# THE ASSOCIATION OF SOCIODEMOGRAPHIC CHARACTERISTICS AND
# ORAL HEALTH SERVICE UTILIZATION AMONG THAI OVER TIME

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A Thesis Submitted in Partial Fulfillment of the Requirements
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ความสัมพันธ์ระหว่างลักษณะพื้นฐานทางสังคมของประชากรไทย
กับการใช้บริการทันตกรรมเมื่อเวลาเปลี่ยนไป

นางสาววรารัตน์ ใจชื่น

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วรารัตน์ ใจชื่น : ความสัมพันธ์ระหว่างลักษณะพื้นฐานทางสังคมของประชากรไทยกับการใช้บริการทันตกรรมเมื่อเวลาเปลี่ยนไป (THE ASSOCIATION OF SOCIODEMOGRAPHIC CHARACTERISTICS AND ORAL HEALTH SERVICE UTILIZATION AMONG THAI OVER TIME) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: อ. ปีเตอร์ ซีนอส, 117 หน้า.

ที่มาและความสำคัญ

การศึกษานี้จัดทำขึ้นโดยมีจุดมุ่งหมายเพื่อศึกษาความสัมพันธ์ระหว่างลักษณะพื้นฐานทางสังคมของประชากรไทยกับการใช้บริการทันตกรรมเมื่อเวลาเปลี่ยนไป ผลลัพธ์จากการศึกษานี้จะเป็นข้อมูลนำเข้าที่เป็นประโยชน์ต่อการคาดประมาณความต้องการกำลังคนด้านทันตสาธารณสุขรวมถึงการพัฒนาระบบบริการทันตสุขภาพที่เหมาะสมกับประชากรไทยในอนาคต

ระเบียบวิธีการวิจัย

รูปแบบการวิจัยเป็นการศึกษาตามรุ่นย้อนหลัง โดยใช้ข้อมูลระดับบุคคลจากชุดข้อมูลการสำรวจอนามัยและสวัสดิการแห่งชาติ วิเคราะห์ข้อมูลด้วยสถิติเชิงพรรณนาและการวิเคราะห์ถดถอยโลจิสติก และใช้วิธีการ Age-Period-Cohort analysis ในการค้นหาผลกระทบจากเวลาที่เปลี่ยนไป ผลลัพธ์ที่ได้คือสมการทำนายความต้องการใช้บริการทันตสุขภาพของประชากรไทย โดยอาศัยลักษณะพื้นฐานทางสังคมของประชากรเป็นตัวแปรทำนาย ซึ่งแบ่งเป็น 3 กลุ่มปัจจัย ได้แก่ ปัจจัยนำส่วนบุคคล ปัจจัยนำส่วนครอบครัว และปัจจัยเอื้อ

ผลการศึกษา

ตัวแปรต้นทุกตัวในการศึกษานี้มีความสัมพันธ์กับการใช้บริการทันตกรรมของประชากรอย่างมีนัยสำคัญทางสถิติ โดยระดับการศึกษาและบทบาทในครอบครัวของแต่ละบุคคลเป็นตัวแปรที่แสดงความพันธ์กับการใช้บริการทันตกรรมอย่างชัดเจนเมื่อคำนึงถึงเวลาที่เปลี่ยนไป ทั้งนี้การใช้บริการทันตกรรมมีความต่างกันอย่างชัดเจนระหว่างกลุ่มอายุแม้จะมีการควบคุมตัวแปรทุกตัวร่วมด้วยแล้ว ในสมการทำนายความต้องการใช้บริการทันตสุขภาพที่ทดสอบเฉพาะผลกระทบจากปัจจัยนำส่วนบุคคล พบว่าความแตกต่างระหว่างเพศส่งผลต่อความการใช้บริการชัดเจนที่สุด เมื่อทดสอบผลกระทบจากปัจจัยนำส่วนบุคคลร่วมกับปัจจัยนำส่วนครอบครัว พบว่าตัวแปรที่ส่งผลต่อความการใช้บริการชัดเจนที่สุดกลายเป็นระดับการศึกษาของบุคคล และเมื่อทดสอบผลกระทบจากปัจจัยเอื้อร่วมด้วยแล้ว พบว่าภูมิภาคของที่อยู่อาศัยส่งผลต่อความการใช้บริการชัดเจนกว่าตัวแปรอื่นๆ ทั้งนี้อิทธิพลของระดับการศึกษาของหัวหน้าครอบครัวต่อการใช้บริการทันตกรรมพบว่ามีค่าคงที่ทั้งก่อนและหลังควบคุมตัวแปรอื่นๆร่วมด้วย แม้ว่าสมการที่รวมปัจจัยทั้งสามส่วนแสดงอำนาจการทำนายสูงที่สุด แต่ก็ไม่แตกต่างกันนักกับสมการที่รวมเฉพาะปัจจัยนำและสมการพื้นฐาน

บทสรุป

การคาดประมาณความต้องการใช้บริการทันตสุขภาพของประชากรไทยโดยคำนึงถึงเฉพาะความแตกต่างของกลุ่มอายุนั้นไม่เพียงพอที่จะบ่งบอกความไม่เท่าเทียมกันในการเข้าถึงบริการ ปัจจัยเรื่องความแตกต่างระหว่างเพศ ระดับการศึกษาของบุคคล ระดับการศึกษาของหัวหน้าครอบครัว และภูมิภาคที่อยู่อาศัยของประชากร เป็นข้อมูลสำคัญที่ควรคำนึงถึงร่วมด้วย

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| สาขาวิชา   สาธารณสุขศาสตร์ | ลายมือชื่อนิสิต _____ |
| ปีการศึกษา 2559 | ลายมือชื่อ อ.ที่ปรึกษาหลัก _____ |

WARARAT JAICHUEN: THE ASSOCIATION OF SOCIODEMOGRAPHIC CHARACTERISTICS AND ORAL HEALTH SERVICE UTILIZATION AMONG THAI OVER TIME. ADVISOR: PETER XENOS, Ph.D., 117 pp.

Background: This study aimed to explore associations among sociodemographic characteristics and oral health service utilization (DU for dental utilization) among Thai over time. The outcome will be helpful for the next projection of the oral health workforce, and also for designing an oral health service system that is appropriate for the population in the future.

Method: Retrospective data analysis, study of cohort behavior regarding oral health service utilization. Micro data from a series of the Health and Welfare Surveys (HWS) of Thailand were used. Descriptive analysis and binary logistic regression were used for exploring the outcome, applying three matrices of Age-Period-Cohort analysis for alternative perspectives on time. Sociodemographic characteristics of population were divided into predisposing – individual factors, predisposing – family factors, and enable factors. Three different compositions of those factors were used for exploring appropriate models for predicting dental health care demand.

Result: All independent variables had significant association to DU. By the way, education of individual and role in family showed remarkably change of associations to DU over time. A large difference among age groups were seen from larger gaps of DU after controlled for all independent variables. In model which controlled only predisposing – individual factor, gender showed more remarkably impact to DU than other variables. While after controlled for both predisposing – individual factor and family factor, education of individual showed remarkably impact to DU instead. Then, after controlled for all three factors, variable which showed remarkably impact to DU was shifted to region of residence, and predicted power of this model was also the highest. Anyway, in all models, education of family head showed impact to DU independently from all other control variables. In term of predicted power of model, there were not much difference among all three models and also base model.

Conclusion: Information on gender, education of individual, education of family head, region of residence, and health insurance were recommended to include in forecasting of demand for dental health care. All models included this set of variables were more appropriate for forecasting dental care demand than considering only differences among age group. These sets of variable will help to clarify existing inequality.

Field of Study:  Public Health          Student's Signature _____

Academic Year: 2016               Advisor's Signature _____

# ACKNOWLEDGEMENTS

# CONTENTS

# CHAPTER I

# INTRODUCTION

## Background and Rationale

For achieving population health outcomes, the WHO have mentioned to six building blocks of health systems framework which are service delivery, health workforce, health information systems, access to essential medicines, financing, and leadership and governance (The World Health Organization, N.d.). Process of planning and managing these six blocks is the big issue for policy maker especially in the block of health workforce, because of many uncontrollable factors when dealing with human and complexity of health workforce planning which relate to both supply and demand side of health sectors, long period of production process is one example. For achieving the good health workforce planning, the accurate information about population demand for health care is required.

The planning of health workforce specifically in the projection of health workforce demand, four principle methods were mentioned, which were population ratio, health need, health demand, and service target method. Each method have different strength and weakness points, no one is the best that appropriate for all situations, which one should be selected is depend on the context of each country such as characteristics of health service system, coordination among health sectors, and so on  (Hall, 1978). Anyway, in practical, the major barrier when choosing appropriate method is depending on availability of related information.

In Thailand, for projection of oral health workforce, we have experienced in all four methods that mentioned above. The health need method was used in many rounds of projection, data used in this calculation was oral health status which depend on dentists' view on population need for treatment, which referenced from the national oral health survey (Udompanich, 1997) (Wichawut, Pholdeeyiam, Busarakumruha, & Sudkornrayuth, 2009). This method is very complex and need the process of transforming service need in professional view into perceived need or real population demand. In the latest projection, the method was changed to health demand method, by

using the actual oral health service utilization, which referenced from the national health and welfare survey, to calculate for future demand (Jaichuen, 2016b). Anyway, whatever method used, the underlying assumption of projection always limited to status quo approach, which both service system and population' behavior were thought to have the same characteristics as they were at that time, by using information only at the point of time for referring to future situation. *Is that approach appropriate enough for important issue like health workforce planning? Is the demand still stable while human life changes every day?* This question may be appearing in your though, and I also think of that too. *What is the actual demand for care of future population?* The answer for these questions will be valuable and very helpful for policy makers who need to manage their limited resources in most efficiency ways, although it is not easy to make the right answer, we should try to find out now.

For planning of oral health workforce and developing of oral health service system in Thailand, related planners need better understanding in oral health care utilization behavior of population. Refer to the behavioral model of health care utilization (Aday & Andersen, 1974; Ronald Andersen & Newman, 2005; R. M. Andersen, 1995), while there are many levels of determinants that effect to health care utilization, this study aims to explore only individual level specifically in sociodemographic factors that may be influence in oral health service utilization among Thai, by analysis data from the Health and Welfare Surveys (HWS) which conducted by the National Statistics Offices (NSO). And under the assumption that "time changes, people changes", the Age-Period-Cohort (APC) analysis will be used for defining the effect of time (Suzuki, 2012), because concerning in the pattern of dynamic changes is very important for understanding the nature of population in the system. The outcome of this study will be use in the projection of oral health workforce in the future and it also helpful for policy makers in designing oral health service system that appropriate for population in the future and planning for more efficiency choice.

**Research questions**

1. Do the associations among sociodemographic factors and characteristics (prevalence, regularity, type, and place) of oral health service utilization among Thai change with the passage of time?

2. Which sociodemographic factors change with time and significantly affect characteristics (prevalence, regularity, type, and place) of oral health service utilization among Thai?

**Objectives**

1. To investigate the effects of time to the association among sociodemographic factors and characteristics (prevalence, regularity, type, and place) of oral health service utilization among Thai.

2. To explore the sociodemographic factors that appropriate for projection of population demand for oral health care.

**Conceptual framework**

| Sociodemographic characteristics of samples at points of time | Characteristics of oral health service utilization at points of time |
|---|---|
| **Predisposing factors**<br>Individual characteristics<br>- Birth cohort<br>- Age/ age group<br>- Gender<br>- Educational level<br>- Working status<br>- Marital status<br>- Role in family<br>Family characteristics<br>- Household size<br>- Educational level of head of family<br>- Working status of head of family<br>- Marital status of head of family<br>**Enabling factors**<br>- Type of health insurance<br>- Area of residence<br>- Region of residence | - Probability of utilization<br>- Regularity of utilization<br>- Type of service use<br>- Place of service use |

**Operational definitions**

**Oral health service utilization** is a self-reported information of samples in using oral health services in the past 12 months before interview.

**Points of time** are the year of HWS that will be used in analysis, there are 6 years including 2003, 2007, 2009, 2011, 2013, and 2015.

**Individual characteristics** are any sociodemographic characteristics at individual level which getting from their own individual information.

**Family characteristics** are any sociodemographic characteristics at individual level which reference from information of the head of their family.

**Birth cohort** refers to the groups of people who were born in similar time period, which categorized into 7 group including 'Before 1941', '1941-1950', '1951-1960', '1961-1970', '1971-1980', '1981-1990', '1991-2000', and 'After 2000'.

**Age group** are the aggregation of people into group of similar age, applied from the classification of Department of Health, Ministry of Public Health. There are 7 age group in this study

- *Early childhood* is a group of samples who have age among 0-5 years at the point of survey year.
- *Childhood (school children)* is a group of samples who have age among 6-14 years at the point of survey year.
- *Adolescence* is a group of samples who have age among 15-24 years with the condition that they have no any occupation at the point of survey year.
- *Early adult* is a group of samples who have age among 15-24 years with the condition that they have some occupation at the point of survey year, combine with a group of samples who have age among 25 – 35 years at the point of survey year.
- *Adult* is a group of samples who have age among 36 – 49 years at the point of survey year.
- *Late adult* is a group of samples who have age among 50 – 65 years at the point of survey year.

- *Elderly* is a group of samples who have age > 65 years at the point of survey year.

**Household size** refer to total numbers of member in household. There are 3 categories of household size including small size (1-3 members), medium size (4-6 members), and large size (> 6 members).

**Marital status** is the latest marital status of samples or head of family at the point of survey year. There are 3 categories of marital status including 'never married', 'married', and 'used to married' (including 'widowed', 'divorced', 'separated', and 'married but unknown status').

**Roles in family** are the statuses of person in their family which related to household head at the point of survey year. There are 3 categories of roles in family including 'head', 'spouse', and 'Other' (including 'unmarried son or daughter', 'married son or daughter', 'son or daughter-in-law', 'grandchild', 'parents/spouse's parents/grandparent', 'brother or sister and other relative', 'non- relative/ servant, and household workers').

**Educational level** is the highest educational level of samples or head of family at the point of survey year. There are 3 categories of educational level including 'Primary level' (including 'Not educated', 'Pre-primary school', 'Primary school'), 'Secondary level' (including 'Junior high school', 'Senior high school', 'Vocational certificate'), and 'Tertiary level' (including 'High vocational/ technical certificate', 'Bachelor degree', and 'Higher than bachelor degree').

**Work status** is the type of work which samples or head of family were employed at the point of survey year. There are 5 categories of working status including 'No work', 'Self-employed' (including 'Employer', 'Own- account worker', 'Unpaid family worker'), 'Public employee' (including 'Employee – government', 'State enterprise employee'), 'Private employee', and 'Member of co-operative group'.

**Health insurance** is type of health insurance which samples have been insured at the point of survey year. There are 5 categories of health insurance including 'not have any health insurance', 'the Universal Health Coverage scheme/ UCS', 'the Social Security Scheme/ SSS', 'the Civil Servant Medical Benefit Scheme/ CSMBS', and 'Other' (including 'Insurance company, 'Employer pay', and 'Others').

**Area of residence** is the location of household which samples live at the point of survey year, categorize into Bangkok, urban or inside municipality, and rural or outside municipality.

**Region of residence** is the location of household which samples live at the point of survey year, categorize by geographical areas, Bangkok, Central, Northern, Northeastern, and Southern.

**Probability of utilization** is the probability of using oral health services in the past 12 months, which divided into 'Yes, at least one visit', and 'No, not any'.

**Regularity of utilization** is grouping from number of dental visits in past 12 months. There are 2 categories of regularity of utilization including 'One visits a year', and 'More than one visit a year'.

**Type of service use** is the grouping of dental care services. There are 3 categories of dental care services including 'Oral health prevention' (including 'Oral screening', 'Sealant', and 'Apply topical fluoride'), 'Basic dental treatment' (including 'Tooth extraction', 'Tooth filling', and 'Scaling, polishing, periodontal treatment'), and 'Complicated dental treatment' (including 'Root canal treatment', 'Prosthodontic', and 'Orthodontic'). Noted that the answer for using periodontal treatment was categorized in basic treatment because the primary data was included this treatment in the same answer for using scaling and polishing, which was using the term 'Scaling, polishing, periodontal treatment'.

**Place of service use** is the place which sample was received the latest oral health services in the past 12 months before interview. There are 2 categories of place of service use including 'Public provider' (including 'Health center, without dental personnel', 'Health center, with dental personnel', 'District hospital', 'Provincial hospital/ general hospital', 'University's hospital', 'Other public hospital', 'Mobile service (from any organization)', and 'School'), 'Private provider' (including 'Private hospital', and 'Private clinic'), and 'Other' (including 'Motorcycle/ pick up doctor', 'Others', and 'Don't know').

# CHAPTER II

# LITERATURE REVIEW

## The behavioral model of health care utilization

Health care utilization can be viewed as one type of human behavior which can explain by individual determinants, societal determinants, and interaction among those two determinants. In the past, two principle approaches were used when analysis about health care utilization, one was "Economic model", the other was "Social-Psychological model". Anyway neither approach could clearly explain the determinants of health care utilization, thus, in 1968, Ronald M. Andersen started to develop "the behavioral model of health care utilization" by combining those two model together. In the first model (Figure 1), Andersen used family as a unit of analysis because he found that family has much influence to any decision of health care use among family members, therefore three components related to family were included on his model. The first component is *predisposing factors* which exist prior to the onset of any illness, three subcomponents were defined in this factors which are family composition, social structure, and health beliefs, and all were mainly characteristics of family head, such as age, sex, educational level, employment status, and so on. Next is *enabling factors* which make family able to use any health care that they need, this factors were divided into family resources, such as family income and health insurance, and community resources, such as physician-population ratio and region of residence. The last component is *need factor* which is measured in amount of illness that family perceive and how they response.

Furthermore, in the result part, Andersen classified health care use into discretionary and non-discretionary. More discretionary mean that the decision of health care usage is primarily depend on family by their own, and this characteristic can be explaining by predisposing and enabling factors of the family. In contrast, which health care usage have less discretionary mean that it is mostly made decision by the provider of service, and this behavior can explain by need factor instead. Among type of medical care, dental care has highest level of family discretionary, it means that

predisposing and enabling factors of family can explain a lot on the way they use dental care.
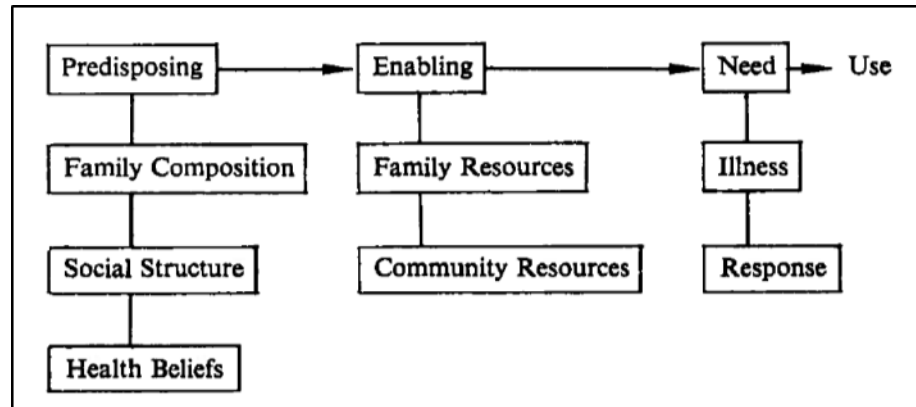


*Figure 1: The first phase of behavioral model of health care utilization*

However, there were some unexplainable result that cause by using family as a unit of analysis, therefore Andersen suggested to change method of analysis by using individual as a unit of analysis and concern the influence of family to individual instead. Andersen also used his model for explaining the effect of each component when assume the equitable distribution of health care, and he mentioned that only the family composition, such as age and sex structure, size of family, and amount of illness, have maximum influence on use of health care. In the other words, these variables are the principle factors that influence the difference of health care usage among families even though there are equitable chance to access to care. Anyway, the other variables still play the important role in the real situation (R. Andersen, 1968).

