidence Rate of Food Poisoning Diseases Mode(estimated t-statistic in parentheses)

Variable	2000	2002	2004	2000-2002	2002-2004
C	**-22.67** (-1.61)	**3.94** (0.19)	**-24.66** (-0.47)	**-11.70** (-1.37)	**3.50** (0.22)
LnGPP	**0.51** (2.95) *	**0.43** (2.68) *	**0.41** (3.59) *	**0.43** (4.04) *	**0.41** (4.54) *
LnEXPENSE FOOD AWAY HOME RATIO	**-0.15** (-1.16)	**-0.15** (-0.50)	**-0.23** (-2.65) *	**-0.1816** (-1.63)	**-0.22** (-2.59) *
LnCHILD	**0.82** (0.69)	**-0.79** (-1.09)	**-0.48** (-0.87)	**-0.18** (-0.53)	**-0.81** (-2.16)
LnDOCTOR	**0.03** (0.14)	**0.08** (0.41)	**-0.10** (-0.71)	**0.08** (0.65)	**0.03** (0.28)
LnSTUDENT	**2.35** (1.29)	**-0.94** (-0.19)	**8.78** (0.75)	**1.43** (0.95)	**-0.78** (-0.20)
LnRAIN	**0.41** (1.38)	**0.17** (0.66)	**0.18** (0.92)	**0.30** (1.79)	**0.20** (1.34)
LnDRINK	**-0.30** (-0.21)	**1.72** (1.36)	**-2.31** (-1.40)	**0.91** (1.06)	**1.09** (1.23)
LnWATER	**-0.26** (-1.08)	**-0.21** (-0.78)	**0.02** (0.09)	**-0.1943** (-1.27)	**-0.12** (-0.86)
LATRINE	**1.68** (0.82)	**-1.66** (-0.81)	**-1.03** (-0.22)	**-0.33** (-0.27)	**-1.11** (-0.75)
LnCFGT	**-2.21E-05** (-0.0003)	**0.003** (0.04)	**-0.13** (-1.67)	**0.01** (0.27)	**-0.004** (-0.11)
NORTHEAST	**1.37** (3.09) *	**1.55** (3.92) *	**1.81** (5.96) *	**1.48** (5.43) *	**1.64** (6.90)
NORTH	**1.19** (2.92) *	**0.96** (2.60) *	**0.95** (3.37) *	**1.04** (4.13) *	**0.96** (4.50) *
SOUTH	**-0.40** (-0.88)	**-0.07** (-0.20)	**-0.18** (-0.63)	**-0.15** (-0.64)	**-0.06** (-0.27)
EAST	**0.85** (2.50)	**0.64** (1.95)	**0.71** (2.89)	**0.79** (3.77)	**0.70** (3.67)
WEST	**0.73** (1.83)	**0.35** (0.96)	**0.12** (0.42)	**0.57** (2.30)	**0.26** (1.3
CENRAL	**0.35** (0.91)	**0.23** (0.63)	**0.19** (0.73)	**0.32** (1.32	**0.20** (0.94)
R-squared	0.56	0.60	0.77	0.57	0.67
Adjusted R-squared	0.47	0.50	0.71	0.52	0.63
Mean dependent variable	5.18	5.17	5.24	5.17	5.20
S.D. dependent variable	0.70	0.70	0.72	0.69	0.71
Number of observations	74**	76	76	150**	152

* = Significant t-statistic **Omitted Pichit and Uttraladit Province

Table 4.13: Expansion of CFGT Impact on Incidence Rate of Dysentery Diseases Model (estimated t-statistic in parentheses)