Then in 1973 the model was developed in the second phase (Figure 2), Andersen and his colleague paid more attention in societal determinants, thus factors related to health policy, resources and organization, were added in the model because these are affected from societal determinants and can be influence to the use of health service. For utilization component, more characteristics were added which were type, purpose, and unit of analysis, because each characteristic had different pattern of relationship to the other components. In this phase, he also described more about individual determinants which change from previous family unit of analysis to individual level (Ronald Andersen & Newman, 2005).
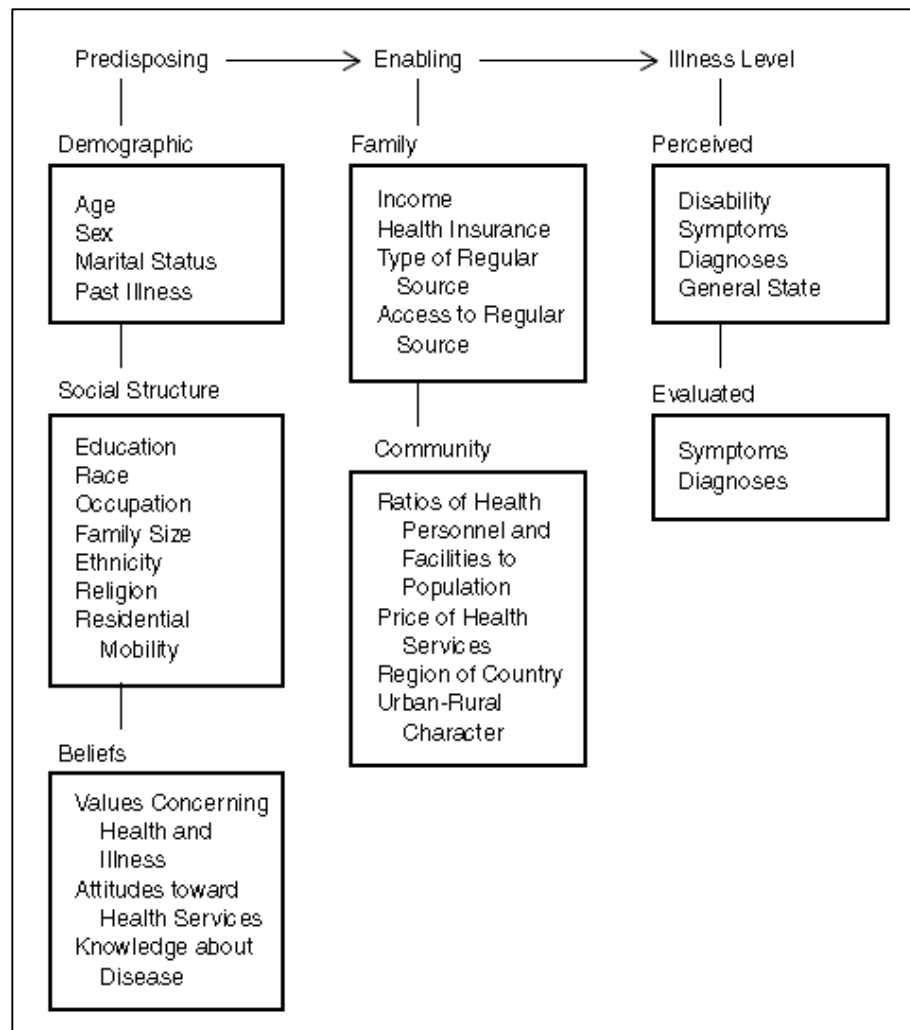
*Figure 2: Details of the individual determinants in the second phase of the behavioral model of health care utilization*

Later in 1994, the third phase of model was developed (Figure 3). In this phase, the model was added one more input, the external environment, which including physical, political, and economic components. And in part of health behavior, there was not only the behavior in the use of health care, but also personal health practices, such as diet, exercise, and self-care, because they both could be related to health outcome (R. M. Andersen, 1995).
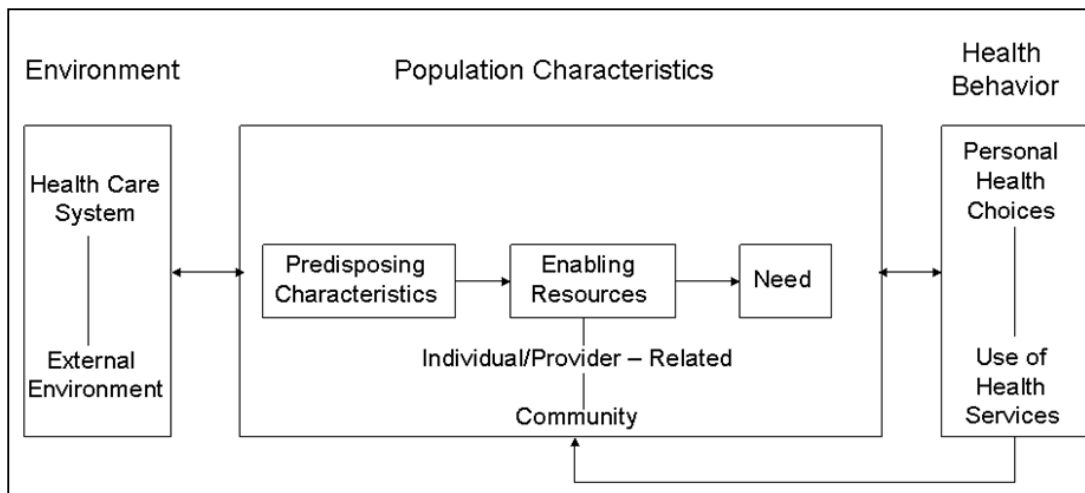
*Figure 3: The third phase of behavioral model of health care utilization*

While the whole model of Andersen was included both societal and individual components, but the scope of analysis in this study will cover only individual component, specifically in sociodemographic characteristics of Thai. Clearly understanding in depth of these points will help the further study to move forward beyond other factors in the higher level of determinants.

**Evidence of the association among sociodemographic factors and health service utilization**

Basic oral disease, dental caries and periodontal disease, are progressed by time, so that it need routine oral health checking up and early detection for observation those progression and prompt treatment. Many study found the different of dental visiting upon sociodemographic characteristics, gender, age group, country of resident, educational level, and social class (Karimalakuzhiyil Alikutty & Bernabé, 2016). Those have association with long-term pattern of dental attendance and affect to oral health outcome. Furthermore, in the characteristic of dental visit, educational level has association with regularity of check-up visit, while visit cause by complaint were affected by gender and age too (El Bcheraoui et al., 2016)

**Age**

Pattern of health care utilization differ among age group, middle-aged adult trend to using health care in lower rate when compare with older ones, these related with employment status and how they assess their health status also. Some disease show

increasing rate when they grow up, diabetes for example, these may effect from their late treatment, and lead to more cost for treatment (Zayas et al., 2016). There are various factors under the relation among age and health care utilization, health insurance is one factor that play important role, including both benefit package and usage criteria, working age group seem to have more barrier in accessing to health care by using their health insurance benefit (Nasseh & Vujicic, 2015), another factor is the status of their health, not all elderly need more health care if they stay healthy, so the projection of population need in the future by concerning on age alone may represent in much more health need than actual situation (McNamara, Normand, & Whelan, 2013).

**Gender**

Gender is one importance issue that public health workforce, policy maker also, should pay more attention. Gender is not only difference between physiological sexes but also have more detail related, social constructed roles, human beings as male and female. The relation among gender and health, health related behavior, health care-seeking behavior, have complexity in pathway of each phenomenon, such as women who cannot manage time to receive health care because they spend a lot of time for take care their family, in this case we cannot think directly and blame those women that they do not recognize and beware of their health. Another example is about mother and nutrition of child, most countries create programs for education mother about good nutrition for her child, but in some area the decision power in buying food for family is under man only, so this method may not effective. Social roles contribute to gender differences in health-service use, anyway those differences nearly gone after adjusted for educational level, marital status, head-of-family employment status, and social network (Redondo-Sendino, Guallar-Castillón, Banegas, & Rodríguez-Artalejo, 2006). In summarize, gender difference is very important issue that have been overlook for a long time. We can explore the association among gender difference and health in three aspects, social determinant, economic determinant, and biological determinant. (Hawkes & Buse; Vlassoff, 2007). Better understanding about this issue will bring to more proper policy for achieve health of population

**Marital status**

Many study found the association among marital status and health care utilization, divorced and widowed mostly have highest health utilization rate, while

never married was the lowest utilization rate group. These association is changed when adjusted for chronic diseases, all of these status, divorced, widowed, and never married, have higher health utilization rate than married people (Joung, Van Der Meer, & Mackenbach, 1995; Womack et al., 2014). This result may be in contrast when gender difference was concern, one study found that married men have more heath care visit when compare with single ones (Blumberg, Vahratian, Blumberg, & Survey, 2012). The reason why married people, especially women, have lower utilization rate when compare to other groups may be explain in the same way like association of gender different and health care-seeking that they have more responsibilities at home so not enough time for go to see doctor at clinic or hospital. Furthermore, these relationship confound by another sociodemographic factors, most influence is educational level, lower educational level lead to more divorce status (Joung et al., 1995).

**Education**

Level of education have influent to pattern of health care utilization both direct, by improve knowledge which bring to more concern in health and better decision for health-related choice, and indirect way, through occupational context, by increase in level of income, by privilege from health insurance plan, which lead to easier choices in accessibility to health care. Investment of education in national level show a pretty good outcome in health related behavior, higher rate in preventive health care utilization among population (Fletcher & Frisvold, 2009). The type of health care utilization also related to level of education, people with high educational attainment show more likely using health service from specialists and health screening too (Alguwaihes & Shah, 2009).

**Working status**

Working or employment status is the importance factors of working age population, because these factor influence most time of their routine life. Employment status effect to health care utilization, many studies found unemployment increase the rate of visiting doctor. These phenomena may be explain in various ways, unemployment can cause people more stress so the need for treatment is increase (Kraut, Mustard, Walld, & Tate, 2000), another simple logic is that unemployed people have enough time to visit doctor while people with long working hours cannot use health service although they feel ill (Economou, Nikolaou, & Theodossiou, 2008).

**Health Insurance**

The most important barrier in access to health care is expenditure or cost of care. Countries around the word have been advocated to provide universal health coverage system for protecting their citizens from financial bankrupt which related to health expenditure. Many countries have more than one public-provided health insurance schemes for support people in each categories, such as Thailand have three types of public-provided health insurance schemes, Universal health Coverage Scheme (UCS), Social Security Scheme (SSS), and Civil Servant Medical Benefit Scheme (CSMBS) (Lapying & Putthasri, 2013). There were difference of prevalence and characteristics of health care utilization when compare among types of health insurances (Kim, Lee, Yoo, & Park, 2015) (Jaichuen, 2016a), and also strong evidence showed enhancing in health service utilization related to health insurance coverage (Spaan et al., 2012).

**Area of residence**

The different patterns of health service usage found between urban and rural area. These affected from scarcity and reallocation of resources, and these expanded inequality among social gradient (Lahana, Pappa, & Niakas, 2011)

## Age – Period – Cohort (APC) Analysis

The Age – Period – Cohort (APC) Analysis is one analytical approach which concern and need to assess the effect of time. This method was paid more attention since the evolution of modern epidemiology which ecological concept has been used to explain the cause of problem. APC is use for analyzing the relation among any situation and time-varying elements in three-time scale, age, period or calendar year, and cohort or year of birth. An 'age effect' is the outcome from one's life course, which are shaped by biological and social factors in the aging process. A 'cohort effect' is meaning to a group of population which born at the same point of time, such as born after war, cohort can explain about generation. A 'period effect' is the external factor which affect everybody in all age at the same time equally, specific events affect to situation in a period of time, such as economic regression (Suzuki, 2012).

In APC, the data typically used are one from this three types, aggregated data, repeated cross-sectional data, and longitudinal data, the first one is population-based data while the last two types are individual-based data. Each type of data has been seen

in different view when the conceptual thought was related to time, for example in case of repeated cross-sectional data, the representative samples in each round of data collection are not necessary to be the same persons, but we can reclassify them into new group of same period by using the surveys year as reference, or same cohort by referring to group of persons who born in the similar year, while age effect was already attribute in any samples (Fig. 4) (Suzuki, 2012).
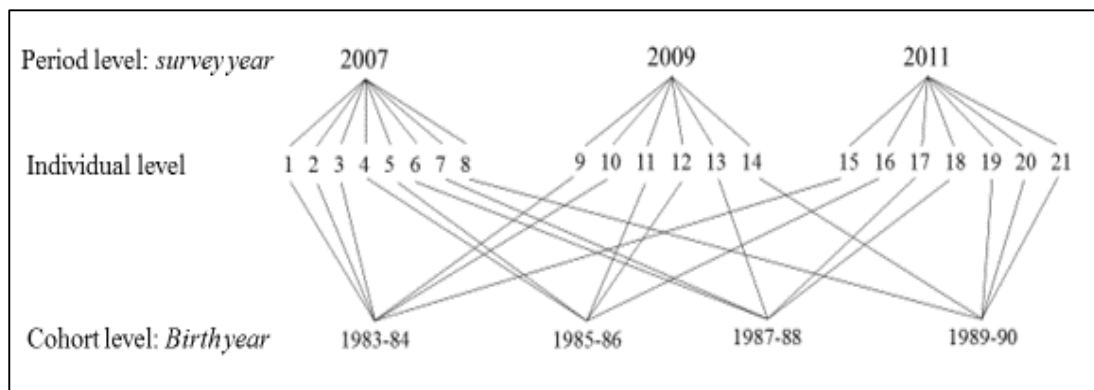


*Figure 4: The reclassified data structure of an age-period-cohort analysis in a repeated cross-sectional survey (Applied from figure 1 of Time change, so do people (Suzuki, 2012))*

Although we can manage and calculate effect of time like the general number, but in the real world it cannot interpret too simple like that, because time is non-material and uncontrollable, and the result from their effect is come through some other intermediate factors (Suzuki, 2012).

This study need to clearly understand the association of sociodemographic factors of Thai and their oral health care utilization characteristics under the assumption that these factors are change by time, thus the APC approach is appropriate for this study by using a series of HWS which is a set of repeated cross-sectional data among Thai population. Anyway, in each mathematic calculation, either age, period, or cohort, one component from those should be excluded from the analyzing under theoretical based assumption (Bell & Jones, 2014), for this reason, period effect will be exclude from this study. Although there was a big change in the population's behavior on health service utilization after the announcement of the National Health Security act in 2002, which should not be left out of consideration, the data available for this study covers

only the period after this policy had been implemented, thus we cannot examine this likely period effect.

There were also no evident that approved both period and cohort effect to pattern of oral health care utilization in Thailand, but after tracking the related policies and strategies since the existence of dental work in Ministry of Health which now is upgraded the position and authority to Bureau of Dental Health, the core organization which responsible in planning of oral health system in national level, I found that the nature of oral health programs in Thailand were managed in form of target group, totally five groups, were classified by their age which related to oral health state. One underlying objective of many oral health program in target group is related to the concept of life course trajectories, the relation among experience in the early stage of life and any events in later stage of life, which hope the children who early exposed to oral health care would be familiar with the service system so that their oral health behavior would be improved and they might use oral health service more usual at least 1-2 visits a year as dentists' recommendation (Jirapongsa, Prasertsom, & Wongkongkatep, 2004). Those underlying objectives were related to concept of cohort effect, so this study would be exploring the effect of age and cohort.

**Changes in Population Structure of Thailand**

Thailand have conducted the population and housing census every 10 years by National Statistical Office (NSO). The data showed changes in every aspects, not only whole population size but also age-sex structure, urban-rural ratio, educational level, characteristics of household, and type of work (National Statistical Office, 2012). Details of changes in key indicators showed in table 1.

*Table 1: The changes of Thai population among 1990 -2010*

| | Year of Census | | |
|---|---|---|---|
| Items of indicators | 1990 | 2000 | 2010 |
| **Total population** (person) | 54,548,530 | 60,916,441 | 65,479,453 |
| Annual population growth rate (%) | 1.96 | 1.10 | 0.80 |
| **Age & Sex** | | | |
| Sex ratio (males per 100 females) | 98.5 | 97.1 | 96.2 |
| Population by age group | | | |

| | Year of Census | | |
| --- | --- | --- | --- |
| Items of indicators | 1990 | 2000 | 2010 |
| 0-14 years (%) | 29.2 | 24.4 | 19.2 |
| 15-59 years (%) | 63.4 | 66.1 | 67.9 |
| 60 years and over (%) | 7.4 | 9.5 | 12.9 |
| **Urban/Rural** | | | |
| Population in municipal area (%) | 29.4 | 31.1 | 44.2 |
| **Education** | | | |
| Population aged 6-24 years not attending school (%) | 54.5 | 38.9 | 29.4 |
| **Household** | | | |
| Average household size (persons per household) | 4.4 | 3.8 | 3.1 |
| One person households (%) | 5.1 | 9.4 | 18.4 |
| Female - headed households (%) | 19.4 | 26.2 | 34.7 |
| **Work status** | | | |
| Employers (%) | 0.8 | 1.3 | 2.0 |
| Own account workers (%) | 29.5 | 30.8 | 33.2 |
| Employees (%) | 27.0 | 35.9 | 42.3 |
| Unpaid family workers (%) | 42.7 | 31.9 | 22.2 |
| Members of producers' cooperatives (%) | na | 0.1 | 0.3 |

This information confirms the need for depth understanding in population's demand for health care which should be related to these changes in population structure.

**Present situations of oral health service system in Thailand**

**Oral public health policies**

In the year 2016, followed the 20-year national strategy which is aimed for long-term development of Thailand, the MOPH launched four excellent strategies to be main direction for action in the next 20 years including "Promotion and Prevention (PP) excellent strategies", "Service excellent strategies", "People excellent strategies", and "Governance excellent strategies". For dental health field, two main issue that we have direct participatory are PP excellent strategies which aiming to improve quality of life for Thai in every age group, the other issue is the Oral Health Service Plan (OHSP), under the service excellent strategies, which details about the resources and service

planning for achieve the main oral health goals of the first issue (*Oral Health Service Plan*, 2013) (*The 20-year national strategies (Public health issue)*, 2016).

In other words, oral public health work is structured under the age-groups concept which categorized population into five groups, which relate to their age, health status, and working status, including pregnancy and early childhood group, childhood or school student group, adolescent group, working-age group, and elderly group. This concept appeared since the past, all oral public health policies have been created, developed, and implemented into each group of people, thus this study should manage analysis in each group separately so that the result would help the researcher to be better understand the real situation, and then lead to appropriate policy recommendation for the future.

The definition of each age-group in this study were described in part of "Operational Definition"

**Oral health benefits under three main public provided-health insurance schemes**

Thailand has a long history in health service system development. In the past, MOPH started with a vast investment in infrastructure of health care units, followed by the policy in health centers development, there were available of public provided-health care services in nearly all area of country since the year 2000. At that period, only 69% of population were covered by four main public provided-health insurance schemes which were the Medical Welfare Scheme (MWS), Civil Servant Medical Benefit Scheme (CSMBS), Voluntary Health Card Scheme (VHCS), and Social Security Scheme (SSS). Later in 2001, following the political issue of the government at that time, the health welfare was reorganized, therefore the "30 baht for treatment of all disease" scheme, later changed to the Universal Coverage Scheme (UCS), were launched for protection all Thai citizen from financial burden of health care service (Pitayarangsarit, 2004).

At present, Thai citizens are covered by three major public provided-health insurance schemes, 15% who are private employees covered by the Worker Compensation Scheme (WCS) for their work-related injuries or illness and the Social Security Scheme (SSS) for their non-work related injuries or illnesses, 7% who are public employees covered by the Civil Servant Medical Benefit Scheme (CSMBS), and

the rest 76% covered by the Universal Coverage Scheme (UCS). These health insurance schemes have difference history and have been developed independently at different times (Sakunphanit, 2008) (Table 2-3).