Variable	2000	2002	2004	2000-2002	2002-2004
C	**1.31** (0.07)	**42.02** (1.36)	**324.99** (3.68) *	**19.19** (1.56)	**55.57** (2.11)
LnGPP	**0.31** (1.30)	**-0.09** (-0.39)	**0.03** (0.15)	**0.10** (0.63)	**-0.1** (-0.72)
LnEXPENSE FOOD AWAY HOME RATIO	**-0.01** (-0.05)	**0.43** (0.97)	**-0.02** (-0.14)	**0.05** (0.31)	**0.03** (0.18)
LnCHILD	**3.02** (1.84)	**1.81** (1.72)	**0.51** (0.54)	**1.84** (3.78) *	**1.85** (3.03)
LnDOCTOR	**0.20** (0.76)	**-0.13** (-0.47)	**-0.07** (-0.31)	**0.06** (0.35)	**-0.18** (-1.07)
LnSTUDENT	**0.77** (0.31)	**-4.09** (-0.56)	**-71.11** (-3.61)	**-0.88** (-0.41)	**-8.2** (-1.29)
LnRAIN	**0.83** (2.03)	**0.14** (0.39)	**0.37** (1.09)	**0.52** (2.13)	**0.11** (0.46)
LnDRINK	**-0.35** (-0.18)	**-0.69** (-0.37)	**-0.57** (-0.20)	**-0.15** (-0.12)	**-0.52** (-0.36)
LnWATER	**0.23** (0.70)	**0.05** (0.12)	**-0.32** (-1.12)	**0.20** (0.89)	**-0.9** (-0.81)
LATRINE	**-4.10** (-1.44)	**-3.98** (-1.34)	**1.49** (0.19)	**-4.61** (-2.65)	**-2.84** (-1.17)
LnCFGT	**0.15** (1.5 0)	**-0.09** (-0.70)	**-0.26** (-1.94)	**0.05** (0.76)	**-0.90** (-1.50)
NORTHEAST	**0.68** (1.11)	**1.50** (2.60)	**1.77** (3.47)	**1.12** (2.88)	**1.53** (3.95)
NORTH	**1.21** (2.13)	**1.3 4** (2.49)	**0.71** (1.49)	**1.15** (3.19)	**1.22** (3.46)
SOUTH	**-1.02** (-1.59)	**-0.16** (-0.31)	**-0.06** (-0.12)	**-0.34** (-1.04)	**-0.13** (-0.37)
EAST	**0.23** (0.49)	**0.77** (1.61)	**1.09** (2.63)	**0.60** (2.00)	**0.95** (3.04)
WEST	**0.15** (0.27)	**0.44** (0.84)	**0.44** (0.93)	**0.29** (0.83)	**0.45** (1.27)
CENRAL	**0.41** (0.79)	**0.45** (0.84)	**0.47** (1.07)	**0.47** (1.36)	**0.39** (1.13)
R-squared	0.50	0.45	0.69	0.48	0.53
Adjusted R-squared	0.36	0.36	0.60	0.42	0.47
Mean dependent variable	3.60	3.58	3.32	3.77	3.45
S.D. dependent variable	0.88	0.90	1.04	0.91	0.98
Number of observations	74**	76	76	150**	52

* = Significant t-statistic

**Omitted Pichit and Uttraladit Province

Table4.14 : Expansion of CFGT Impact on Incidence Rate of Enteric Diseases Model (estimated t-statistic in parentheses)

Variable	2000	2002	2004	2000-2004	2002-2004
C	**3.89** (-0.80)	**41.63** (0.90)	**497.19** (3.65) *	**8.87** (0.48)	**70.64** (1.76)
LnGPP	**0.08** (0.18)	**0.43** (1.21)	**-0.22** (-0.73)	**0.21** (0.92)	**-0.02** (-0.07)
LnEXPENSE FOOD AWAY HOME RATIO	**-0.25** (-0.87)	**-0.10** (-0.14)	**0.22** (0.97)	**-0.26** (-1.08)	**0.11** (0.51)
LnCHILD	**3.00** (1.20)	**-0.34** (-0.21)	**-2.24** (-1.56)	**0.12** (0.17)	**0.05** (0.06)
LnDOCTOR	**-0.02** (-0.05)	**0.60** (1.39)	**0.25** (0.70)	**0.38** (1.47)	**0.43** (1.64)
LnSTUDENT	**4.76** (1.24)	**-2.70** (-0.25)	**-89.23** (-2.94) *	**2.56** (0.79)	**-8.3099** (-0.86)
LnRAIN	**0.79** (1.28)	**0.75** (1.36)	**0.66** (1.27)	**0.** (2.00)	**0.62** (1.65)
LnDRINK	**2.01** (0.67)	**3.49** (1.26)	**-4.24** (-0.99)	**2.8** (1.52)	**0.89** (0.41)
LnWATER	**0.16** (0.31)	**0.09** (0.16)	**0.20** (0.04)	**0.37** (1.12)	**0.06** (0.16)
LATRINE	**-4.17** (-0.96)	**-12.56** (-2.80)	**-14.22** (-1.19)	**-9.75** (-3.72)	**-9.28** (-2.51)
LnCFGT	**-0.01** (-0.06)	**-0.23** (-1.26)	**-0.08** (-0.38)	**-0.08** (-0.77)	**-0.10** (-1.14)
NORTHEAST	**-0.41** (-0.43)	**0.73** (0.84)	**0.74** (0.94)	**0.44** (0.76)	**0.58** (0.99)
NORTH	**1.90** (2.19)	**1.58** (1.95)	**0.85** (1.16)	**1.76** (3.22)	**1.62** (3.04)
SOUTH	**0.04** (0.04)	**0.97** (1.24)	**1.49** (2.02)	**1.09** (2.20)	**1.20** (2.26)
EAST	**-0.54** (-0.75)	**0.12** (0.17)	**0.90** (1.41)	**0.13** (0.28)	**0.59** (1.24)
WEST	**-0.01** (-0.02)	**0.24** (0.30)	**0.32** (0.44)	**0.32** (0.59)	**0.41** (0.77)
CENRAL	**0.40** (0.49)	**0.51** (0.63)	**0.48** (0.71)	**0.50** (1.23)	**0.54** (1.03)
R-squared	0.43	0.45	0.55	0.40	0.41
Adjusted R-squared	0.27	0.30	0.43	0.33	0.34
Mean dependent variable	2.39	2.26	1.97	2.33	2.12
S.D. dependent variable	1.25	1.30	1.35	1.27	1.327
Number of observations	74**	76	76	150**	152

* = Significant t-statistic

**Omitted Pichit and Uttraladit Province

Table 4.15: Summary expansion of CFGT Impact on incidence Rate of diarrhoeal diseases Model (estimated t-statistic in parentheses)

Disease	Variable	2000	2002	2004	2000-2002	2002-2004
Acute Diarrhoeal Diseases Model	**LnEXPENSE FOOD AWAY HOME RATIO**	**0.09** (1.16)	**0.42** (2.22) *	**0.05** (0.73)	**0.15** (2.24) *	**0.09** (1.45)
	LnCFGT	**0.01** (0.26)	**-0.09** (-1.80)	**-0.09** (-1.58)	**-0.02** (-0.74)	**-0.03** (-1.2)
severe diarrhoeal diseases	**LnEXPENSE FOOD AWAY HOME RATIO**	**0.22** (0.32)	**0.07** (0.06)	**0.53** (1.62)	**-0.22** (-0.45)	**0.30** (0.93)
	LnCFGT	**0.19** (0.55)	**0.35** (0.96)	**0.33** (1.05)	**0.17** (0.79)	**0.09** (0.52)
Food Poisoning Diseases	**LnEXPENSE FOOD AWAY HOME RATIO**	**-0.15** (-1.16)	**-0.15** (-0.50)	**-0.23** (-2.65) *	**-0.1816** (-1.63)	**-0.22** (-2.59) *
	LnCFGT	**-2.21E-05** (-0.0003)	**0.003** (0.04)	**-0.13** (-1.67)	**0.013** (0.27)	**-0.003** (-0.11)
Dysentery Diseases	**LnEXPENSE FOOD AWAY HOME RATIO**	**-0.01** (-0.05)	**0.43** (0.97)	**-0.03** (-0.14)	**0.5** (0.31)	**0.03** (0.18)
	LnCFGT	**0.14** (1.50)	**-0.09** (-0.70)	**-0.26** (-1.94)	**0.05** (0.76)	**-0.09** (-1.50)
Enteric Diseases Model	**LnEXPENSE FOOD AWAY HOME RATIO**	**-0.25** (-0.87)	**-0.10** (-0.14)	**0.22** (0.97)	**-0.26** (-1.08)	**0.11** (0.51)
	LnCFGT	**-0.01** (-0.06)	**-0.23** (-1.26)	**-0.08** (-0.38)	**-0.08** (-0.77)	**-0.10** (-1.14)