*Table 2: Characteristics of public provided–health insurance schemes which related to oral health service system.*

| Characteristics | UCS | SSS | CSMBS |
|---|---|---|---|
| The first year of implement | 2001 (full coverage in 2002) | 1991 | 1978 |
| Main objective of insurance scheme | Reduce financial burden of health care service by providing a comprehensive benefit package on treatment and prevention | Protect private employees from non-work related injuries or illnesses | Fringe benefits without contribution in compensation a generally low-salary scale |
| Source of financing | General tax | Tri-parties 1.5% of payroll each, (reduce to 1% since 1999) | General tax |
| Payment mechanism | Capitation fee, some dental services are reimbursed by Fee for service | Capitation fee, some dental services are reimbursed by Fee for service | Fee for service for OP DRG for IP (July 2007) |
| Target population | All Thai citizen except those who are covered by SSS or CSMBS | Formal sector private employees | Civil servant of the central government, pensioners and their dependents (parents, spouse, children) |

Sources: applied from (Sakunphanit, 2008)

*Table 3: Oral health benefit package of public provided-health insurance schemes.*

| Type of service | UCS[1] | SSS[2] | CSMBS[3] |
|---|---|---|---|
| Oral examination | √ | √ | √ |
| Tooth filling | √ | √ | √ |
| Dental scaling and root planning | √ | √ | √ |
| Tooth extraction | √ | √ | √ |
| Prosthetic treatment | √<br>Only acrylic removable denture in elderly | √<br>With ceiling cost | √<br>With ceiling cost and limited amount in a period of time |
| Dental root canal treatment | x | x | √ |
| Oral disease prevention (e.g. dental sealant, apply fluoride) | √ | x | x |

Sources: applied from (Lapying & Putthasri, 2013)

[1] Receive services from subcontractor, can be both public or private providers, but mainly are public providers, with unlimited visits

[2] Limit of service use, not more than twice a year, and have ceiling compensation cost for treatment

[3] Receive services from public providers only with unlimited visits

**Situation of oral health and oral health service utilization**

Globally, oral conditions were including in the 100 top ranking of causes of DALYs, nearly 4 billion people around the world were affected by oral conditions. Untreated dental caries had a highest prevalence among all causes, followed by severe periodontitis and severe tooth loss, with the number of people affected on 35%, 11%, and 9% respectively. While the magnitude of oral problem is increase from the past, the factors that affect this phenomenon mostly impacted from the growth of population and aging situation. Furthermore, some regions such as Southeast Asia showed the declination of oral health problem when compared to their population size, this means that the quality of oral health service system is another key factor which contribute to

this problem (Marcenes et al., 2013). In high income countries, Canada and United States, which people are mainly under private insurance, showed the persistence of inequality in oral health although overall problem were decrease in magnitude. While level of income and education are the main contributing factors to those inequality, inaccessibility to oral health service is another factors which cannot overlook (Farmer, McLeod, Siddiqi, Ravaghi, & Quiñonez, 2016).

In Thailand, although the prevalence of oral health disease has been decrease from the past but the data from national oral health survey in the years 2012 showed the inequality among population with difference regions, these were included all three importance oral health conditions which mentioned before in the global situation, untreated dental caries, severe periodontitis and severe tooth loss (Bureau of Dental Health 2013). After the announcement of National Health Security act in 2002 led to origination of universal health coverage scheme (National Health Security Office, 2002), combine with other two health insurance schemes, the Civil Servant Medical Benefit Scheme and the Social Security Scheme, the number of Thai people with insurance coverage was steadily increasing, totally 98.5% with insurance coverage in 2015. Although all of those insurance was include basic oral health care in their benefit package (Lapying & Putthasri, 2013), but the oral health care utilization rate in this period were nearly the same at the rate of under 10%. The oral health service utilization rate was highest in the youngest age-group and lower in progressively older age groups, 9.8%, 8.8%, 7.7%, and 6.7% in age-group of 0-14 years, 15-24 years, 25-59 years, and more than 60 years respectively (National Statistic Office, 2016). Furthermore, there was the same pattern of inequity in oral health service utilization among Thai people with sociodemographic differences, male had lower utilization rate than female, urbanites had higher rate than rural one, and higher level of education had higher utilization rate (Jaichuen, 2016a).

While many strategies have done for improving coverage of oral health care among population, the main focusing point was to increase number of dental provider in the service system by increasing the production. In the past 10 years, the data showed improvement in the number of dental operators, dentists and dental nurses, density increased from 0.21 to 0.31 per 1,000 populations (Bureau of Dental Health, 2015). Nowadays, the problem in oral health inequalities have been more discussed, and this

issue has been raised attention by global-level institutions (Glick et al., 2012; Sgan-Cohen et al., 2013). One study found that cohort change of population affected the pattern of health and health care utilization, and surprisingly the overall need for services was decreased over time (Whittaker, Birch, MacKenzie, & Murphy).

**Summary of literature review**

This study would be exploring the association among sociodemographic characteristics of samples and their oral health care utilization, both in the whole picture of population and separately analysis of each age group, because it is the practical structure of policy planning and implementation. Another consideration was that the variables for each age group would not exactly the same, they would be applied appropriately with the real world situation instead (Table 4).

*Table 4: List of variables would be used for binary logistic regression in each age group.*

| Variables of interest | Early childhood | Childhood | Adolescent | Early adult, adult, late adult | Elderly |
|---|---|---|---|---|---|
| **Independent - individual** | | | | | |
| Birth cohort | √ | √ | √ | √ | √ |
| Age | √ | √ | √ | √ | √ |
| Gender | √ | √ | √ | √ | √ |
| Educational level | - | - | √ | √ | √ |
| Working status | - | - | - | √ | √ |
| Marital status | - | - | - | √ | √ |
| Role in family | - | - | - | √ | √ |
| Type of health insurance | √* | √* | √* | √ | √ |
| Area of residence | √ | √ | √ | √ | √ |
| Region of residence | √ | √ | √ | √ | √ |
| **Independent - family** | | | | | |
| Household size | √ | √ | √ | √ | √ |

| Variables of interest | Early childhood | Childhood | Adolescent | Early adult, adult, late adult | Elderly |
|---|---|---|---|---|---|
| Educational level of head of family | √ | √ | √ | √ | √ |
| Working status of head of family | √ | √ | √ | √ | √ |
| Marital status of head of family | √ | √ | √ | √ | √ |
| **Dependent** | | | | | |
| Proportion of utilization | √ | √ | √ | √ | √ |
| Type of service use | √ | √ | √ | √ | √ |
|   Oral health prevention | √ | √ | √ | √ | √ |
|   Basic dental treatment | √ | √ | √ | √ | √ |
|   Complicated dental treatment | √ | √ | √ | √ | √ |
| Regularity of utilization | √ | √ | √ | √ | √ |
| Place of utilization | √ | √ | √ | √ | √ |

[*] not including SSS

# CHAPTER III
# RESEARCH METHODOLOGY

## Research design

Retrospective data analysis, study of cohort behavior regarding oral health service utilization by using a series of cross sectional survey to assess changes in behavior within cohort.

## Source of data

The data in this study is micro data from the Health and Welfare Survey (HWS) of Thailand for 2003, 2007, 2009, 2011, 2013, and 2015, totally six waves of data were used. The HWS is a cross-sectional survey, carried out by National Statistical Office. While the first HWS was conducted on 1974, the information of oral health service usage appeared first time in the year 2003, but not seen in 2009, then seen again in the year 2007 and the later surveys which done in every two years. This study is received permission from National Statistical Office to using micro data.

## Data preparation

All variables were recoded into the same value before starting analysis, see appendix for detail of data dictionary. The data were verified following the conceptual framework and summary of related variables shown in table 4 of the previous chapter. In this step, the error data was excluded from analysis (for example, children who were recorded to have SSS coverage).

## Outcome variables

The outcome variables of this study were characteristics of oral health service utilization, including probability of oral health service utilization, regularity of oral health service utilization, type of oral health service, and place of utilization. This

information was based on four questions in the HWS. The English translation of those questions is shown below.

1.    Did you use any oral health service in 12 months preceding the survey?

2.    How many visits of oral health service utilization in 12 months preceding the survey?

3.    What was the type of oral health service utilization that you use in the latest visits? (This question allowed for two answers but they were priority ranked by respondents. The first priority ranking was included in analysis.)

4.    Where did you receive oral health service in the latest visits?

After that, each dependent variable was categorized into dichotomous data. The detail of each variable was showed below.

- Probability of oral health service utilization was categorized into dichotomous data, 0 = no, and 1 = yes.

- Regularity of oral health service utilization was categorized into dichotomous data, 0 = once a year, and 1 = more than once a year, which grouping from number of dental visit they used in the past 12 months.

- Type of oral health service was divided into three categories including 'Oral health prevention', 'Basic dental treatment', and 'Complicated dental treatment'. Then dummy variables for each type of oral health service were created.

- Place of oral health service utilization was meaning to the provider that provided dental health service for sample in the latest visit, which was categorized into dichotomous data, 0 = public provider, and 1 = private provider.

**Independent/ Explanatory variables**

Individuals' sociodemographic characteristics were used as independent variables, which were divided into 3 groups. The first group was predisposing-individual factor, which were birth cohort, age group or age, gender, education of individual, working status of individual, marital status of individual, and role in family. The value for birth year was calculated from survey year minus recorded age, then the

data were organized by dividing the population into groups of similar birth year, totally seven groups, or birth cohorts. Table 5 showed the relation among age and birth cohort which used in this study.

*Table 5: Dummy table of relation among age-period-cohort*

| Cohort | Survey year | | | | | |
|---|---|---|---|---|---|---|
| | 2015 | 2013 | 2011 | 2009 | 2007 | 2003 |
| After 2000 | 0-14 | 0-12 | 0-10 | 0-8 | 0-6 | 0-2 |
| 1991-2000 | 15-24 | 13-22 | 11-20 | 9-18 | 7-16 | 3-12 |
| 1981-1990 | 25-34 | 23-32 | 21-30 | 19-28 | 17-26 | 13-22 |
| 1971-1980 | 35-44 | 33-42 | 31-40 | 29-38 | 27-36 | 23-32 |
| 1961-1970 | 45-54 | 43-52 | 41-50 | 39-48 | 37-46 | 33-42 |
| 1951-1960 | 55-64 | 53-62 | 51-60 | 49-58 | 47-56 | 43-52 |
| 1941-1950 | 65-74 | 63-72 | 61-70 | 59-68 | 57-66 | 53-62 |
| Before 1941 | $\geq 75$ | $\geq 73$ | $\geq 71$ | $\geq 69$ | $\geq 67$ | $\geq 63$ |

The second group of independent variables was predisposing-family factors, which were household size, education of family head, working status of family head, and marital status of family head. In this group, the related variables were created by identifying household members, their household numbers were coded, then the total number of members in each household was counted and recorded as the value for variable 'Household size'. The related characteristics of family heads, which were education, working status, and marital status, were applied to all of their family members by transferring the value of each of the variables from the individual who was recorded as head of family to all other members. Thus all members in the same household would have the same value on these variables.

The last group was enabling factors, which were area of residence, region of residence, and type of health insurance. Since the respondents might indicate more than one source of health insurance, only the primary health insurance was used for analysis.

**Sampling technique**

The HWS is a self-reported data on welfare status and health service utilization, through face-to-face interview, by training staff of National Statistic Office, from members of representative households, structured questionnaire was used. The

stratified two - stage sampling technique was done to obtain a representative sample of households, the first stage was divided country into provincial strata, and the number of strata was depended on the actual number of province at that time. Then dividing each provincial stratum into areas, urban and rural, boundary by municipality. After that, each area was divided into enumeration areas (EA). The representative EA were independently random sampling by using proportion of urban and rural EA in each province. Another stage was the sampling of household, started by listing all household in each selected EA independently, and then rearranged them by 'number of family members' & 'economical type of household', the representative households were random sampling from that list. All of representative households' members are samples of the survey.

*Table 6: Details of data collection in each surveys (2007 – 2015)[*]*

| Topic | Survey year | | | | |
|---|---|---|---|---|---|
| | 2007 | 2009 | 2011 | 2013 | 2015 |
| **Stratum (province)** | 76 | 76 | 76 | 77 | 77 |
| **Enumeration area** | | | | | |
| Urban-EA | 1,107 | 1,112 | 1,112 | 1,020 | 2,040[**] |
| Rural-EA | 938 | 820 | 820 | 970 | 1,940[**] |
| Total EA (n) | 2,045 | 1,932 | 1,932 | 1,990 | 3,980[**] |
| TOTAL EA (N) | 109,966 | 109,966 | 109,966 | 127,460 | 127,460 |
| **Ratio of HH:EA** | | | | | |
| Urban | 15 | 15 | 15 | 16 | 16 |
| Rural | 10 | 12 | 12 | 12 | 12 |
| **Number of HH** | | | | | |
| Urban | 16,605 | 16,680 | 16,680 | 16,320 | 32,640 |
| Rural | 9,380 | 9,840 | 9,840 | 11,640 | 23,280 |
| Total | 25,985 | 26,520 | 26,520 | 27,960 | 55,920 |
| Period of collecting data | Jan-Jun 2007 | Apr 2009 | Mar 2011 | Mar 2013 | Mar-April 2015 |

[*] The details of data collection in survey year 2003 was not received from NSO

[**] The number of EA in year 2015 was increasing from previous years because the NSO needed to report information on level of regional service provider for the 13 regions following the actual service system of MOPH at present, not identical to the geographic regional classification.

**Weighting technique**

The results were presented in unit of region population, totally 5 regions which were Bangkok, Central (except BKK), Northern, Northeast (Isan), and Southern. Each region was divided into two groups by area, urban (inside municipality) and rural (outside municipality).

The first step was weighing for total sample at each 'age and sex group'. The actual number of sample at each age and sex group in each representative 'UA-area-province-region' was weighted for total sample size if all of UA-area-province-region was surveyed. The second step was weighing for total population at each 'age and sex group'. The actual number of population at each age and sex group in each representative 'UA-area-province-region' was weighted for total population if all of UA-area-province-region was surveyed. The last step was transforming the sample-population ratio from survey to actual sample-population ratio by using rule of three in arithmetic with forecast population.

In short, the adjustments were made so that the final sample age and sex group distribution was the same as that estimated for the actual population at that time. The weighting value from these processes was called "Population weight". In addition, this study was used another weighting value which was called "Proportional weight" (see table 7). The proportional weight is a constant value for each HWS, which was calculated from dividing population size by sample size. The objective of proportional weight was to reduce the size of population into smaller sample size which appropriate for using inferential statistics.

**Sample size and Study population**

The HWS' micro data at the individual level. The target population of this study is all population. The total number of sample and population in each HWS are shown in table 7.

*Table 7: Number of sample and population, and proportional weighted.*

| Year of HWS | Sample size (unweighted) | Population size (weighted) | Proportional weighted |
|---|---|---|---|
| 2003 | 68,433 | 63,884,552 | 0.001071 |
| 2007 | 69,679 | 65,644,404 | 0.001061 |
| 2009 | 73,087 | 66,788,572 | 0.001094 |
| 2011 | 71,847 | 67,495,323 | 0.001064 |
| 2013 | 71,533 | 66,263,166 | 0.001080 |
| 2015 | 139,858 | 67,163,733 | 0.002082 |

**Data analysis**

The population's characteristics and behavior using dental health services were observed at points in time following the time of surveys from 2003 - 2015. Descriptive and binary logistic regression analysis were two main statistical methods used in this study.

Descriptive analysis was used for comparing sociodemographic characteristics and oral health service utilization among six surveys. In this analysis, sample size was weighted by using population weights, thus the differences among population were directly compared without using any inferential statistics. The relationships among sociodemographic characteristics of populations were reorganized into an informal diagram of relationships which would use for choosing appropriate explanatory variables for the later part of analysis. The informal diagram of relationships among variables was not tested for actual associations.

Binary logistic regression with list wise deletion of cases with missing information was used for exploring the relationships among sociodemographic characteristics and oral health service utilization over time. In this analysis, sample size was weighted by using proportional weights. A series of models were estimated to test the effects of independent variables, both individually and in groups, on behavior related to use of oral health services. All series were estimated for the whole population, which included samples from all age groups, a total of seven age groups, and then each age group separately. The composition of explanatory variables and the objective of each model is showed in table 8.

*Table 8: Composition of explanatory variables and objectives of models for prediction oral health service utilization.*

| Model | Explanatory variables | Objective |
|---|---|---|
| 0 | each singly explanatory variable | To explore association of each explanatory variable and oral health service utilization. |
| 1A | each singly explanatory variable combine with age group*, and birth cohort | To explore association of each explanatory variable and oral health service utilization when considering the effect of time. |
| 1B | all explanatory variables combine with age group*, and birth cohort | To explore association of each explanatory variable and oral health service utilization when considering the effect of time and other independent variables. |
| 1,2, 2A (base model) | age group*, birth cohort, education of family head, education of individual, and gender | To set the appropriate model using as base model for testing association among three different groups of explanatory variables and oral health service utilization. |
| 3, 3A | Base model + predisposing-individual factor | To test the effect of predisposing-individual factor to oral health service utilization. |
| 4, 4A | Base model + predisposing-individual factor + predisposing-family factor | To test the effect of predisposing-individual factor and predisposing – family factor to oral health service utilization. |
| 5, 5A | Base model + predisposing-individual factor + predisposing-family factor + enabling factor | To test the effect of predisposing-individual factor, predisposing-family factor, and enabling factor to oral health service utilization. |

Notes: all models were estimated both for all age groups combined and separately by age group. In models of separate age groups, the explanatory variables for models 2 – 5 were not exactly the same, the selecting variables depending on the level of association to oral health service utilization from models 1, 1A, and 1B.
*for models of separate age groups, age in years was used instead.

The analysis was carried out with the software package SPSS version 22. The significance levels for binary logistic regressions were estimated at p-value 0.01, 0.05, and 0.0001. The power of prediction is showed in terms of -2 Log likelihood, and Nagelkerke R2. The Hosmer & Lemeshow test was used for testing the goodness of fit of predicted equations.

**Ethical consideration**

This study was approved from the ethics review committee for research involving human research subjects, health science group, Chulalongkorn University, on the condition of using secondary data (COA No. 104/2017).

**Limitation of the study**

Firstly, data from the HWS is a self-reported information which asking about the experience of health utilization in the past 12 months, thus the information might be affected by the memory and honesty of interviewees. Secondly, the data about dental health service utilization was firstly found in the 2003 HWS questionnaire, it is only 6 surveys that present this data, covering thirteen years' period totally until now. Therefore, it might be seen only small change in situation of interest, however this methodology would be more and more useful as more survey rounds accumulate in the future.

**Expected benefit and outcome**

The result would be useful for dental health administrators and policy makers. This information would help them in planning of oral health service system that match for the changes in sociodemographic of future population. Furthermore, this study will be an example of method for understanding the dynamic change of people which related to health service system, by using new design for analyzing survey data, which may be inspire other health system planners in Thailand. The approach of distinguishing age group differences, from age related changes across the experience of a cohort might provide important insights that would have application in many other areas of public health.

**Budget**

3,000 Baht (for publication)

**Timeline**

| Process | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|
| Developing Proposal | / | / | / | | | | | | | |
| Proposal Examination | | | | / | | | | | | |
| Ethical Approval | | | | | / | / | | | | |
| Data Analysis | | | | | | | / | | | |
| Report Writing | | | | | | | / | / | | |
| Thesis Examination | | | | | | | | | / | |
| Publication | | | | | | | | | | / |

# CHAPTER IV
# RESULT

## Part 1: Descriptive analysis

### 1.1 Population structure

The composition of population from each surveys which were cross-sectional observations showed differences among years as seen from table 9, which was consistent with the changes in overall population of Thailand according to annually estimations. Number of people in early childhood and childhood group were steadily declined from year 2003 to 2015, however, the changes of population could not see clearly direction in adolescent and early adult group, while late adult, and elderly group were remarkably increased in proportion from year 2003 to 2015. The variables that represented the characteristics of family also showed consistency with other estimations. The proportion of small size-household tended to increase, while the larger size was in contrast. The family head tended to have higher educational level in more recently surveys, and less proportion in married status, while working status did not show clearly direction of changes.

The differences in population composition among surveys could be seen in the view of birth cohort too, because age and birth year are truly related to each other. This can conclude that considering data in the view of surveys could show the change of population structure in the whole picture, but this is not appropriate for comparison the detail of characteristics changes in population which should be considered in the view of birth cohort from each age group separately.