* = Significant t-statistic
Note: Summary table from table 4.10-4.14

Our estimation results show that, the coefficient of incidence rate of acute diarrhoeal disease which the sign on the CFGT variable is negative in year 2002, 2004, 2000 -2002 and 2002-2004 .But it is insignificance. However, the coefficient of CFGT variable has the correct sign but for the in specification is not statistically significant. In contrast, the sign on the coefficient of the eaten away from home and average monthly income ratio variable is positive sign for 2000, 2002, 2004, 2000 -2002 and 2002-2004 with t-statistic significant for 2002 and 2000 -2002.

The coefficient of incidence rate of incidence rate of severe diarrhoeal disease which the coefficient sign of the CFGT variable is positive in only year 2000 -2002. But it is insignificance. The sign on the coefficient of the eaten away from home and average monthly income ratio variable is positive. But it is insignificance.

The coefficient of incidence rate of food poisoning which the coefficient sign of the CFGT variable is negative in year 2000, 2004, and 2002-2004. But it is insignificance. However the sign on the coefficient of the eaten away from home and average monthly income ratio variable is significantly negative.

The coefficient of incidence rate of dysentery which the coefficient sign on the CFGT variable is negative in only year 2000, 2002 and 2002-2004. But it is insignificance. The sign on the coefficient of the eaten away from home and average monthly income ratio variable is positive sign 2002, 2000 -2002 and 2002-2004 but negative sign 2000 and 2004 .And it is insignificance.

The coefficient of incidence rate of enteric fever which the coefficient sign on the CFGT variable is negative in for 2000, 2002, 2004, 2000 -2002 and 2002-2004.But it is insignificance. The sign on the coefficient of the eaten away from home and average monthly income ratio variable is positive in 2002, 2000 -2002 and 2002-2004 but negative in 2000 and 2004. But it is insignificance.

4.2 Discussion

In this section, we will discuss about our estimation results intuitively by comparing to previous study analyzed.

4.2.1 The impact of Introduction Clean Food Good Taste Project (CFGT) on the incidences of diarrhoeal diseases in Thailand from 1991 to 2005

One of the purposes of this study was to test impact trend of CFGT and socio-economics, environment and intervention factor on the incidence rate of diarrhoeal diseases in Thailand with public policy CFGT in 1999. Which compared the trend of the incidence rate of diarrhoeal diseases in Thailand before introduce with public policy CFGT and during adoption expansions CFGT.

These analyses are based on the secondary data time series of population in 76 provinces Thailand from 1991 to 2005.This study design was intended to test the hypothesis the impact trend of Clean Food Good Taste Project (CFGT) and socio-economics, environment and intervention factor on the incidence of diarrhoeal diseases in 76 provinces Thailand.

From the results of introduction's impact we found that, the introduction CFGT and food habit culture proxy variable has a likely of relationship with trend impact on incidence rate of severe diarrhoeal disease. Moreover, socio-economic, environmental and intervention factors have likely of relationship with trend impact on incidence rate of diarrhoeal.

The results showed that the southern has significant positive trend impact on incidence rate of acute diarrhoeal disease. Bangkok (vicinities) has insignificant positive trend on severe diarrhoeal disease. Endemic severe diarrhoeal disease is primarily in urban crowd area (Bronstein Paula, 2006).Northeastern has significant positive trend on food poisoning disease. Northern has significant positive trend on both dysentery diseases and enteric disease which associate to unhygienic behavior raw food eating habit of people (Communicable Disease Control, 2006).