*Table 9: Population structure and family characteristics among the survey 2003 –*
*2015, percentage distributions.*

| Variable | Survey year | | | | | |
|---|---|---|---|---|---|---|
| | 2003 | 2007 | 2009 | 2011 | 2013 | 2015 |
| Total population | 63,884,552 | 65,644,404 | 66,788,572 | 67,495,323 | 66,263,166 | 67,163,733 |
| Age group (%) | | | | | | |
| Early childhood | 9.6 | 8.9 | 8.1 | 7.5 | 6.9 | 6.8 |
| Childhood | 15.0 | 13.6 | 13.1 | 12.7 | 11.6 | 11.1 |
| Adolescent | 8.6 | 8.2 | 8.1 | 9.3 | 8.2 | 8.4 |
| Early Adult | 28.3 | 26.0 | 25.5 | 20.4 | 22.9 | 22.1 |
| Adult | 19.8 | 22.1 | 22.4 | 23.0 | 22.9 | 22.4 |
| Late adult | 12.9 | 14.9 | 16.1 | 19.9 | 18.9 | 20.0 |
| Elderly | 5.9 | 6.4 | 6.9 | 7.2 | 8.6 | 9.2 |
| Birth cohort (%) | | | | | | |
| before 1941 | 7.7 | 5.8 | 5.2 | 4.8 | 4.6 | 4.0 |
| 1941-1950 | 7.8 | 7.2 | 7.1 | 6.2 | 6.6 | 6.1 |
| 1951-1960 | 12.2 | 12.4 | 12.0 | 14.0 | 11.6 | 11.5 |
| 1961-1970 | 15.8 | 16.2 | 16.1 | 16.8 | 15.8 | 15.7 |
| 1971-1980 | 18.0 | 16.7 | 16.3 | 15.1 | 16.3 | 16.0 |
| 1981-1990 | 17.2 | 15.7 | 15.4 | 12.6 | 15.0 | 14.4 |
| 1991-2000 | 16.8 | 15.7 | 15.7 | 15.9 | 14.2 | 14.3 |
| after 2000 | 4.5 | 10.2 | 12.2 | 14.5 | 15.9 | 17.9 |
| Household size (%) | | | | | | |
| Small size (1-3 members) | 33.2 | 37.6 | 37.8 | 39.2 | 44.7 | 46.6 |
| Medium size (4-6 members) | 56.2 | 53.9 | 52.7 | 52.4 | 50.4 | 47.3 |
| Large size (>6 members) | 10.7 | 8.5 | 9.5 | 8.4 | 4.9 | 6.0 |
| Education of family head (%) | | | | | | |
| Total population [*] | 63,755,230 | 65,581,182 | 66,612,876 | na | 66,157,293 | 63,406,813 |
| Primary level | 77.2 | 73.5 | 72.3 | na | 66.2 | 64.3 |
| Secondary level | 14.8 | 17.3 | 18.1 | na | 20.4 | 22.6 |
| Tertiary level | 8.0 | 9.2 | 9.6 | na | 13.4 | 13.1 |
| Work status of family head (%) | | | | | | |
| Total population [*] | 63,861,652 | 65,644,404 | 66,784,447 | na | 66,257,918 | 63,775,455 |
| No work | 18.1 | 18.5 | 22.0 | na | 21.3 | 24.2 |
| Self employed | 53.0 | 51.3 | 45.8 | na | 47.9 | 46.1 |
| Public employed | 7.1 | 8.2 | 7.7 | na | 7.0 | 6.4 |
| Private employed | 21.7 | 22.0 | 24.3 | na | 23.7 | 23.2 |
| Member of co-operative group | 0.1 | 0.0 | 0.3 | na | 0.1 | 0.1 |
| Marital status of family head (%) | | | | | | |
| Total population [*] | 63,795,052 | 65,644,404 | 66,788,572 | na | 66,263,166 | 63,773,484 |
| Never married | 4.3 | 5.0 | 4.6 | na | 6.2 | 6.4 |
| Married | 80.1 | 78.2 | 78.1 | na | 75.0 | 74.6 |
| Used to married | 15.5 | 16.8 | 17.3 | na | 18.7 | 19.0 |

| Variable | Survey year | | | | | |
|---|---|---|---|---|---|---|
| | 2003 | 2007 | 2009 | 2011 | 2013 | 2015 |

*Number of total population for each variable are not the same depend on the completeness of data
na is no data available

### 1.2 Proportion of dental use and characteristic of population

The different proportion of self-reported dental care services use in the preceding year, let say dental use, or DU, among age group were clearly seen from table 10, childhood showed the highest DU, while the lowest found in early childhood group. But we could not see clearly direction of changes in DU among age group when consider by survey and birth cohort, these confirm the necessary of using multiple logistic regression for revealing much smoother trend of changes of DU over time, when the joint effects of age group and birth cohort have been removed.

However, the appropriate assumptions for multiple logistic regression models could get from initial findings of dental use and also characteristic of population from descriptive analysis which could make us more understanding in this set of data. From the result of DU by age group, the independent variables could be grouping into two main groups depending on their effects to DU, the first group was variables which had similar effect to DU among age groups, while another group was variables which had different effect to DU among age groups.

*Table 10: Proportion of dental use by age group, various independent variables.*

| Variable | Early childhood | Childhood | Adolescent | Early Adult | Adult | Late adult | Elderly |
|---|---|---|---|---|---|---|---|
| Total | 0.04 | 0.14 | 0.10 | 0.08 | 0.09 | 0.10 | 0.07 |
| Survey year | | | | | | | |
| 2003 | 0.04 | 0.17 | 0.11 | 0.09 | 0.10 | 0.11 | 0.07 |
| 2007 | 0.03 | 0.13 | 0.08 | 0.07 | 0.09 | 0.10 | 0.07 |
| 2009 | 0.03 | 0.15 | 0.09 | 0.08 | 0.08 | 0.11 | 0.08 |
| 2011 | 0.03 | 0.11 | 0.12 | 0.09 | 0.09 | 0.10 | 0.06 |
| 2013 | 0.04 | 0.14 | 0.12 | 0.09 | 0.09 | 0.10 | 0.07 |
| 2015 | 0.06 | 0.12 | 0.10 | 0.08 | 0.07 | 0.08 | 0.06 |
| Birth cohort | | | | | | | |
| Before 1941 | - | - | - | - | - | 0.09 | 0.06 |
| 1941-1950 | - | - | - | - | - | 0.10 | 0.09 |
| 1951-1960 | - | - | - | - | 0.10 | 0.10 | - |
| 1961-1970 | - | - | - | 0.10 | 0.09 | 0.09 | - |
| 1971-1980 | - | - | 0.10 | 0.09 | 0.08 | - | - |
| 1981-1990 | - | 0.12 | 0.10 | 0.08 | - | - | - |
| 1991-2000 | 0.07 | 0.14 | 0.10 | 0.07 | - | - | - |
| After 2000 | 0.03 | 0.14 | - | - | - | - | - |

| Variable | Early childhood | Childhood | Adolescent | Early Adult | Adult | Late adult | Elderly |
|---|---|---|---|---|---|---|---|
| Gender | | | | | | | |
| Male | 0.04 | 0.13 | 0.08 | 0.06 | 0.07 | 0.09 | 0.07 |
| Female | 0.04 | 0.15 | 0.12 | 0.11 | 0.10 | 0.11 | 0.07 |
| Education of individual [a] | | | | | | | |
| Primary level | na | na | 0.08 | 0.05 | 0.07 | 0.08 | 0.06 |
| Secondary level | na | na | 0.11 | 0.07 | 0.09 | 0.13 | 0.13 |
| Tertiary level | na | na | 0.13 | 0.15 | 0.17 | 0.21 | 0.20 |
| Work status of individual [b] | | | | | | | |
| No work | na | na | na | 0.10 | 0.09 | 0.11 | 0.06 |
| Self-employee | na | na | na | 0.07 | 0.08 | 0.09 | 0.09 |
| Public employee | na | na | na | 0.13 | 0.15 | 0.16 | 0.12 |
| Private employee | na | na | na | 0.08 | 0.08 | 0.09 | 0.09 |
| Marital status of individual | | | | | | | |
| Never married | na | na | na | 0.09 | 0.10 | 0.12 | 0.07 |
| Married | na | na | na | 0.08 | 0.09 | 0.10 | 0.08 |
| Used to married | na | na | na | 0.07 | 0.08 | 0.10 | 0.06 |
| Role in family | | | | | | | |
| Head | na | na | na | 0.11 | 0.09 | 0.10 | 0.08 |
| Spouse | na | na | na | 0.11 | 0.10 | 0.10 | 0.07 |
| Other | na | na | na | 0.07 | 0.07 | 0.08 | 0.05 |
| Household size | | | | | | | |
| Small size (1-3 members) | 0.04 | 0.15 | 0.11 | 0.10 | 0.10 | 0.11 | 0.08 |
| Medium size (4-6 members) | 0.04 | 0.14 | 0.10 | 0.07 | 0.08 | 0.09 | 0.06 |
| Large size (> 6 members) | 0.03 | 0.09 | 0.09 | 0.05 | 0.06 | 0.06 | 0.05 |
| Education of family head [a] | | | | | | | |
| Primary level | 0.03 | 0.13 | 0.08 | 0.06 | 0.07 | 0.08 | 0.06 |
| Secondary level | 0.05 | 0.16 | 0.11 | 0.10 | 0.09 | 0.12 | 0.10 |
| Tertiary level | 0.07 | 0.22 | 0.18 | 0.17 | 0.17 | 0.20 | 0.15 |
| Work status of family head [b] | | | | | | | |
| No work | 0.03 | 0.13 | 0.09 | 0.08 | 0.07 | 0.10 | 0.07 |
| Self-employee | 0.04 | 0.15 | 0.10 | 0.07 | 0.08 | 0.09 | 0.07 |
| Public employee | 0.06 | 0.19 | 0.14 | 0.14 | 0.14 | 0.15 | 0.06 |
| Private employee | 0.04 | 0.13 | 0.09 | 0.09 | 0.08 | 0.10 | 0.07 |
| Marital status of family head | | | | | | | |

| Variable | Early childhood | Childhood | Adolescent | Early Adult | Adult | Late adult | Elderly |
|---|---|---|---|---|---|---|---|
| Never married | 0.03 | 0.10 | 0.12 | 0.11 | 0.12 | 0.13 | 0.07 |
| Married | 0.04 | 0.15 | 0.10 | 0.08 | 0.08 | 0.10 | 0.07 |
| Used to married | 0.03 | 0.13 | 0.08 | 0.07 | 0.08 | 0.09 | 0.07 |
| Area of residence | | | | | | | |
|   Bangkok | 0.05 | 0.15 | 0.17 | 0.14 | 0.14 | 0.17 | 0.14 |
|   Urban | 0.04 | 0.13 | 0.12 | 0.08 | 0.09 | 0.10 | 0.07 |
|   Rural | 0.04 | 0.14 | 0.09 | 0.07 | 0.08 | 0.09 | 0.06 |
| Region of residence | | | | | | | |
|   Bangkok | 0.05 | 0.15 | 0.17 | 0.14 | 0.14 | 0.17 | 0.14 |
|   Central | 0.03 | 0.11 | 0.09 | 0.07 | 0.08 | 0.09 | 0.06 |
|   Northern | 0.04 | 0.18 | 0.11 | 0.08 | 0.09 | 0.10 | 0.07 |
|   Northeastern | 0.04 | 0.14 | 0.09 | 0.07 | 0.07 | 0.08 | 0.06 |
|   Southern | 0.03 | 0.12 | 0.10 | 0.08 | 0.09 | 0.10 | 0.06 |
| Health insurance | | | | | | | |
|   Not have any health insurance | 0.02 | 0.12 | 0.12 | 0.07 | 0.06 | 0.12 | 0.11 |
|   UCS | 0.04 | 0.13 | 0.09 | 0.07 | 0.07 | 0.08 | 0.06 |
|   SSS | na | na | na | 0.11 | 0.12 | 0.14 | 0.12 |
|   CSMBS | 0.07 | 0.20 | 0.16 | 0.15 | 0.16 | 0.16 | 0.11 |
|   Other [c] | 0.04 | 0.23 | 0.30 | 0.11 | 0.15 | 0.17 | 0.10 |

na = Not application.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Not showed result of people in member of co-operative group because of very small sample size.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

*1.2.1 Variables with similar effect to dental use among age groups*

From table 10, there were four variables that showed the same direction of changes in DU for all age groups, which were 'Education of individual', 'Role in family', 'House size', and 'Education of family head'.

The result showed that DU was increased by level of education, both by education of themselves and also by their family head's. In term of role in family, either the family head or their spouse also had the highest DU, and it was nearly the same proportion, while other role in family always had the lowest DU. The last variable in this group was household size, which showed decreasing in DU when size of household was increased. All those relations showed similar result among age groups, so these variables would be the clue for exploring the association to dental use in this study.

*1.2.1.1 Education of family head and related variables*

The information from aggregated data (table 11) showed the tendency of increased proportion of tertiary educational level and decreased of primary level in people whose family head had higher education, or say that, individual' education tend to increase by family head' education. While the size of household tends to decreased when family head was increased in education. And as relation of role in family and household size, the more proportion of smaller household size, the more proportion of family head and spouse.

*Table 11: Proportion of individuals' education and household size by family heads' education.*

| Variable | Educational level of family head | | |
|---|---|---|---|
| | Primary | Secondary | Tertiary |
| % of $N^a$ (n = 301,011) | 71.0% | 18.1% | 10.9% |
| Education of individual | | | |
|    Primary level | 0.77 | 0.18 | 0.09 |
|    Secondary level | 0.17 | 0.71 | 0.13 |
|    Tertiary level | 0.06 | 0.11 | 0.78 |
| % of $N^b$ (n =414,475) | 70.7% | 18.6% | 10.7% |
| Household size | | | |
|    Small size (1-3 members) | 0.37 | 0.47 | 0.50 |
|    Medium size (4-6 members) | 0.54 | 0.48 | 0.47 |
|    Large size (>6 members) | 0.09 | 0.05 | 0.03 |

[a] Included cases were early adult to elderly, Population size after weighting was 230,963,799.
b Included all age groups, Population size after weighting was 325,513,393.

*1.2.1.2 Education of individual and related variables*

Moreover, from the relationship among those first group of clue variables, we could track more information from education of individual, which should be directly affect to their own predisposing factors, working and marital status. However, for reducing the confounder by age, this group of variables would be considered only for people in the group of working age which were early adult to late adult.

The result from aggregated data (table 12) showed the increased proportion of people working in formal sectors, public and private employees, when their education were increased. These affected to type of health insurance and place of residence which

related to type of work, the more proportion of working in formal sectors, the more proportion of people covered by SSS and CSMBS, and also the more proportion of living in Bangkok and urban area, while the less proportion in the Northern and Northeastern region.

In term of marital status, there were tendency of never married status in people with higher education, while decreasing in married and used to married status. Thus the different DU among marital statuses, which showed the highest in never married people, might be confounded by level of education.

*Table 12: Proportion of individuals' working status by individuals' education.*

| Variable | Educational level of individual | | |
|---|---|---|---|
| | primary | secondary | tertiary |
| % of N[a] | 55.5% | 28.4% | 16.1% |
| Work status of individual | | | |
| No work | 0.14 | 0.09 | 0.10 |
| Self-employee | 0.58 | 0.43 | 0.23 |
| Public employee | 0.02 | 0.07 | 0.29 |
| Private employee | 0.26 | 0.41 | 0.38 |
| Health insurance | | | |
| Not have any health insurance | 0.02 | 0.02 | 0.02 |
| UCS | 0.84 | 0.62 | 0.27 |
| SSS | 0.09 | 0.28 | 0.41 |
| CSMBS | 0.04 | 0.07 | 0.27 |
| Other | 0.01 | 0.01 | 0.03 |
| Area of residence | | | |
| Bangkok | 0.08 | 0.14 | 0.27 |
| Urban | 0.20 | 0.28 | 0.36 |
| Rural | 0.72 | 0.58 | 0.37 |
| Region of residence | | | |
| Bangkok | 0.08 | 0.14 | 0.27 |
| Central | 0.23 | 0.31 | 0.29 |
| Northern | 0.2 | 0.15 | 0.13 |
| Northeastern | 0.36 | 0.26 | 0.18 |
| Southern | 0.13 | 0.14 | 0.13 |
| Marital status of individual | | | |
| Never married | 0.11 | 0.29 | 0.37 |
| Married | 0.78 | 0.65 | 0.59 |
| Used to married | 0.11 | 0.06 | 0.04 |

[a] Included case were early adult to late adult for all variables, but the numbers of cases are different because the cell counts have been rounded. Sample size (n) of working status = 306,792, n of health insurance = 306,565, n of area of residence = 306,890, n of region of residence = 306,890, and n of marital status = 306,866. Population size after weighted (N) of working status = 251,105,375, N of health insurance = 250,942,262, N of area of residence = 251,206,674, N of region of residence = 251,206,675, and N of marital status = 251,187,042.

To confirm the assumption that type of health insurance and place of residence were related to working status of individual, let considered DU again.

In the group of early adult to late adult, considering in term of working status (table 13), DU were highest in people who were public employees, followed by no work people, while self-employees and private employees which showed similar proportion were the lowest. Nevertheless, when considering in term of health insurance and working status, except for people with no wok, DU were highest in people who covered by CSMBS, followed by SSS, and UCS. The effect of health insurance was clearly seen especially in people who were self- and private employees.

In the relation among working status and health insurance, we should consider working status of family head too, because the criteria of one health insurance scheme, CSMBS, was also covered other people in family. As we seen from table 10 that people whose family head were public employees showed remarkably higher DU than all other working status.

These could say that type of health insurance had more impact to dental use, however, working status of both individuals' and their family heads' lead to the opportunity to get better type of health insurance.

*Table 13: Proportion of dental use in working age group (early adult to late adult).*

| Health insurance | Working status | | | |
|---|---|---|---|---|
| | No work | Self-employee | Public employee | Private employee |
| Not have any health insurance | 0.11 | 0.09 | 0.00 | 0.04 |
| UCS | 0.09 | 0.07 | 0.09 | 0.06 |
| SSS | 0.17 | 0.14 | 0.13 | 0.11 |
| CSMBS | 0.15 | 0.15 | 0.17 | 0.12 |
| Other | 0.15 | 0.17 | 0.23 | 0.09 |
| Total | 0.10 | 0.08 | 0.15 | 0.08 |

*1.2.2 Variables with different effect to dental use among age groups*

Apart from the previous group of variables which had similar effect to DU among age groups, the second group of variables were in contrast. The variables in this group were 'Gender', 'Place of residence (area and region)', and 'Marital status of family head'.

*1.2.2.1 Gender*

The different DU among genders (table 14), higher in female, were found in childhood to late adult groups, while in early childhood and elderly were the same. These differences might be related to other factors but the result did not show the same direction of effect to DU among age groups. Such as level of individual education, which we found from previous result that higher education leads to higher proportion of dental use, therefore, in female which had higher DU should have more proportion of higher education too, but this result was not found in adult and late adult, even it could see in adolescent and early adult group. Furthermore, as I mentioned that marital status of individual might be linked to DU by educational level, but when comparing among genders, the result was not coinciding with the first assumption anymore. No matter what level of education they are, married male shifted to be the highest DU instead, while never married female still be the highest DU among their genders (table 15).

The unusual effect to DU among genders was also seen in term of health insurance, although we concluded from previous result that people whom covered by CSMBS always had higher proportion of dental use than SSS and UCS, thus female of working age group should show higher proportion in the CSMBS and SSS group than male, but this relationship was eccentric in adult and late adult group.

Therefore, the difference of dental use among male and female may be affected by gender itself, it might not relate to any other variables, except for education in adolescent and early adult groups.

*Table 14: Proportion of people in related variable by age group and gender.*

| Variable | Adolescent (N = 33,611,905) | | Early Adult (N = 95,850,481) | | Adult (N = 87,773,636) | | Late adult (N = 68,019,231) | |
|---|---|---|---|---|---|---|---|---|
| | male | female | male | female | male | female | male | female |
| Education of individual | | | | | | | | |
| Primary level | 0.17 | 0.15 | 0.34 | 0.31 | 0.58 | 0.65 | 0.76 | 0.85 |
| Secondary level | 0.76 | 0.78 | 0.48 | 0.43 | 0.27 | 0.20 | 0.14 | 0.07 |
| Tertiary level | 0.07 | 0.07 | 0.18 | 0.26 | 0.15 | 0.15 | 0.10 | 0.08 |

| Variable | Adolescent (N = 33,611,905) | | Early Adult (N = 95,850,481) | | Adult (N = 87,773,636) | | Late adult (N = 68,019,231) | |
|---|---|---|---|---|---|---|---|---|
| | male | female | male | female | male | female | male | female |
| Health insurance | | | | | | | | |
| Not have any health insurance | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 |
| UCS | 0.86 | 0.88 | 0.64 | 0.58 | 0.69 | 0.71 | 0.75 | 0.79 |
| SSS | 0.00 | 0.00 | 0.29 | 0.33 | 0.19 | 0.17 | 0.08 | 0.05 |
| CSMBS | 0.09 | 0.07 | 0.03 | 0.04 | 0.08 | 0.09 | 0.14 | 0.13 |
| Other | 0.02 | 0.02 | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 |

*Table 15: Proportion of dental use by gender and individuals' marital status in early adult to elderly.*

| Marital status of individual | Gender | |
|---|---|---|
| | male | female |
| Never married | 0.06 | 0.13 |
| Married | 0.07 | 0.10 |
| Used to married | 0.06 | 0.09 |

### 1.2.2.2 Place of residence

Almost all age groups, except for childhood, DU was highest in people who lived in Bangkok, followed by urban, and rural people were the lowest. The effect of place of residence to dental use might be related to education of individual, which seen from the proportion of people in adolescent to elderly groups who lived in Bangkok had more proportion of higher education than people in urban and rural area respectively (table 16). Anyway, when comparing DU by controlling for education and age group (table 17), the highest proportion was still found in Bangkok people, but nearly the same for urban and rural people, furthermore, in some groups of people, the rural people showed higher DU than urban people too. These result could tell us that the association among place of residence and dental use was not only linked by level of education, but also other intermediate factors such as access to care which might be seen in the view of the available of provider in the area. Although the supported result to these assumptions could not directly explore from this study, but the result from comparing dental use among regions showed that people in the Central and

Northeastern region had the lowest DU, and the difference of dental use among regions was still exist even it was controlled for type of health insurance and age group.

*Table 16: Proportion of people in each age group by education of individual and area of residence.*

| Age group | Education of individual | Area of residence | | |
|---|---|---|---|---|
| | | Bangkok | Urban | Rural |
| Adolescent | Primary level | 0.08 | 0.13 | 0.18 |
| | Secondary level | 0.79 | 0.79 | 0.76 |
| | Tertiary level | 0.13 | 0.08 | 0.06 |
| Early Adult | Primary level | 0.22 | 0.23 | 0.39 |
| | Secondary level | 0.38 | 0.48 | 0.47 |
| | Tertiary level | 0.40 | 0.29 | 0.15 |
| Adult | Primary level | 0.38 | 0.47 | 0.72 |
| | Secondary level | 0.28 | 0.30 | 0.20 |
| | Tertiary level | 0.34 | 0.23 | 0.08 |
| Late adult | Primary level | 0.54 | 0.70 | 0.89 |
| | Secondary level | 0.21 | 0.15 | 0.07 |
| | Tertiary level | 0.25 | 0.16 | 0.04 |
| Elderly | Primary level | 0.68 | 0.85 | 0.96 |
| | Secondary level | 0.16 | 0.09 | 0.03 |
| | Tertiary level | 0.16 | 0.06 | 0.01 |

*Table 17: Proportion of dental use by age group, area of residence, and education of individual.*

| Age group | Area of residence | Educational level of individual | | |
|---|---|---|---|---|
| | | Primary | Secondary | Tertiary |
| Adolescent | Bangkok | 0.08 | 0.17 | 0.23 |
| | Urban | 0.07 | 0.12 | 0.15 |
| | Rural | 0.08 | 0.09 | 0.08 |
| Early Adult | Bangkok | 0.06 | 0.10 | 0.21 |
| | Urban | 0.05 | 0.07 | 0.13 |
| | Rural | 0.06 | 0.07 | 0.12 |
| Adult | Bangkok | 0.08 | 0.12 | 0.23 |
| | Urban | 0.07 | 0.08 | 0.14 |
| | Rural | 0.06 | 0.08 | 0.15 |
| Late adult | Bangkok | 0.11 | 0.17 | 0.30 |
| | Urban | 0.08 | 0.12 | 0.17 |
| | Rural | 0.08 | 0.11 | 0.18 |
| Elderly | Bangkok | 0.09 | 0.20 | 0.27 |
| | Urban | 0.06 | 0.12 | 0.15 |
| | Rural | 0.06 | 0.09 | 0.19 |

*1.2.2.3 Marital status of family head*

The result showed different effect of marital status of family head to DU among age groups. Early childhood and childhood whose family heads were married showed the highest DU. While adolescent to late adult whose family heads were never married showed the highest DU instead. And there was the same DU in elderly people even their family head had different marital status.

Although there was irregular effect of marital status of family head to DU, but one assumption from the logical relation was that household size and role of individual in family should be the linkage between marital status of their family head and DU. After tracking in detail of marital status of family head together with these variables (table 18), the result showed the higher proportion of people in small size household if their family head were never married, and also higher proportion of role of family head, or they were head of family by themselves. In contrast with household which the head was married or used to married, there were more proportion of people in medium and large size household and also showed higher proportion of other role instead.

Furthermore, the result also showed relationship among education of family head and their marital status, never married head had nearly equal proportion among three levels of educational, while married and used to married head had mainly proportion in primary educational level.

*Table 18: Proportion of household size, individual role in family, and education of family head by marital status of family head.*

| Variable | Marital status of family header | | |
| --- | --- | --- | --- |
| | Never married | Married | Used to married |
| % of $N^a$ (n = 415,494) | 5.3% | 77.2% | 17.5% |
| Household size | | | |
| Small size (1-3 members) | 0.75 | 0.37 | 0.46 |
| Medium size (4-6 members) | 0.22 | 0.55 | 0.47 |
| Large size (>6 members) | 0.03 | 0.08 | 0.07 |
| Role in family | | | |
| Head | 0.58 | 0.27 | 0.32 |
| Spouse | 0.00 | 0.24 | 0.00 |
| Other | 0.42 | 0.49 | 0.68 |
| Education of family header | | | |
| Primary level | 0.35 | 0.69 | 0.87 |
| Secondary level | 0.35 | 0.20 | 0.08 |
| Tertiary level | 0.30 | 0.11 | 0.05 |

[a] Included all age groups, population size after weighting was 326,264,679.

**1.3 Diagram of relationship among independent variables and dental use**

The results from descriptive analysis should be summarized into diagram of relationship among independent variables and dental use as showed in figure 5, and this would be used for making assumption for modelling multiple logistic regression equation. However, this diagram was only the informal representation of causal structure of dental use in this study, but it was not tested for their real relationship.
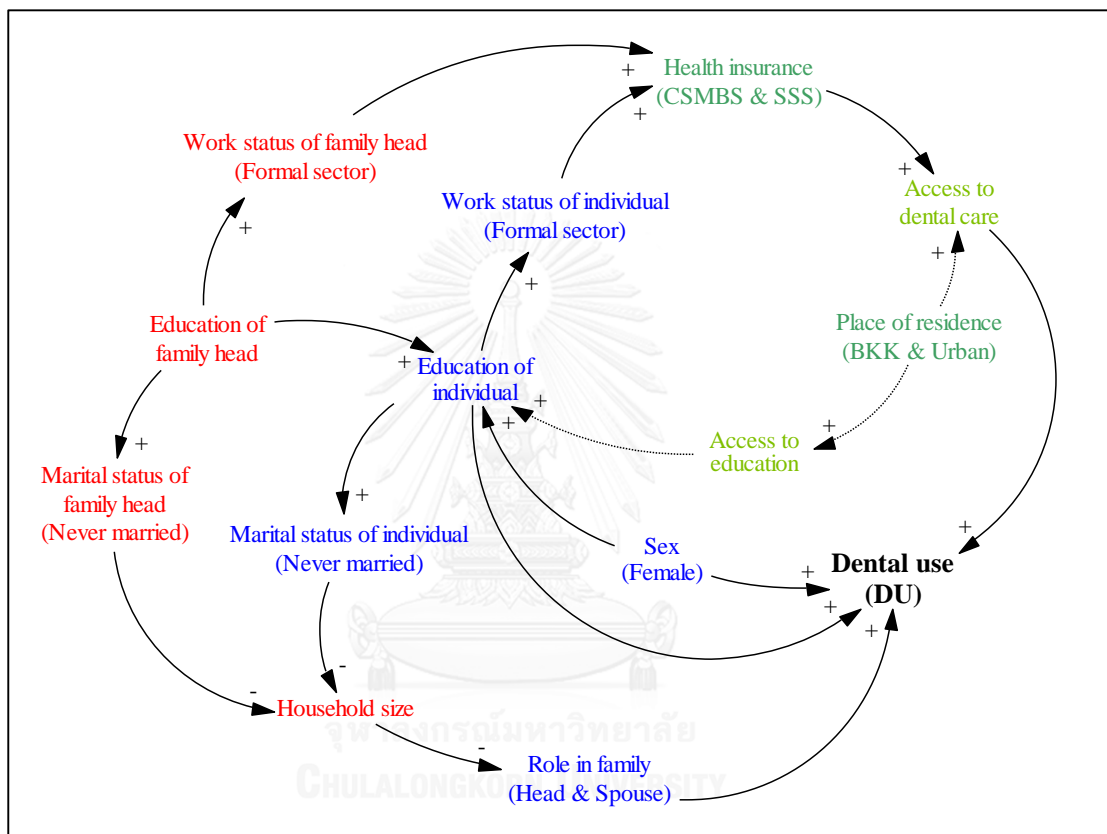


*Figure 5: Informal diagram of relationship among independent variables and dental use.*
Notes: Predisposing factors (individual characteristics) were included sex, education of individual, working status of individual, marital status of individual, and role in family.

Predisposing factors (family characteristics) were including household size, education of family head, working status of family head, and marital status of family head.

Enabling factors were included place of residence (area and region), and health insurance.

**Part 2: Multiple logistic regression models for whole population**

The association of each independent variables (IVs) to DU were generally described in previous section. In this section, I would like to present those associations when considering with other variables. Firstly, were the changes of each IVs by time which represent by age group (A), and birth cohort (C). Secondly were the changes of each IVs after controlled by all other IVs.

**2.1 The association of DU and each independent variable**

Table 19 showed summary of odds ratio (OR) for each independent variable from binary logistic regression models for predicting probability of dental service utilization of Thai (the full models are shown in table 27 - 30 of appendix). Model 0 was included each independent variable singly. Model 1A was included each independent variable together with AC, noted that OR of A and C in model 1A were from the model included AC only, OR of A and C from all other combination please see full table in appendix. Model 1B was included all independent variables together except for area of residence because the overlapping of 'Bangkok' category with the variable region of residence, and result from model 1A showed higher predicted power of region than area of residence.

*Table 19: Summary of odds ratio of each variable from multiple logistic regression models for predicting probability of dental service utilization of Thai.*

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Age group | | | | | | |
| Early childhood | 0.27 | *** | 0.27 | *** | 0.28 | *** |
| Childhood *(reference)* | | *** | | *** | | *** |
| Adolescent | 0.73 | *** | 0.70 | *** | 0.49 | *** |
| Early Adult | 0.57 | *** | 0.51 | *** | 0.35 | *** |
| Adult | 0.58 | *** | 0.45 | *** | 0.27 | *** |
| Late adult | 0.67 | *** | 0.44 | *** | 0.25 | *** |
| Elderly | 0.47 | *** | 0.36 | *** | 0.20 | *** |
| Birth cohort | | | | | | |
| Before 1941 *(reference)* | | *** | | *** | | *** |
| 1941-1950 | 1.60 | *** | 1.42 | *** | 1.26 | *** |
| 1951-1960 | 1.67 | *** | 1.36 | *** | 1.06 | |
| 1961-1970 | 1.46 | *** | 1.17 | ** | 0.84 | ** |
| 1971-1980 | 1.38 | *** | 1.03 | | 0.66 | *** |
| 1981-1990 | 1.45 | *** | 0.93 | | 0.56 | *** |
| 1991-2000 | 1.88 | *** | 0.90 | | 0.63 | *** |

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| After 2000 | 1.40 | *** | 0.85 | ** | 0.55 | *** |
| Gender | | | | | | |
| Male *(reference)* | | | | | | |
| Female | 1.46 | *** | 1.46 | *** | 1.58 | *** |
| Education of individual [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | *** |
| Secondary level | 1.16 | *** | 1.48 | *** | 1.22 | *** |
| Tertiary Level | 2.27 | *** | 3.04 | *** | 1.80 | *** |
| Work status of individual | | | | | | |
| Public-employee *(reference)* | | *** | | *** | | *** |
| Private-employee | 0.54 | *** | 0.56 | *** | 0.91 | ** |
| Self-employee | 0.50 | *** | 0.50 | *** | 1.06 | |
| Member of co-operative group | 0.49 | ** | 0.49 | ** | 0.94 | |
| No work | 0.63 | *** | 0.58 | *** | 1.02 | |
| Marital status of individual | | | | | | |
| Never married *(reference)* | | *** | | *** | | *** |
| Married | 0.85 | *** | 0.84 | *** | 0.84 | *** |
| Used to married [b] | 0.76 | *** | 0.78 | *** | 0.75 | *** |
| Role in family | | | | | | |
| Head *(reference)* | | *** | | *** | | *** |
| Spouse | 1.03 | | 1.01 | | 0.86 | *** |
| Other | 0.91 | *** | 0.69 | *** | 0.69 | *** |
| Household size | | | | | | |
| Small size (1-3 members) *(reference)* | | *** | | *** | | *** |
| Medium size (4-6 members) | 0.84 | *** | 0.80 | *** | 0.88 | *** |
| Large size ( > 6 members) | 0.58 | *** | 0.56 | *** | 0.67 | *** |
| Education of family head [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | *** |
| Secondary level | 1.43 | *** | 1.48 | *** | 1.20 | *** |
| Tertiary Level | 2.59 | *** | 2.69 | *** | 1.52 | *** |
| Work status of family head | | | | | | |
| Public-employee *(reference)* | | *** | | *** | | *** |
| Private-employee | 0.59 | *** | 0.61 | *** | 0.93 | ** |
| Self-employee | 0.59 | *** | 0.59 | *** | 1.06 | * |
| Member of co-operative group | 0.53 | ** | 0.52 | *** | 1.03 | |
| No work | 0.55 | *** | 0.57 | *** | 0.94 | * |
| Marital status of family head | | | | | | |
| Never married *(reference)* | | *** | | *** | | *** |
| Married | 0.77 | *** | 0.73 | *** | 1.17 | *** |
| Used to married [b] | 0.68 | *** | 0.65 | *** | 1.15 | *** |
| Area of residence | | | | | | |
| Bangkok *(reference)* | | *** | | *** | | |
| Urban | 0.59 | *** | 0.57 | *** | - | - |
| Rural | 0.53 | *** | 0.51 | *** | - | - |
| Region of residence | | | | | | |
| Bangkok *(reference)* | | *** | | *** | | *** |

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Central | 0.51 | *** | 0.50 | *** | 0.57 | *** |
| Northern | 0.63 | *** | 0.61 | *** | 0.76 | *** |
| Northeastern | 0.52 | *** | 0.50 | *** | 0.64 | *** |
| Southern | 0.57 | *** | 0.55 | *** | 0.67 | *** |
| Health insurance | | | | | | |
| UCS (reference) | | *** | | *** | | *** |
| SSS | 1.47 | *** | 1.74 | *** | 1.43 | *** |
| CSMBS | 2.04 | *** | 2.10 | *** | 1.42 | *** |
| Other [c] | 2.12 | *** | 2.18 | *** | 1.54 | *** |
| Not have any health insurance | 1.02 | | 1.08 | * | 0.90 | ** |

Notes:

Model 0 was included each independent variable singly. Model 1A was included each independent variable together with age group and cohort (AC), noted that OR of A and C were from the model included AC only, OR of AC from all other combination please see full table in appendix (table 2.6 – 2.9). Model 1B was included all independent variables together except for area of residence.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

From model 1A, after control for AC, DU among age groups and birth cohorts were smoother after controlling for each other. Only two variables showed remarkably changes of DU, the first was wider gap of different among three levels of education, the second was wider gap of different among other members and head of family. While all other variables showed similar DU either controlled for AC or not.

From model 1B, after control for all IVs, DU among age groups and birth cohorts showed unusual pattern in early childhood group, cohort 1981 - 1990 and after 2000. For all other IVs, there were 3 groups of IVs which had different patterns of changes among before and after controlled for all IVs.

The first group were IVs which showed narrower gaps of different after controlled for all IVs, they were education of both individual and family head, working status of both individual and family head, marital status of family head, region of residence, and health insurance.

Different gaps among education of individual were widest after controlled for AC, but the gaps were smaller when controlled for all IVs. This pattern was seen in

education of family head too. The gaps among regions of residence were smaller after controlled for all IVs but the ranking was the same as before controlled. DU of people who covered by SSS were much higher than UCS after controlled for AC, because this health insurance was directly related to some age group. But after controlled for all IVs, the gaps were smaller for all category of health insurance. The different gaps among working status, both for individual and family head, nearly gone after controlled for all IVs. Marital status of family head was shifted from highest to lowest for never married status.

The second group were IVs which showed wider gap of different after controlled for all IVs, they were age group, gender, and role in family. And the last group were IVs which showed no difference among before and after controlled for all IVs, they were household size and marital status of individual.

In summary, when considering DU of whole population, although all IVs had significant association to DU, education of individual and their role in family showed remarkably change of their associations to DU by time. Anyway, there were larger gaps of DU among age groups when controlled for all IVs, or referring to much differences among age groups, therefore even the predicted model of DU could be generated in term of whole population, it would be more appropriate if we could consider each age group separately.

However, before moving forward to the next section which showed the result of DU for each age group in separately, I would like to continue on modelling binary logistic regression for whole population, following my assumptions of relationship among each IV as mentioned in the informal diagram.

**2.2 The association of DU and groups of independent variables**

Before considering each groups of IVs as assumptions, the base model for all assumption was generated by selecting IVs from previous result, thus education of head and education of individual which showed the highest predicted power of binary logistic regression models, in term of family factor and individual factor respectively, were included in base model together with AC (model 2 from table 20). Moreover, as the result in part I showed that gender was independently affected to DU beyond the relation from other variables, thus another base model was generated, which included three variables - education of head, education of individual, and gender, together with

AC (model 2A from table 20). The result from model 2A showed that differences among levels of education were still the same pattern and also showed significantly difference among genders. Therefore, model 2A was more appropriate for using as base model than model 2.

*Table 20: Base models for predicting probability of dental service utilization of Thai.*

| Variables in the Equation | Model 1 | | | | Model 2 | | | | Model 2A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Constant | -1.71 | *** | 0.06 | 0.18 | -1.39 | *** | 0.07 | 0.25 | -1.61 | *** | 0.07 | 0.20 |
| Age group | | | | | | | | | | | | |
| Early childhood | -1.30 | *** | 0.03 | 0.27 | -1.28 | *** | 0.03 | 0.28 | -1.29 | *** | 0.03 | 0.28 |
| Childhood *(reference)* | | *** | | | | *** | | | | *** | | |
| Adolescent | -0.36 | *** | 0.02 | 0.70 | -0.68 | *** | 0.03 | 0.51 | -0.73 | *** | 0.03 | 0.48 |
| Early Adult | -0.67 | *** | 0.03 | 0.51 | -1.01 | *** | 0.03 | 0.36 | -1.02 | *** | 0.03 | 0.36 |
| Adult | -0.80 | *** | 0.04 | 0.45 | -1.21 | *** | 0.04 | 0.30 | -1.23 | *** | 0.04 | 0.29 |
| Late adult | -0.82 | *** | 0.04 | 0.44 | -1.24 | *** | 0.05 | 0.29 | -1.25 | *** | 0.05 | 0.29 |
| Elderly | -1.03 | *** | 0.06 | 0.36 | -1.48 | *** | 0.06 | 0.23 | -1.50 | *** | 0.06 | 0.22 |
| Birth cohort | | | | | | | | | | | | |
| before 1941 *(reference)* | | *** | | | | *** | | | | *** | | |
| 1941-1950 | 0.35 | *** | 0.04 | 1.42 | 0.28 | *** | 0.04 | 1.32 | 0.29 | *** | 0.04 | 1.33 |
| 1951-1960 | 0.31 | *** | 0.05 | 1.36 | 0.12 | * | 0.05 | 1.13 | 0.13 | ** | 0.05 | 1.14 |
| 1961-1970 | 0.16 | ** | 0.05 | 1.17 | -0.13 | * | 0.05 | 0.88 | -0.13 | * | 0.05 | 0.88 |
| 1971-1980 | 0.03 | | 0.05 | 1.03 | -0.40 | *** | 0.06 | 0.67 | -0.40 | *** | 0.06 | 0.67 |
| 1981-1990 | -0.07 | | 0.06 | 0.93 | -0.58 | *** | 0.06 | 0.56 | -0.58 | *** | 0.06 | 0.56 |
| 1991-2000 | -0.11 | | 0.06 | 0.90 | -0.50 | *** | 0.06 | 0.61 | -0.49 | *** | 0.06 | 0.61 |
| after 2000 | -0.17 | ** | 0.06 | 0.85 | -0.64 | *** | 0.07 | 0.53 | -0.62 | *** | 0.07 | 0.54 |
| Education of family head [a] | | | | | | | | | | | | |
| Primary level *(reference)* | | | | | | *** | | | | *** | | |
| Secondary level | | | | | 0.31 | *** | 0.02 | 1.37 | 0.31 | *** | 0.02 | 1.36 |
| Tertiary Level | | | | | 0.63 | *** | 0.02 | 1.88 | 0.63 | *** | 0.02 | 1.87 |
| Education of individual [a] | | | | | | | | | | | | |
| Primary level *(reference)* | | | | | | *** | | | | *** | | |
| Secondary level | | | | | 0.19 | *** | 0.02 | 1.20 | 0.23 | *** | 0.02 | 1.26 |
| Tertiary Level | | | | | 0.70 | *** | 0.02 | 2.01 | 0.72 | *** | 0.02 | 2.05 |
| Gender | | | | | | | | | | | | |
| Male *(reference)* | | | | | | | | | | *** | | |
| Female | | | | | | | | | 0.41 | *** | 0.01 | 1.51 |
| n | 494,437 | | | | 414179 | | | | 414179 | | | |
| % of dental use | 8.96 | | | | 8.92 | | | | 8.92 | | | |
| -2 Log likelihood | 294,648 | | | | 240,366 | | | | 239,024 | | | |
| Nagelkerke R Square | 0.016 | | | | 0.045 | | | | 0.052 | | | |

| Variables in the | Model 1 | | | | Model 2 | | | | Model 2A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Equation | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Hosmer and Lemeshow Test - χ2 | 7.06, df = 8, p = 0.53 | | | | 36.9, df = 7, p < 0.0001 | | | | 137.6, df = 8, p < 0.0001 | | | |

Notes:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

Then three assumptions of association among groups of IVs and DU were explored, the first group of IVs included only *predisposing-individual factors*, the second group was added more variables from *predisposing-family factors*, the last group was added more variables from *enabling factors*.