4.2.2 Statistic significant trend impact of socio-economics, environment and intervention factor on the incidences of diarrhoeal diseases.

4.2.2.1 Socio-economics factor

(a) Culture factor

The results suggested that food habit culture proxy variable average monthly expenditures foods eaten away from home and total income per household ratios has insignificant positive trend impact on incidence rate of acute diarrhoeal disease, enteric disease and significant positive trend impact on incidence rate of severe diarrhoeal disease. But average monthly expenditures foods eaten away from home and total income per household ratios has insignificant negative trend impact on incidence rate of food poisoning disease and dysentery diseases.

(b) Economics factor

This study finds that gross provincial product per capita has significant positive trend impact on incidence rate of acute diarrhoeal disease and food poisoning disease, insignificant positive trend impact on severe diarrhoeal disease and dysentery disease, Which has insignificant negative trend impact on enteric disease. The diarrhoeal diseases have clear linkages to socio-economic development with decrease or increase risk factor the diarrhoeal diseases. As a result the gaps of economics are widening. However, not everyone has benefited from economic growth and vulnerable groups have been left behind (Jamison et al 1993). Diarrhoeal diseases are major causes of morbidity and affect those living in impoverished conditions most. With the shift to urban living and improved socioeconomic status in Thailand. Such as risk factor for diarrhoeal diseases in the working and living conditions among the construction workers were generally poor. The results suggest that an urgent need to improve sanitation and safety conditions on the construction sites and camp sites (Thinkhamrop B., et al 1997).

(c) Population factor

Our results show that, the proportion of the child population less than 4 years has significant positive trend impact on incidence rate of acute diarrhoeal disease acute, severe diarrhoeal disease and enteric fever and insignificant

positive trend impact on incidence rate of dysentery**.** But it has insignificant negative trend impact on incidence rate of food poisoning. Contrary Bureau of Epidemiology reported Investigation Report of food poisoning 2005 child less than 4 years group has morbidity rate of food poisoning disease 15.96%. (Communicable Disease Control, 2006) However, measles is known to predispose to diarrheal disease secondary to measles-induced immunodeficiency (Feachem & Koblinsky, 1983). estimate that measles vaccine given to 45 to 90 percent of infants would prevent 44 to 64 percent of measles cases, 0.6 to 3.8 percent of diarrheal episodes, and 6 to 26 percent of diarrheal deaths among children under five.

(d) Health care service factor

We found that, the population per doctor ratio has insignificant positive trend impact on incidence rate of acute diarrhoeal disease, severe diarrhoeal disease enteric disease and significant positive trend impact on incidence rate of dysentery disease. But insignificant negative trend on incidence rate of food poisoning disease. Report case of diarrhoeal diseases base on surveillance system is dependent upon health care service (Yawarat Porapakkham, et al 1988). Bureau of Epidemiology R.506 surveillance systems reported that diarrhoeal disease cases came from community hospital, health care center and provincial hospital respectively. Population per Doctor Ratio less means that more number of doctors in health care service which will increase the outpatient visits (Office of the Permanent Secretary for Public Health, 2002). In August 2004 Ministry of Public Health by Bureau of Epidemiology R.506 surveillance systems started to report severe diarrhoeal disease in term of cholerae disease that may be underreported disease.

(e) Education factor

This study showed that, compulsory student retention rate has significant negative trend on impact of incidence rate of dysentery disease, enteric disease and insignificant negative trend impact on incidence rate of acute diarrhoeal disease. But compulsory student retention rate has insignificant negative trend impact on incidence rate of severe diarrhoeal disease and food poisoning. Result of the study by Pornthip, et al. (2006) showed that visiting school and having visitors from outside reduced the risk of shigellosis, whereas other studies, usually conducted during

shigellosis outbreaks, have shown that social gatherings and school contacts increase the risk of shigellosis. Thailand has made significant progress in education. Gross primary enrolment has been above 100% (United Nations country Team in Thailand, 2005:39-42).