From table 21, model 3 and 3A were represent the assumption that DU was affected from "predisposing-individual factor", by included marital status of individual and role in family with model 2A. Furthermore, the interaction term of gender - education of individual, gender - marital status of individual, and gender - role in family were explored for more understanding of the relationship among gender and these IVs as drew in the informal diagram.

The result showed that after controlled for marital status of individual and their role in family, the different gaps of DU among educational levels of individual and among genders were wider, but in contrast with education of family head. Moreover, these associations were affected from the interaction among gender and each variable too. There was some combining effect among sex and education of individual, high educated female showed more DU than high educated male. While the effect among gender and education of family head was in contrast, although the heads of family who were female had higher education, their family members' DU were still lower than male head's. However, if female were in spouse position, their family members' DU were also higher than male spouse's. The interaction effect among individual gender and their marital status to DU was not different.

*Table 21: Binary logistic regression models for the assumption that DU was affected from "Predisposing-individual factor".*

| Variables in the Equation | Model 2A | | | | Model 3 | | | | Model 3A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR |
| Constant | -1.61 | *** | 0.07 | 0.20 | -1.22 | *** | 0.07 | 0.30 | -1.16 | *** | 0.07 | 0.31 |
| Age group | | | | | | | | | | | | |
| Early childhood | -1.29 | *** | 0.03 | 0.28 | -1.29 | *** | 0.03 | 0.28 | -1.28 | *** | 0.03 | 0.28 |
| Childhood (reference) | | *** | | | | *** | | | | *** | | |
| Adolescent | -0.73 | *** | 0.03 | 0.48 | -0.75 | *** | 0.03 | 0.47 | -0.76 | *** | 0.03 | 0.47 |
| Early Adult | -1.02 | *** | 0.03 | 0.36 | -1.06 | *** | 0.03 | 0.35 | -1.04 | *** | 0.03 | 0.35 |
| Adult | -1.23 | *** | 0.04 | 0.29 | -1.30 | *** | 0.04 | 0.27 | -1.28 | *** | 0.04 | 0.28 |
| Late adult | -1.25 | *** | 0.05 | 0.29 | -1.34 | *** | 0.05 | 0.26 | -1.31 | *** | 0.05 | 0.27 |
| Elderly | -1.50 | *** | 0.06 | 0.22 | -1.57 | *** | 0.06 | 0.21 | -1.54 | *** | 0.06 | 0.21 |
| Birth cohort | | | | | | | | | | | | |
| before 1941 (reference) | | *** | | | | *** | | | | *** | | |
| 1941-1950 | 0.29 | *** | 0.04 | 1.33 | 0.24 | *** | 0.04 | 1.27 | 0.24 | *** | 0.04 | 1.27 |
| 1951-1960 | 0.13 | ** | 0.05 | 1.14 | 0.08 | | 0.05 | 1.08 | 0.08 | | 0.05 | 1.09 |
| 1961-1970 | -0.13 | * | 0.05 | 0.88 | -0.17 | ** | 0.05 | 0.85 | -0.17 | ** | 0.05 | 0.85 |
| 1971-1980 | -0.40 | *** | 0.06 | 0.67 | -0.42 | *** | 0.06 | 0.66 | -0.42 | *** | 0.06 | 0.66 |
| 1981-1990 | -0.58 | *** | 0.06 | 0.56 | -0.59 | *** | 0.06 | 0.55 | -0.60 | *** | 0.06 | 0.55 |
| 1991-2000 | -0.49 | *** | 0.06 | 0.61 | -0.49 | *** | 0.07 | 0.61 | -0.50 | *** | 0.07 | 0.60 |
| after 2000 | -0.62 | *** | 0.07 | 0.54 | -0.62 | *** | 0.07 | 0.54 | -0.63 | *** | 0.07 | 0.53 |
| Education of family head [a] | | | | | | | | | | | | |
| Primary level (reference) | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.31 | *** | 0.02 | 1.36 | 0.25 | *** | 0.02 | 1.28 | 0.38 | *** | 0.03 | 1.46 |
| Tertiary Level | 0.63 | *** | 0.02 | 1.87 | 0.55 | *** | 0.02 | 1.74 | 0.72 | *** | 0.03 | 2.05 |
| Education of individual [a] | | | | | | | | | | | | |
| Primary level (reference) | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.23 | *** | 0.02 | 1.26 | 0.26 | *** | 0.02 | 1.29 | 0.01 | | 0.03 | 1.01 |
| Tertiary Level | 0.72 | *** | 0.02 | 2.05 | 0.74 | *** | 0.02 | 2.10 | 0.53 | *** | 0.03 | 1.70 |
| Gender | | | | | | | | | | | | |
| Male (reference) | | *** | | | | *** | | | | *** | | |
| Female | 0.41 | *** | 0.01 | 1.51 | 0.45 | *** | 0.01 | 1.57 | 0.34 | *** | 0.04 | 1.41 |
| Marital status of individual | | | | | | | | | | | | |
| Never married (reference) | | | | | | *** | | | | *** | | |
| Married | | | | | -0.18 | *** | 0.02 | 0.83 | -0.22 | *** | 0.03 | 0.80 |
| Used to married [b] | | | | | -0.30 | *** | 0.03 | 0.74 | -0.38 | *** | 0.05 | 0.68 |
| Role in family | | | | | | | | | | | | |
| Head (reference) | | | | | | *** | | | | *** | | |
| Spouse | | | | | -0.12 | *** | 0.02 | 0.89 | -0.29 | *** | 0.04 | 0.75 |
| Other | | | | | -0.40 | *** | 0.02 | 0.67 | -0.38 | *** | 0.03 | 0.68 |
| Interaction among gender and education of individual | | | | | | | | | | | | |

| Variables in the Equation | Model 2A | | | | Model 3 | | | | Model 3A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR |
| (Male)*(Primary level) *(reference)* | | | | | | | | | | *** | | |
| (Female)*(Secondary level) | | | | | | | | | 0.41 | *** | 0.03 | 1.50 |
| (Female)*(Tertiary level) | | | | | | | | | 0.32 | *** | 0.04 | 1.38 |
| Interaction among gender and education of family head | | | | | | | | | | | | |
| (Male)*(Primary level) *(reference)* | | | | | | | | | | *** | | |
| (Female)*(Secondary level) | | | | | | | | | -0.20 | *** | 0.03 | 0.82 |
| (Female)*(Tertiary level) | | | | | | | | | -0.25 | *** | 0.04 | 0.78 |
| Interaction among gender and role in family | | | | | | | | | | | | |
| (Male)*(Head) *(reference)* | | | | | | | | | | *** | | |
| (Female)*(Spouse) | | | | | | | | | 0.20 | *** | 0.05 | 1.22 |
| (Female)*(Other) | | | | | | | | | -0.01 | | 0.04 | 0.99 |
| Interaction among gender and marital status of individual | | | | | | | | | | | | |
| (Male)*(Never married) *(reference)* | | | | | | | | | | | | |
| (Female)*(Married) | | | | | | | | | 0.04 | | 0.04 | 1.04 |
| (Female)*(Used to married) | | | | | | | | | 0.10 | | 0.06 | 1.11 |
| n | 414179 | | | | 414,146 | | | | 414,146 | | | |
| % of dental use | 8.92 | | | | 8.92 | | | | 8.92 | | | |
| -2 Log likelihood | 239,024 | | | | 238,654 | | | | 238,259 | | | |
| Nagelkerke R Square | 0.052 | | | | 0.055 | | | | 0.056 | | | |
| Hosmer and Lemeshow Test - χ2 | 137.6, df = 8, p < 0.0001 | | | | 127.2, df = 8, p < 0.0001 | | | | 82.2, df = 8, p < 0.0001 | | | |

Notes:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

From table 22, model 4 and 4A were represent the assumption that DU was affected from "predisposing factors both individual factor and family factor", by included role in family and household size with model 2A. The interaction effects

among IVs in this set of models were explored for education of individual – role in family, and household size - role in family.

The result showed that after controlled for household size and role in family, the differences of DU among genders, education of individual, and education of family head showed the same pattern of changes like found from model 3. While interaction effect among role and education of individual showed that although spouse and other members in family had lower DU than the head, this different gaps were smaller if they had higher level of education. In addition, more equal of DU among roles in family was seen in medium size family from the irregular interaction among role in family and household size, which showed narrower gap of DU among head of family and their members. While in large size family, this gap was the same as in small size family.

*Table 22: Binary logistic regression models for the assumption that DU was affected from "Predisposing –both individual factor and family factor".*

| Variables in the Equation | Model 2A | | | | Model 4 | | | | Model 4A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Constant | -1.61 | *** | 0.07 | 0.20 | -1.24 | *** | 0.07 | 0.29 | -1.08 | *** | 0.07 | 0.34 |
| Age group | | | | | | | | | | | | |
| Early childhood | -1.29 | *** | 0.03 | 0.28 | -1.27 | *** | 0.03 | 0.28 | -1.27 | *** | 0.03 | 0.28 |
| Childhood *(reference)* | | *** | | | | *** | | | | *** | | |
| Adolescent | -0.73 | *** | 0.03 | 0.48 | -0.79 | *** | 0.03 | 0.45 | -0.87 | *** | 0.03 | 0.42 |
| Early Adult | -1.02 | *** | 0.03 | 0.36 | -1.15 | *** | 0.03 | 0.32 | -1.24 | *** | 0.04 | 0.29 |
| Adult | -1.23 | *** | 0.04 | 0.29 | -1.41 | *** | 0.04 | 0.24 | -1.50 | *** | 0.04 | 0.22 |
| Late adult | -1.25 | *** | 0.05 | 0.29 | -1.47 | *** | 0.05 | 0.23 | -1.56 | *** | 0.05 | 0.21 |
| Elderly | -1.50 | *** | 0.06 | 0.22 | -1.73 | *** | 0.06 | 0.18 | -1.82 | *** | 0.06 | 0.16 |
| Birth cohort | | | | | | | | | | | | |
| Before 1941 *(reference)* | | *** | | | | *** | | | | *** | | |
| 1941-1950 | 0.29 | *** | 0.04 | 1.33 | 0.26 | *** | 0.04 | 1.30 | 0.26 | *** | 0.04 | 1.29 |
| 1951-1960 | 0.13 | ** | 0.05 | 1.14 | 0.10 | * | 0.05 | 1.10 | 0.10 | * | 0.05 | 1.10 |
| 1961-1970 | -0.13 | * | 0.05 | 0.88 | -0.15 | ** | 0.05 | 0.86 | -0.15 | ** | 0.05 | 0.86 |
| 1971-1980 | -0.40 | *** | 0.06 | 0.67 | -0.41 | *** | 0.06 | 0.67 | -0.40 | *** | 0.06 | 0.67 |
| 1981-1990 | -0.58 | *** | 0.06 | 0.56 | -0.57 | *** | 0.06 | 0.57 | -0.58 | *** | 0.06 | 0.56 |
| 1991-2000 | -0.49 | *** | 0.06 | 0.61 | -0.46 | *** | 0.06 | 0.63 | -0.45 | *** | 0.06 | 0.64 |
| After 2000 | -0.62 | *** | 0.07 | 0.54 | -0.60 | *** | 0.07 | 0.55 | -0.58 | *** | 0.07 | 0.56 |
| Education of family head [a] | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.31 | *** | 0.02 | 1.36 | 0.24 | *** | 0.02 | 1.27 | 0.24 | *** | 0.02 | 1.27 |
| Tertiary Level | 0.63 | *** | 0.02 | 1.87 | 0.54 | *** | 0.02 | 1.71 | 0.63 | *** | 0.02 | 1.87 |
| Education of individual [a] | | | | | | | | | | | | |

| Variables in the Equation | Model 2A | | | | Model 4 | | | | Model 4A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.23 | *** | 0.02 | 1.26 | 0.26 | *** | 0.02 | 1.30 | 0.22 | *** | 0.03 | 1.25 |
| Tertiary Level | 0.72 | *** | 0.02 | 2.05 | 0.77 | *** | 0.02 | 2.15 | 0.53 | *** | 0.03 | 1.70 |
| **Gender** | | | | | | | | | | | | |
| Male *(reference)* | | *** | | | | *** | | | | *** | | |
| Female | 0.41 | *** | 0.01 | 1.51 | 0.43 | *** | 0.01 | 1.54 | 0.42 | *** | 0.01 | 1.53 |
| **Household size** | | | | | | | | | | | | |
| Small size (1-3 members) *(reference)* | | | | | | *** | | | | *** | | |
| Medium size (4-6 members) | | | | | -0.13 | *** | 0.01 | 0.88 | -0.22 | *** | 0.02 | 0.80 |
| Large size ( > 6 members) | | | | | -0.40 | *** | 0.03 | 0.67 | -0.38 | *** | 0.07 | 0.68 |
| **Role in family** | | | | | | | | | | | | |
| Head *(reference)* | | | | | | *** | | | | *** | | |
| Spouse | | | | | -0.10 | *** | 0.02 | 0.91 | -0.18 | *** | 0.03 | 0.83 |
| Other | | | | | -0.27 | *** | 0.02 | 0.77 | -0.49 | *** | 0.03 | 0.62 |
| **Interaction among education of individual and role in family** | | | | | | | | | | | | |
| (Primary level)*(Head) *(reference)* | | | | | | | | | | *** | | |
| (Secondary level)*(Spouse) | | | | | | | | | 0.05 | | 0.04 | 1.05 |
| (Secondary level)*(Other) | | | | | | | | | 0.12 | ** | 0.04 | 1.13 |
| (Tertiary level)*(Spouse) | | | | | | | | | 0.13 | ** | 0.04 | 1.14 |
| (Tertiary level)*(Other) | | | | | | | | | 0.45 | *** | 0.04 | 1.57 |
| **Interaction among household size and role in family** | | | | | | | | | | | | |
| (Small)*(Head) *(reference)* | | | | | | | | | | *** | | |
| (Medium)*(Spouse) | | | | | | | | | 0.12 | *** | 0.03 | 1.13 |
| (Medium)*(Other) | | | | | | | | | 0.14 | *** | 0.03 | 1.15 |
| (Large)*(Spouse) | | | | | | | | | 0.08 | | 0.10 | 1.09 |
| (Large)*(Other) | | | | | | | | | 0.00 | | 0.08 | 1.00 |
| n | 414179.00 | | | | 414179.00 | | | | 414179.00 | | | |
| % of dental use | 8.92 | | | | 8.92 | | | | 8.92 | | | |
| -2 Log likelihood | 239,024 | | | | 238,370 | | | | 238,223 | | | |
| Nagelkerke R Square | 0.052 | | | | 0.056 | | | | 0.056 | | | |
| Hosmer and Lemeshow Test - $\chi^2$ | 137.6, df = 8, p < 0.0001 | | | | 151.7, df = 8, p < 0.0001 | | | | 107.6, df = 8, p < 0.0001 | | | |

Notes:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

From table 23, model 5 and 5A were represent the assumption that DU was affected from all factors together, which were "predisposing factors both individual factor and family factor, and enabling factor", by included region of residence and health insurance with model 2A. The interaction effects among IVs in model 5A were explored for region of residence - education of individual, and region of residence – health insurance, these pairs of IVs were referred to access to education and access to dental service, which showed in informal diagram.

The result from model 5 was contrast from model 3 and 4. In this model which controlled for health insurance and region of residence, the different gap of DU among gender, education of individual, and education of family head were all decreased. After controlling for interaction among region of residence and education of individual, and region of residence and health insurance, the different gaps of DU among education and health insurance were wider, while the different gaps among regions was smaller. However, people in the Northeastern region always had lowest DU even they had the same level of education as other regions. Furthermore, people in all region still had lower DU than Bangkok although they had higher education. There was not much different of DU among regions for each type of public-provided health insurance, except for SSS in the Northeastern which had significantly higher DU than this group in other regions.

*Table 23: Binary logistic regression models for the assumption that DU was affected from "Predisposing factor both individual factor and family factor, and enabling factor".*

| Variables in the Equation | Model 2A | | | | Model 5 | | | | Model 5A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Constant | -1.61 | *** | 0.07 | 0.20 | -1.33 | *** | 0.07 | 0.26 | -1.58 | *** | 0.07 | 0.21 |
| Age group | | | | | | | | | | | | |
| Early childhood | -1.29 | *** | 0.03 | 0.28 | -1.29 | *** | 0.03 | 0.27 | -1.28 | *** | 0.03 | 0.28 |
| Childhood *(reference)* | | *** | | | | *** | | | | *** | | |
| Adolescent | -0.73 | *** | 0.03 | 0.48 | -0.68 | *** | 0.03 | 0.51 | -0.66 | *** | 0.03 | 0.52 |
| Early Adult | -1.02 | *** | 0.03 | 0.36 | -1.03 | *** | 0.03 | 0.36 | -1.01 | *** | 0.03 | 0.36 |
| Adult | -1.23 | *** | 0.04 | 0.29 | -1.23 | *** | 0.04 | 0.29 | -1.22 | *** | 0.04 | 0.30 |
| Late adult | -1.25 | *** | 0.05 | 0.29 | -1.25 | *** | 0.05 | 0.29 | -1.24 | *** | 0.05 | 0.29 |
| Elderly | -1.50 | *** | 0.06 | 0.22 | -1.50 | *** | 0.06 | 0.22 | -1.50 | *** | 0.06 | 0.22 |
| Birth cohort | | | | | | | | | | | | |