4.2.2.2 Environment factor

(a) Climate factor

Our results show that, amount of annual rainfall has insignificant positive trend impact on incidence rate of 5 diarrhoeal diseases. The rainfall data have been collected at the 58 synoptic station of the Meteorological Department with 9 synoptic station estimate from nearby station. Nongnat Ouprasitwong (2001) found that trend annual rainfall was generally decreased while those of proportion of annual rainfall from extreme events were increased at a majority of stations.

(b) Safe drinking water factor

We found that, safe drinking water has insignificant positive trend impact on incidence rate of acute diarrhoeal disease and food poisoning disease. It has significant negative impact on incidence rate of dysentery disease but insignificant negative impact on incidence rate of severe diarrhoeal disease and enteric disease. The study by Pornthip,

et al.) showed that drinking bottled water increases the risk for shigellosis. Explanations include contamination of the bottled water or that those households having only access to poor quality water make use of bottled water.

(c) Water supply in urban

This study showed that, the water supply in urban per population coverage has significant negative trend impact on incidence rate of acute diarrhoeal disease, food poisoning disease and insignificant negative trend impact on incidence rate of severe diarrhoeal disease, dysentery disease and enteric disease. It was the introduction of water filtration and chlorination systems that play the key role to measure and protect people from harmful bacteria in water. (UNDP, 2006:29-32).

Contaminated water supply has been documented as a cause of shigellosis outbreaks in Thailand (Swaddiwudhipong W, Karintraratana S, Kavinum S., 1995:145—50).

(d) Sanitation factor

We found that, latrine household coverage has significant negative trend impact on incidence rate of dysentery, enteric fever and this has insignificant negative trend impact on incidence rate of acute diarrhoeal disease. But latrine household coverage has insignificant positive trend impact on incidence rate of severe diarrhoeal disease and food poisoning disease. Result of the study by Pornthip Chompook, et al. showed that the presence of water for flushing or toilet paper in the latrine had a protective effect against shigellosis. People not using latrines and having to defecate in the environment around the household showed a two-fold increased risk for shigellosis compared to latrine users.

4.2.3 Statistic significant impact of expansion with CFGT on the incidences of diarrhoeal diseases

Furthermore, impact expansion of CFGT to compare trend result between impact expansion of CFGT and food habit culture proxy variable average monthly expenditures food eaten away from home to total income per household ratios. The food services that have to improve food safety standards in to ensure that food does not caused diarrhoeal diseases or health hazard after consumption then expected sign should be positive trend result if personal behavior in food habit of people will change to more eating outside home.

As the result of this analysis, the expansion CFGT and food habit culture proxy variable has impact on incidence rate of acute diarrhoeal disease.

However, in 2005 street food venders, stalls and restaurants have been certified to receive the “Clean Food Good Taste” logo 42.8% from Ministry of Public Health. Development of combining the CFGT with general public stakeholders and consumer protection from the main transmission route for risk reduction of diarrhoeal diseases is a priority consideration.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

As the Food Sanitation Division, Department of Health has a role of promotion and protection of health and environment, it is concerned that food safety and control in food services is an important issue to promote safe and wholesome food for tourists. In 1999, the Clean Food Good Taste Project (CFGT) in Support of Tourism and the Thai Economy is introduced to promote food safety and hygiene in food services. There is a necessity to improve food safety standards in food services to ensure that food does not caused diseases or health hazard after consumption. The project has a collaboration of multi-sectional party.

5.1.1 Incidence of diarrhoeal diseases in Thailand during 1991- 2005.

Based on secondary data, From 1991 to 2005, it can be noticed that the reported number of acute Diarrhoeal disease slightly increased since 1993 high number of about 1,000,000 cases was observed in 1995 still now and food poisoning disease has been steadily increasing but during 2000-2005 its morbidity rate has slightly increased. Severe diarrhoeal disease, dysentery disease and enteric fever disease were observed to be on a steadily decreasing trend.