| Variables in the Equation | Model 2A | | | | Model 5 | | | | Model 5A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Before 1941 *(reference)* | | *** | | | | *** | | | | *** | | |
| 1941-1950 | 0.29 | *** | 0.04 | 1.33 | 0.30 | *** | 0.04 | 1.35 | 0.30 | *** | 0.04 | 1.35 |
| 1951-1960 | 0.13 | ** | 0.05 | 1.14 | 0.14 | ** | 0.05 | 1.15 | 0.15 | ** | 0.05 | 1.16 |
| 1961-1970 | -0.13 | * | 0.05 | 0.88 | -0.10 | | 0.05 | 0.91 | -0.09 | | 0.05 | 0.91 |
| 1971-1980 | -0.40 | *** | 0.06 | 0.67 | -0.36 | *** | 0.06 | 0.70 | -0.35 | *** | 0.06 | 0.70 |
| 1981-1990 | -0.58 | *** | 0.06 | 0.56 | -0.53 | *** | 0.06 | 0.59 | -0.52 | *** | 0.06 | 0.59 |
| 1991-2000 | -0.49 | *** | 0.06 | 0.61 | -0.43 | *** | 0.07 | 0.65 | -0.42 | *** | 0.07 | 0.66 |
| After 2000 | -0.62 | *** | 0.07 | 0.54 | -0.56 | *** | 0.07 | 0.57 | -0.54 | *** | 0.07 | 0.58 |
| Education of family head [a] | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.31 | *** | 0.02 | 1.36 | 0.25 | *** | 0.02 | 1.28 | 0.25 | *** | 0.02 | 1.29 |
| Tertiary Level | 0.63 | *** | 0.02 | 1.87 | 0.50 | *** | 0.02 | 1.65 | 0.50 | *** | 0.02 | 1.65 |
| Education of individual [a] | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.23 | *** | 0.02 | 1.26 | 0.17 | *** | 0.02 | 1.19 | 0.42 | *** | 0.04 | 1.53 |
| Tertiary Level | 0.72 | *** | 0.02 | 2.05 | 0.56 | *** | 0.02 | 1.75 | 0.91 | *** | 0.04 | 2.49 |
| Gender | | | | | | | | | | | | |
| Male *(reference)* | | *** | | | | *** | | | | *** | | |
| Female | 0.41 | *** | 0.01 | 1.51 | 0.41 | *** | 0.01 | 1.50 | 0.41 | *** | 0.01 | 1.50 |
| Health insurance | | | | | | | | | | | | |
| UCS *(reference)* | | | | | | *** | | | | *** | | |
| SSS | | | | | 0.26 | *** | 0.02 | 1.29 | 0.23 | *** | 0.03 | 1.26 |
| CSMBS | | | | | 0.33 | *** | 0.02 | 1.39 | 0.38 | *** | 0.04 | 1.46 |
| Other [b] | | | | | 0.42 | *** | 0.04 | 1.52 | 0.56 | *** | 0.06 | 1.75 |
| Not have any health insurance | | | | | -0.11 | ** | 0.04 | 0.90 | 0.13 | * | 0.05 | 1.14 |
| Region of residence | | | | | | | | | | | | |
| Bangkok *(reference)* | | | | | | *** | | | | *** | | |
| Central | | | | | -0.53 | *** | 0.02 | 0.59 | -0.28 | *** | 0.03 | 0.75 |
| Northern | | | | | -0.21 | *** | 0.02 | 0.81 | 0.06 | * | 0.03 | 1.06 |
| Northeastern | | | | | -0.39 | *** | 0.02 | 0.68 | -0.10 | ** | 0.03 | 0.90 |
| Southern | | | | | -0.36 | *** | 0.02 | 0.70 | -0.16 | *** | 0.03 | 0.85 |
| Interaction among region of residence and education of individual | | | | | | | | | | | | |
| (BKK)*(primary level) *(reference)* | | | | | | | | | | *** | | |
| (Central)*(secondary level) | | | | | | | | | -0.22 | *** | 0.04 | 0.81 |
| (Central)*(tertiary level) | | | | | | | | | -0.36 | *** | 0.05 | 0.70 |
| (Northern)*(secondary level) | | | | | | | | | -0.35 | *** | 0.05 | 0.70 |
| (Northern)*(tertiary level) | | | | | | | | | -0.53 | *** | 0.06 | 0.59 |

| Variables in the Equation | Model 2A | | | | Model 5 | | | | Model 5A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| (Northeastern)*(secondary level) | | | | | | | | | -0.42 | *** | 0.04 | 0.66 |
| (Northeastern)*(tertiary level) | | | | | | | | | -0.65 | *** | 0.05 | 0.52 |
| (Southern)*(secondary level) | | | | | | | | | -0.16 | ** | 0.05 | 0.85 |
| (Southern)*(tertiary level) | | | | | | | | | -0.36 | *** | 0.06 | 0.69 |
| Interaction among health insurance and region of residence | | | | | | | | | | | | |
| (UCS)*(BKK) (reference) | | | | | | | | | | *** | | |
| (SSS)*(Central) | | | | | | | | | -0.05 | | 0.05 | 0.95 |
| (SSS)*(Northern) | | | | | | | | | 0.06 | | 0.06 | 1.06 |
| (SSS)*(Northeastern) | | | | | | | | | 0.19 | ** | 0.06 | 1.21 |
| (SSS)*(Southern) | | | | | | | | | 0.07 | | 0.07 | 1.07 |
| (CSMBS)*(Central) | | | | | | | | | -0.02 | | 0.06 | 0.98 |
| (CSMBS)*(Northern) | | | | | | | | | 0.01 | | 0.06 | 1.01 |
| (CSMBS)*(Northeastern) | | | | | | | | | -0.05 | | 0.06 | 0.95 |
| (CSMBS)*(Southern) | | | | | | | | | 0.00 | | 0.06 | 1.00 |
| (Other)*(Central) | | | | | | | | | -0.32 | ** | 0.10 | 0.73 |
| (Other)*(Northern) | | | | | | | | | -0.29 | * | 0.13 | 0.75 |
| (Other)*(Northeastern) | | | | | | | | | 0.11 | | 0.13 | 1.11 |
| (Other)*(Southern) | | | | | | | | | -0.50 | ** | 0.17 | 0.61 |
| (not any)*(Central) | | | | | | | | | -0.48 | *** | 0.10 | 0.62 |
| (not any)*(Northern) | | | | | | | | | -0.61 | *** | 0.14 | 0.54 |
| (not any)*(Northeastern) | | | | | | | | | -0.37 | * | 0.15 | 0.69 |
| (not any)*(Southern) | | | | | | | | | -0.10 | | 0.13 | 0.90 |
| n | 414179 | | | | 413,875 | | | | 413,875 | | | |
| % of dental use | 8.92 | | | | 8.92 | | | | 8.92 | | | |
| -2 Log likelihood | 239,024 | | | | 237,451 | | | | 237,144 | | | |
| Nagelkerke R Square | 0.052 | | | | 0.06 | | | | 0.061 | | | |
| Hosmer and Lemeshow Test - χ2 | 137.6, df = 8, p < 0.0001 | | | | 92.7, df = 8, p < 0.0001 | | | | 64.7, df = 8, p < 0.0001 | | | |

Notes:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Nonpublic-provided health insurances such as insurance company, and employer pay.

* p < 0.05, ** p < 0.01, *** p < 0.0001, Symbol in reference line meaning to significant level of that variable in the whole picture.

In conclusion for association of DU and groups of independent variables, when the model was controlled only predisposing-individual factors, model 3, gender showed more remarkably impact to DU than other control variables. While after controlled for

both predisposing-individual factor and predisposing-family factor, model 4, the remarkably impact to DU was shifted to education of individual. Then, after controlled for all three factors in model 5, region of residence showed more remarkably impact to DU than other control variables. However, from model 3 to 5, education of family head showed impact to DU independently from all other control variables. In term of predicted power of model, although model 5 had highest power, and model 3 and 4 showed similar predicted power, there were not much difference among all three models and also base model, therefore, if we need to predict DU in the whole picture of population, and the related information included in models were available, all models could be used with similar benefit.

**Part 3: Binary logistic regression models for each age group separately**

The result from previous section showed much difference among age groups, both level of DU and the related IVs. This section was started by finding the association of each IV to DU for each age group separately, then binary logistic regression models were generated by selecting appropriated IVs for each age group which might be different, anyway, all models followed the assumptions from informal diagram as the models done for whole population. Noted that the changes of each IVs by time was represented by age in year instead of age group, and birth cohort still included (AC). All models related to this section were in appendix.

**3.1 The association of DU and each independent variable**

*3.1.1 Independent variables as predisposing-individual factor*

*3.1.1.1 Age*

The association of DU and age were similar either controlled for other variable or not, or said that age was affected to DU by itself. However, the effect of age to DU was seen only in some age groups, increasing DU by age in early childhood (table 31), decreasing DU by age in childhood (table 33), and slightly decreasing DU by age in elderly (table 43). All other age groups showed similar DU among age (table 35, 37, 39, 41).

*3.1.1.2 Birth cohort*

There was irregular effect of birth cohort to DU in each age groups. In early childhood (table 31), there was decreasing of DU in more recently cohort, even the magnitude of different was smaller after controlled for other variables. Although childhood group (table 33) showed decreasing of DU in newly cohort too, but this association was smoothly after controlled for other variables. The contrast result seen from adolescent group (table 35), which increased DU instead. While DU tend to decreased in more recently cohort for all working age groups (table 37, 39, 41), and these different gap among cohort were wider after control for all other variables. By the way, there was no association among DU and birth cohort in elderly group (table 43).

*3.1.1.3 Gender*

the association among DU and gender was firstly seen in childhood group (table 3.3) which showed slightly more DU in female than male, then these different of DU among genders was increased in adolescent (table 35) and highest in early adult (table 37), after that the gap of different was steadily decreased in adult and late adult (table 39, and 41), and there was not any difference of DU among genders in elderly group (table 43).

The change of DU and gender by time, there was very small decreasing of DU gap among genders when control for AC in adolescent (table 35) and early adult group (table 37), but not seen any change in other age groups. Anyway, after control for all other variables, the different gap of DU among genders was increased for nearly all age group, except only childhood (table 33) which showed decreasing gap instead. There was no association among DU and gender in early childhood (table 31) and elderly (table 43), either controlled for any variables or not.

*3.1.1.4 Education of individual*

The different gap of DU among level of individual education was wider from adolescent to elderly (table 35, 37, 39, 41, 43), people with more education showed increasing DU.

After control for AC, these gaps were wider in all working age groups (table 37, 39, 41), but it was smaller in adolescent (table 35) and elderly (table 43). By the way, in all age groups, these gaps were smaller after control for all variables together.

*3.1.1.5 Working status of individual*

Although the association of work status of individual and DU were significant when comparing by themselves, or controlled for AC which showed similar direction and magnitude of different among working status, but these associations were nearly gone after control for all other variables. This showed that the association among DU and work status of individual was more affected by other intermediate variables (table 37, 39, 41, 43).

*3.1.1.6 Marital status of individual*

Even marital status of individual was significantly associated to DU, highest DU in never married and lowest in used to married people. After control for AC, the

gap of difference was wider in early adult (table 37) and adult group (table 39), while the gap was the same in late adult (table 41), and no association anymore in elderly (table 43).

But after control for all other variables, the different gap of DU among marital status showed irregular changes in each age group, the gap was decreasing in adult group (table 39), married people shifted to have the lowest DU in early adult group (table 37), while married people in late adult showed the highest DU instead (table 41). The association among DU and marital status of individual was still not seen in elderly (table 43).

*3.1.1.7 Role in family*

The association of DU and role in family for working age groups (table 37, 39, 41) was similar when control for AC, which head of family and spouse had similar DU, while other members in family had lower DU. The unusual pattern was seen in elderly (table 43), after control for AC, spouse tended to have much lower DU than head of family, while other members tended to have less gap from the head of family.

Anyway, role in family showed clearer direction and significant association to DU after control for other variables, highest DU for head of family, followed by spouse, and lowest for other members in family. These pattern of association were the same for both working age and elderly group (table 37, 39, 41, 43).

*3.1.2 Independent variables as predisposing – family factor*

*3.1.2.1 Household size*

Comparing DU among household size, the highest DU found in people lived in small family, and DU was decreasing when family size was larger. After control for AC, the different gap was smaller in early childhood (table 31), but wider gap in childhood (table 33), while other age group were nearly the same as not control for AC (table 35, 37, 39, 41, 43).

However, after control for other variables, these gaps were smaller for almost all age (table 3.1, 3.3, 3.5, 3.7, 3.9, 3.11) groups, except for elderly group (table 3.13) which not showed any change either control for other variables or not.

*3.1.2.2 Education of family head*

The association among DU and education of family head were nearly the same when control for AC, or without control any variable. But after control for all other variable together, these different gaps of DU among level of family heads' education showed a large decreasing, however, the higher level of family heads' education showed more DU of family members (table 31, 33, 35, 37,39, 41, and 43).

*3.1.2.3 Working status of family head*

Even though the association among DU and work status of family head were significantly showed in working age group when control for AC or without control any variables, these associations were nearly gone after control for all other variables (table 31, 33, 39, 41), except for adolescent (table 35) and early adult group (table 37) which still showed the significantly different of DU in some working status of family head. While these association was never seen in elderly group (table 43).

*3.1.2.4 Marital status of family head*

There were irregular association of DU and marital status of family head among age groups, early childhood (table 31) and childhood (table 33) whose family heads were never married showed the lowest DU, in contrast with other age group (table 35, 37, 39, 41, 43) which showed the highest DU instead. However, these associations did not show much change after controlling for AC for all age groups.

After controlling for all other variables, the association of DU and marital status of family head in childhood group (table 33) was nearly the same as before controlling. While these associations in early adult group (table 37) was conversely change from the highest in never married family head when include only this variable itself or after controlling for AC only, to be the lowest in this marital status. These associations were nearly gone in other age group (table 31, 35, 39, 41), while never seen in elderly group (table 43).

*3.1.3 Independent variables as enabling factors*

*3.1.3.1 Area of residence*

The different gap of DU among area of resident were nearly the same both before and after control for AC for all age groups (table 31, 33, 35, 37, 39, 41, and 43),

urban and rural people showed lower DU than Bangkok people. However, this variable was not included in model 1B which included all variable together, because region of residence was selected for representing place of residence instead.

*3.1.3.2 Region of residence*

There were significantly lower DU in all regions than Bangkok people for all age groups (table 31, 33, 35, 37, 39, 41, and 43), and these associations were similar after controlling for AC. Even though after controlling for all other variables, the association were still with smaller gaps of DU among regions of residence. These pattern were nearly the same for all age groups, except for early childhood (table 31) which showed increasing gap among two regions from Bangkok, the Northern and Southern.

*3.1.3.3 Health insurance*

Among public-provided health insurance schemes, people with CSMBS showed the highest DU for all age group (table 31, 33, 35, 37, 39, 41, and 43), followed by SSS in working age (table 37, 39, 41) and elderly (table 43), and the lowest DU were people with UCS. The magnitude of association did not show much change when controlling by AC, except for elderly people (table 43) who covered by SSS which showed decreasing gap of different from UCS.

After controlling for all other variables, these associations were change in working age groups, early adult (table 37) who covered by SSS shifted to have higher DU than CSMBS, while the different of DU among these types of health insurance were nearly the same in adult and late adult group (table 39, and 41). By the way, people who covered by UCS still had the lowest DU.

**3.2 The association of DU and groups of independent variables for each age group**

The base model in this section was applied from the base model of whole population. Firstly, age was included in model instead of age group. Secondly, education of individual was excluded from base model for early childhood and childhood, because it was not appropriated for these age groups. Thirdly, gender was excluded from base model for early childhood and elderly, because it was not associated to DU.

The three assumptions of association among groups of IVs and DU were still the same as models for whole population, but the variables for each assumption might be changed in some age group, depending on their appropriation. In this case, the model for assumption 1, or model 3, which tested for the effect of predisposing-individual factor to DU, did not generate for early childhood, childhood, adolescent, and elderly, because the variables which appropriated for representing this assumption were included in their base model already, no more variable need to add for these age groups. Model 4 was generated for all age groups, however, the models for early childhood, childhood, and adolescent were used marital status of family head instead of role in family. Model 5 was generated for all age groups without any adjustment.

*3.2.1 Early childhood (See table 32 in appendix)*

The base model, model 2, for early childhood was included age, birth cohort, and education of family head, all these variables showed significantly associated to DU, and the predicted power of the base model was as good as model 4, which added two more variables, household size and marital status of family head. Even though model 5 showed higher predicted power than base model, it was not much difference, while it need more information on regions of residence and health insurance. In conclusion, model 2 is good enough for prediction DU for early childhood, however, the result will be better if we have information for using model 5.

*3.2.2 Childhood (See table 34 in appendix)*

The IVs in base model, model 2, for childhood were significantly associated to DU, they were age, birth cohort, education of family head, and gender. In model 4 and 5, all IVs still showed significantly associated to DU, while the predicted power was highest for model 5, followed by model 4, and model 2. In conclusion, model 4 and 5 were better than model 2 for prediction DU for childhood.

*3.3.3 Adolescent (See table 36 in appendix)*

The base model, model 2, for adolescent was included age, birth cohort, education of family head, education of individual, and gender. While almost all of these IVs showed significantly associated to DU, but birth cohort never showed association to DU, both in base model, model 4, and also model 5. The power of prediction was much better after adding enabling factors, region of residence and health insurance, which showed in model 5. While the result did not show more benefit by adding

household size and marital status of family head in model 4. In conclusion, the information used in model 5 was needed for better outcome of prediction DU for adolescent.

*3.3.4 Working age groups (Early adult, adult, and late adult) (See table 3.8, 3.10, 3.12 in appendix)*

In these age groups, the IVs in base model, model 2, were included age, birth cohort, education of family head, education of individual, and gender. Age did not show relation to DU for early adult (table 38) and adult (table 40), but it had significantly association to DU for late adult (table 42). All other IVs in base model were significantly association to DU for all age groups.

These age groups were tested for all three assumptions, model 3 was added marital status of individual and their role in family, model 4 was added role in family and household size, model 5 was added region of residence and health insurance. The results showed that, although all IVs which added to each model were significantly associated to DU for all age groups, but the predicted power of model 3 and 4 were not much different from base model, in addition, model 5 still showed much higher power of prediction than any model. In conclusion, base model is good enough for predicting DU for working age group, but if we had more information about enabling factor, the outcome will be much better.

*3.3.5 Elderly (See table 44 in appendix)*

The result of multiple logistic models for elderly showed a large different from all other age group. The base model for elderly was included age, birth cohort, education of family head, education of individual, but not gender, and all models did not showed association among DU and birth cohort. This age group was tested only for assumption of model 4 and 5, and the result showed that both models had similar power of prediction. The interesting result was that significantly association of education of family head was gone for model 5, and combining with no association of birth cohort to DU, therefore, another model, model 5A, was tested by excluding these two variables from model 5, and the result still showed similar predicted power of model with all IVs significantly associated to DU. In conclusion, both model 4 and 5A were appropriated for predicting DU of elderly, the available of information for each model would be the reason for selecting which one.

**Part 4: The other dependent variables**


In previous sections, we talked about the association of individuals' sociodemographic characteristics and probability of dental use (DU) which was the main dependent variable of this study. In this part, I need to go further in the detail of dental service use, in term of regularity of utilization, type, and place of service use.

Regularity of utilization was the self-reported total number of dental visits for each individual in the preceding year, let say dental visit, or DV, which categorized into 'One visit a year' and 'More than one visit a year'. Type of service use, let say dental care type, or DT, was the self-reported primary dental service that individual was received in the last visit of preceding year, which categorized into 'Oral health prevention', 'Basic dental treatment', and 'Complicated dental treatment'. Place of service use, or DP, was the provider who provided those primary dental service in the last visit of preceding year for each individual, which categorized into 'Public provider', and 'Private provider'.

Since DT were categorized into three levels, which should be analyzed by other statistics such as multinomial logistic regression, which beyond the scope of this study. However, I would like to apply binary logistic regression, which was the main statistic for this study, for roughly checking the association of all independent variables in this study to DT, thus the categories of DT would be divided into two levels of consideration, as showed in figure 6.