5.1.2 Impact of introduction CFGT on the incidences of diarrhoeal diseases.

The empirical analysis to estimate an econometric panel regression model that accounts for simultaneity impact between CFGT and incidence rate of 5 diarrhoeal diseases. The results showed that the introduction CFGT and food habit culture proxy variable has a likely of relationship with trend impact on incidence rate of severe diarrhoeal disease.

5.1.3 Impact of socio-economics, environment and intervention factor on incidence rate of diarrhoeal diseases.

5.1.3.1 Average monthly expenditures foods eaten away from home and total income per household ratios has a likely of relationship with trend impact on incidence rate of severe diarrhoeal disease.

5.1.3.2 Gross provincial product (GPP.) has a likely of relationship with trend impact on incidence rate of acute diarrhoeal disease and food poisoning disease,

5.1.3.3 Child less than 4 years has a likely of relationship with trend impact on incidence rate of acute diarrhoeal disease acute, severe diarrhoeal disease

5.1.3.4 Population per doctor ratio has a likely of relationship with trend impact on incidence rate of dysentery.

5.1.3.5 Compulsory student retention rate has a likely of relationship with trend impact on incidence rate of dysentery and enteric fever.

5.1.3.6 Annual rainfall has a likely of relationship with trend impact on incidence rate of 5 diarrhoeal diseases but insignificant t-statistic .

5.1.3.7 Safe drinking water, household has safe water sufficient to drink has a likely of relationship with trend impact on incidence rate of dysentery.

5.1.3.8 water supply in urban per population coverage has a likely of relationship with trend impact on incidence rate of incidence rate of acute diarrhoeal disease ,food poisoning .

5.1.3.9 Latrine household coverage has a likely of relationship with trend impact on incidence rate of dysentery and enteric fever.

5.1.4 Impact of expansion with CFGT on the incidences of diarrhoeal diseases.

The analysis impact of expansion with CFGT on the incidences of diarrhoeal diseases The number of certified CFGT Restaurants and Street food Vender CFGT and food habit culture proxy variable a likely of relationship with trend impact on incidence rate of acute diarrhoeal disease with insignificant t-statistic.

5.2 Recommendation

According to the analysis of impacts of Clean Food Good Taste Project (CFGT) on the incidence of diarrhoeal diseases in Thailand, the following issues should be mentioned.

5.2.1 Research

The further research should be study with ecological trandisciplinary studies including climate change with special emphasis on population threshold for the maintenance of diarrhoeal diseases. Especially the research on the human factor of diarrhoeal diseases requires strong interactions collaboration between and different disciplines of science, crossing the boundaries between social science and natural and health science which in economics perspective for the policy innovation.

5.2.2 Limitation of study

There are weaknesses associated with this analysis impact of Clean Food Good Taste Project (CFGT) on the incidence of diarrhoeal diseases in Thailand by using secondary data which should be considered. Several limitations are inherent to this analysis. This study used retrospective time series data in which collected from many organization .due to lack of detailed data, the estimation were set. For example, Estimate provinces that have not synoptic stations for amount of annual Rainfall.

5.2.3 Further recommendation for Intervention and Health care Service

This study shown that the improvement of water supply in urban area especially piping water supply has positive impact trend to reducing diarrhoeal diseases. The economics evaluation study to intervention on burden of diarrhoeal diseases will be recommended new public policy on preventive diarrhoeal diseases programme. That one of the most powerful forces for changer was the separation of water from human excrement. Also shows that population per doctor ratio has positive trend impact on incidence rate of diarrhoeal diseases that diarrhoeal diseases still are the burden of the health care service especial outpatient for community hospital. The perspective of health care management with health promotion is the process of enabling people to increase control over their health and its determinants,

and improve their health. It is a core function of public health and contributes work of tackling to communicable diseases.

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