The relation among those three dependent variables showed that DV and DP were depending on DT, which different from the main conceptual framework of this study. From table 24, the result showed that the complicated dental treatment led people to use more than one dental visits a year, while people who used basic dental treatment in last visit showed less chance to use more than one visit when compared to people who use oral health prevention. In term of DP, there was remarkably higher tendency of people to receive complicated dental treatment than oral health prevention at private provider. These result gave us a clue that DT should be considered firstly before go further on DV and DP which might be affect from other variables too, anyway it was beyond the scope of this study.
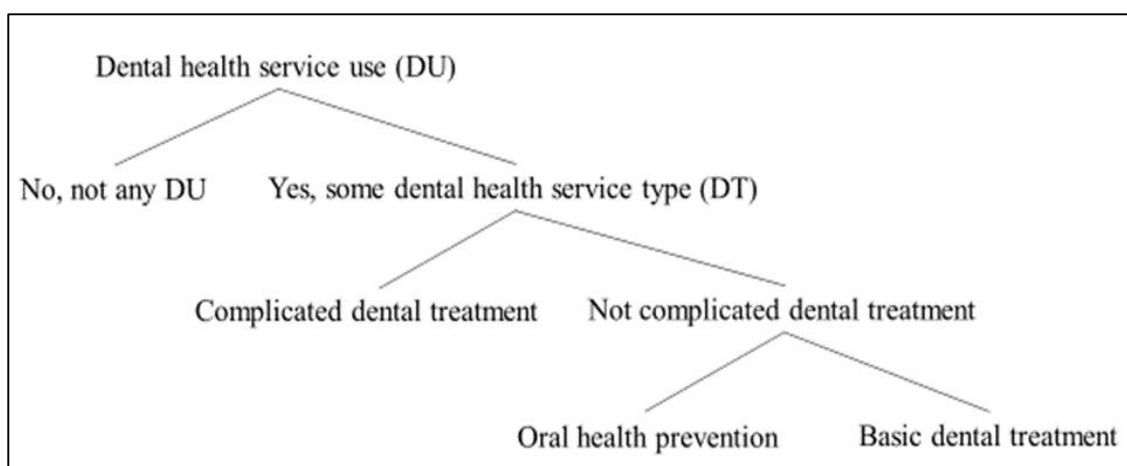
*Figure 6: Diagram showed categories of dental service type (DT) for using binary logistic regression.*

*Table 24: Odds ratio of using more than one visit of dental health service (model of dental visit, DV), and odds ratio of using dental health service from private provider (model of dental place, DP), among types of dental health service (DT).*

|  | Model of dental visit (DV) [a] | | | | Model of dental place (DP) [b] | | | |
|---|---|---|---|---|---|---|---|---|
|  | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR |
| Constant | -0.91 | *** | 0.04 | 0.40 | -1.03 | *** | 0.04 | 0.36 |
| Type of dental service (DT) [c] |  |  |  |  |  |  |  |  |
| Oral health prevention |  | *** |  |  |  | *** |  |  |
| Basic dental treatment | -0.19 | *** | 0.04 | 0.82 | 0.63 | *** | 0.04 | 1.88 |
| Complicated dental treatment | 1.08 | *** | 0.05 | 2.95 | 1.86 | *** | 0.05 | 6.43 |
| n |  | 36,046 | | |  | 35,813 | | |
| % case of dummy variable |  | 28.2 | | |  | 41.5 | | |
| -2 Log likelihood |  | 42,380 | | |  | 47,911 | | |
| Nagelkerke R Square |  | 0.048 | | |  | 0.055 | | |

Notes:

[a] Dental visit (DV) was a dummy variable, 'one visit a year' was equal to 0, and 'More than one visit a year' was equal to 1.

[b] Dental place (DP) was a dummy variable, 'Public provider' was equal to 0, and 'Private provider' was equal to 1. In this study, public provider was included 'Health center, without dental personnel', 'Health center, with dental personnel', 'District hospital', 'Provincial hospital/ general hospital', 'University's hospital', 'Other public hospital', 'Mobile service (from any organization)', and 'School'. While private provider were included 'Private hospital', and 'Private clinic'.

[c] Type of dental services (DT) were grouping 'Oral screening', 'Sealant', and 'Apply topical fluoride' into 'Oral health prevention'. 'Tooth extraction', 'Tooth filling', and 'Scaling, polishing, periodontal treatment' were grouping into 'Basic dental treatment'. 'Root canal treatment', 'Prosthodontic', and 'Orthodontic' were grouping into 'Complicated dental treatment'.

Before exploring the characteristics of DT by using binary logistic regression, I would like to present the result from descriptive analysist, see table 25, which showed the proportion of DT in each age group. There were remarkably different sharing

proportion of DT for each age group, while early childhood and childhood used complicated dental treatment less than 5% of overall dental service use, but adolescent and elderly used more than 20% for this DT, and these differences among age group also seen from binary logistic regression model which include all IVs together, see table 26.

In the same way for comparing among using oral health prevention and simple dental treatment, both descriptive result from table 25, and binary logistic regression result from table 26, also showed clearly different gaps among age groups, early childhood showed nearly half – half sharing proportion among these two types of dental service uses, followed by childhood which had lower proportion of oral health prevention, while all older age groups showed much lower proportion of this DT.

*Table 25: Proportion of dental service type (DT) in each age group.*

| Type of dental service (DT) | Age group | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Early childhood | Childhood | Adolescent | Early Adult | Adult | Late adult | Elderly | Total |
| **Oral health prevention** | **0.51** | **0.20** | **0.07** | **0.05** | **0.06** | **0.06** | **0.10** | **0.10** |
| Oral screening | 0.39 | 0.16 | 0.06 | 0.04 | 0.05 | 0.05 | 0.09 | 0.08 |
| Dental sealant | 0.04 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Apply topical fluoride | 0.07 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| **Basic dental treatment** | **0.48** | **0.76** | **0.72** | **0.85** | **0.87** | **0.83** | **0.69** | **0.80** |
| Tooth extraction | 0.25 | 0.38 | 0.15 | 0.23 | 0.35 | 0.48 | 0.52 | 0.35 |
| Tooth filling | 0.18 | 0.25 | 0.29 | 0.24 | 0.19 | 0.15 | 0.08 | 0.20 |
| Scaling, polishing, periodontal treatment | 0.05 | 0.13 | 0.28 | 0.38 | 0.33 | 0.20 | 0.09 | 0.25 |
| **Complicated dental treatment** | **0.01** | **0.04** | **0.21** | **0.10** | **0.07** | **0.11** | **0.21** | **0.10** |
| Root canal treatment | 0.01 | 0.02 | 0.04 | 0.02 | 0.04 | 0.04 | 0.03 | 0.03 |
| Prosthodontic | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.07 | 0.18 | 0.03 |
| Orthodontic | 0.00 | 0.02 | 0.16 | 0.07 | 0.01 | 0.00 | 0.00 | 0.04 |

*Table 26: Binary logistic regression model for predicting probability of using complicated dental treatment and oral health prevention among Thai.*

| Variables in the Equation | Model 1B Complicated dental treatment | | | | Model 1B Oral health prevention | | | |
|---|---|---|---|---|---|---|---|---|
| | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR |
| Constant | -3.16 | *** | 0.30 | 0.04 | -0.87 | * | 0.38 | 0.42 |
| Age group | | | | | | | | |
| Early childhood | -0.73 | * | 0.31 | 0.48 | 1.26 | *** | 0.08 | 3.52 |
| Childhood *(reference)* | | *** | | | | *** | | |
| Adolescent | 1.59 | *** | 0.13 | 4.91 | -0.59 | *** | 0.13 | 0.55 |
| Early Adult | 1.25 | *** | 0.17 | 3.50 | -0.84 | *** | 0.19 | 0.43 |
| Adult | 1.22 | *** | 0.21 | 3.39 | -0.54 | * | 0.25 | 0.58 |
| Late adult | 1.34 | *** | 0.23 | 3.84 | -0.74 | ** | 0.28 | 0.48 |
| Elderly | 1.53 | *** | 0.25 | 4.62 | -0.51 | | 0.32 | 0.60 |
| Birth cohort | | | | | | | | |
| before 1941 *(reference)* | | *** | | | | *** | | |
| 1941-1950 | -0.26 | * | 0.10 | 0.77 | -0.06 | | 0.16 | 0.94 |
| 1951-1960 | -0.65 | *** | 0.14 | 0.52 | -0.34 | | 0.21 | 0.71 |
| 1961-1970 | -1.14 | *** | 0.16 | 0.32 | -0.68 | ** | 0.24 | 0.51 |
| 1971-1980 | -1.19 | *** | 0.19 | 0.30 | -0.66 | * | 0.26 | 0.51 |
| 1981-1990 | -0.65 | ** | 0.22 | 0.52 | -0.31 | | 0.30 | 0.74 |
| 1991-2000 | -0.44 | | 0.23 | 0.64 | -0.47 | | 0.33 | 0.62 |
| after 2000 | -0.93 | ** | 0.27 | 0.39 | 0.02 | | 0.33 | 1.02 |
| Gender | | | | | | | | |
| Male *(reference)* | | | | | | | | |
| Female | 0.23 | *** | 0.05 | 1.26 | -0.08 | | 0.05 | 0.93 |
| Education of individual [a] | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | |
| Secondary level | 0.08 | | 0.07 | 1.08 | -0.47 | *** | 0.09 | 0.63 |
| Tertiary Level | 0.35 | *** | 0.08 | 1.41 | -0.31 | ** | 0.10 | 0.74 |
| Work status of individual | | | | | | | | |
| Public-employee *(reference)* | | *** | | | | *** | | |
| Private-employee | 0.06 | | 0.11 | 1.06 | -0.60 | *** | 0.13 | 0.55 |
| Self-employee | 0.47 | *** | 0.10 | 1.59 | -0.42 | ** | 0.13 | 0.66 |
| Member of co-operative group | 1.67 | | 1.12 | 5.31 | -1.76 | | 1.99 | 0.17 |
| No work | 0.30 | ** | 0.10 | 1.36 | 0.05 | | 0.13 | 1.05 |
| Marital status of individual | | | | | | | | |
| Never married *(reference)* | | ** | | | | | | |
| Married | -0.30 | *** | 0.09 | 0.74 | 0.11 | | 0.11 | 1.11 |
| Used to married [b] | -0.08 | | 0.11 | 0.92 | -0.03 | | 0.14 | 0.97 |
| Role in family | | | | | | | | |
| Head *(reference)* | | | | | | | | |
| Spouse | -0.02 | | 0.06 | 0.98 | -0.08 | | 0.09 | 0.92 |
| Other | 0.05 | | 0.07 | 1.05 | 0.15 | | 0.09 | 1.17 |
| Household size | | | | | | | | |
| Small size (1-3 members) *(reference)* | | | | | | *** | | |
| Medium size (4-6 members) | 0.01 | | 0.05 | 1.01 | 0.04 | | 0.05 | 1.04 |

| Variables in the Equation | Model 1B Complicated dental treatment | | | | Model 1B Oral health prevention | | | |
|---|---|---|---|---|---|---|---|---|
| | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR |
| Large size ( > 6 members) | 0.14 | | 0.10 | 1.14 | 0.37 | *** | 0.09 | 1.44 |
| Education of family head [a] | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | |
| Secondary level | 0.23 | *** | 0.06 | 1.26 | 0.15 | * | 0.06 | 1.16 |
| Tertiary Level | 0.27 | *** | 0.07 | 1.30 | 0.38 | *** | 0.07 | 1.46 |
| Work status of family head | | | | | | | | |
| Public-employee *(reference)* | | * | | | | | | |
| Private-employee | -0.24 | * | 0.10 | 0.79 | 0.06 | | 0.10 | 1.06 |
| Self-employee | -0.07 | | 0.08 | 0.94 | 0.10 | | 0.09 | 1.11 |
| Member of co-operative group | -1.69 | | 1.40 | 0.19 | 0.93 | | 0.76 | 2.55 |
| No work | -0.01 | | 0.09 | 0.99 | 0.07 | | 0.10 | 1.07 |
| Marital status of family head | | | | | | | | |
| Never married *(reference)* | | | | | | ** | | |
| Married | 0.06 | | 0.09 | 1.07 | -0.27 | * | 0.11 | 0.76 |
| Used to married [b] | 0.04 | | 0.11 | 1.04 | -0.11 | | 0.12 | 0.89 |
| Region of residence | | | | | | | | |
| Bangkok *(reference)* | | *** | | | | *** | | |
| Central | 0.08 | | 0.08 | 1.08 | -0.36 | *** | 0.07 | 0.70 |
| Northern | -0.05 | | 0.08 | 0.95 | -0.13 | | 0.07 | 0.88 |
| Northeastern | -0.15 | | 0.08 | 0.86 | -0.74 | *** | 0.07 | 0.48 |
| Southern | -0.22 | * | 0.09 | 0.81 | -0.69 | *** | 0.08 | 0.50 |
| Health insurance | | | | | | | | |
| UCS *(reference)* | | *** | | | | ** | | |
| SSS | -0.02 | | 0.09 | 0.98 | 0.11 | | 0.10 | 1.12 |
| CSMBS | 0.23 | *** | 0.06 | 1.26 | -0.02 | | 0.08 | 0.98 |
| Other [c] | 0.42 | ** | 0.14 | 1.53 | 0.35 | * | 0.14 | 1.43 |
| Not have any health insurance | 0.36 | * | 0.14 | 1.43 | 0.36 | ** | 0.13 | 1.44 |
| n | 29,330 | | | | 26,311 | | | |
| % of using complicated dental treatment | 10.3 | | | | - | | | |
| % of using oral health prevention | - | | | | 11.1 | | | |
| -2 Log likelihood | 17,934 | | | | 15,998 | | | |
| Nagelkerke R Square | 0.104 | | | | 0.19 | | | |
| Hosmer&Lemeshow - χ2 | 12.5, df = 8, p = 0.13 | | | | 41.8, df = 8, p < 0.0001 | | | |

Notes:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

Since the result from table 4.1 shows a greater tendency to use more than one visit a year for people who used complicated dental treatment, followed by oral health prevention, while people who used basic dental treatment had a lower probability of using more than one visit, we can conclude that the adolescent and elderly group, which had the greatest tendency to use complicated dental treatment, tended to use dental health service with more than one visit per year. In addition, the early childhood and childhood group which had highest tendency to use oral health prevention, were the other two groups that had a greater tendency to use more than one visit a year.

Regarding the sequence of relationships among these dependent variables, we can summarize that DT has an impact on DV, then DV has an impact on DU. Therefore, the initial informal diagram of relationships among independent variables and DU, that used for forming the assumptions underlying this study, should be adjusted for these findings by adding DT and DV as intermediate variables among independent variables and DU in the diagram (figure 7).
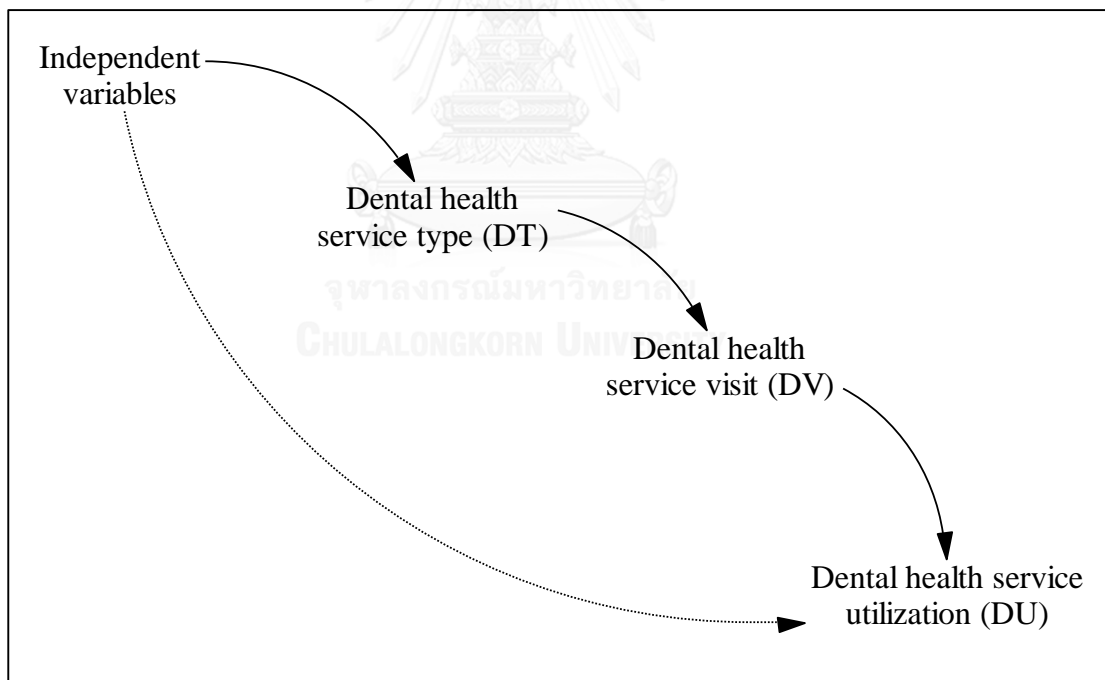


*Figure 7: Adjusted informal diagram of relationships among independent variables and dental use.*

# CHAPTER V

# DISCUSSION, CONCLUSION, AND POLICY RECOMMENDATION

### 5.1 Discussion

The data used in this study was aggregated from six waves of the Health and Welfare Survey (HWS) of Thailand, individual level data was reorganized into the group of birth cohort and age group for accessing changes of DU by time. However, original data from each wave was not included the same birth cohort for each age group, and the same birth cohort also change to older age group as time passed too. Therefore, consideration of age and cohort together was needed when dealing with this type of data. As we seen from result that there was smoother trend of DU among age groups after controlling for birth cohort, which confirms the different among generations. In the same way for considering in the view of cohort, the smoother trend after controlling for age group also confirms the changes of DU when people were growing up.

Since age and cohort were selected for representing time changes, model 1A which included age or age group (A), birth cohort (C), and each independent variable could be the answer for the first research question. Although there were four variables, education of family head, education of individual, household size, and role in family, showed notable association to DU from descriptive analysis, model 1A elucidated that only education of individual and role in family, which represented to predisposing-individual factor, had remarkably change of odds ratio for DU by time. Anyway, these both variables were confounded by age, for example, early childhood could not be the head of family therefore multiple logistic regression models for whole population should be interpreted carefully. While the stability of odds ratio by time for the other two variables, education of family head and household size, which were represented to predisposing-family factor, supported that DU of all age group were equally influenced by this factor. Noted that model 1A was consider changes of each IV by time only, without consideration to any interaction with other variables.

After including all IVs into consideration together in model 1B, the unusual ranking of odds ratio for early childhood emphasized the difference of related variables among age groups. As the real world situation that early childhood had a large different from other age groups, because they are dependent age, therefore their behavior might be highly influenced by other people, mostly by their parents. In this circumstance, which various variables were related, multiple logistic regression analysis is needed for taking into account all variables in the same time. In addition, the changes of odds ratio among each IVs to DU also confirm the must of using at least multiple logistic regression analysis, since they had interaction effects to each other.

The effect of each IV and also their interactions to dental use were similar to previous studies. The first importance characteristic was different DU among age groups, especially lower DU among working age and elderly people, even in high income countries, they also had the same situation. Younger people in the UK had more regular dental visit than older (Karimalakuzhiyil Alikutty & Bernabé, 2016), the same as lower dental visit among older people in the Kingdom of Saudi Arabia (El Bcheraoui et al., 2016). Unequal DU in working age also found in the US, and one reason was mentioned to barrier of accessing to dental care in term of health insurance benefits (Nasseh & Vujicic, 2015). Although there was evidence supported that the coverage of health insurance led to enhancing of health service utilization, the actual access to care, such as available of provider, need to be evaluated (Spaan et al., 2012).

In Thailand, the report of dental health workforce showed the half-half sharing proportion of dentist in public and private health sector, and also unequal distribution among regions (Bureau of Dental Health, 2015). For those situation together with the fact that public health sector was the main provider for UCS and CSMBS health insurance schemes, which had different budget and payment method for people under coverage, we could not refuse that the fee for service of CSMBS had more incentive for providers than capitation fee of UCS (Srithamrongsawat, Aueasiriwon, & Hempisut, 2013). Although the UCS provided all necessary dental care in the package (Lapying & Putthasri, 2013), the result from this study confirm that the inequality of access to care is still exist. In contrast with SSS, people under this health insurance scheme can use dental benefit at both public and private provider. More choices of provider within their benefit from health insurance can decrease the barrier from

waiting time and cost for care, which were the main reason of unmet need (Jaichuen, 2016a), thus the result showed higher DU for this group than UCS. To achieve equity in health as the main concept of UCS cannot solve by the old strategies anymore, expansion of both health care resources and coverage of health insurance could not directly improve access to care, innovative strategy is urgent needed for subsidizes this group of people which were the real problem.

In addition, the assumptions of access to education and access to dental health service that were observed from the descriptive results are supported by the binary logistic regression models which show the close relationship among educational levels of both individuals and family heads, the working statuses of both individuals and family heads, the marital status of family heads, region of residence, and health insurance, in each instance by decreasing gaps of odds ratio among them after controlling for all IVs.

As the result showed remarkable relation among education, both individuals' and family heads', to DU both from descriptive analysis and multiple logistic regressions. The interesting thing is that education is not direct composition of health system but it is one of social determinant that effect to health (World Health Organization, 2011). Many studies found the impact of education to health, one of those suggested that investment of education in national level lead to better health relate behavior (Fletcher & Frisvold, 2009), another one mentioned to different type of health care use by people with different education level (Alguwaihes & Shah, 2009). This study confirms high impact of education to health, in term of dental care utilization, in context of country with universal health coverage for population, differences of DU clearly seen among education level. Since education is social determinant of health, the outcome from educational system is not only direct effect to health by increase of knowledge, but their benefit is lead to better chances in individual life, such as working status which lead to opportunity for better benefit from health insurance. Although the benefit of education system to population health was beyond scope of this study, these initial findings could be encouraging health related researchers and also policy makers to investigate more on efficiency and effectiveness to sustainable health outcome by investment in education.

Previous discussions about access to public services were emphasize to enabling factor which related to government responsibility, now I would like to move back to other interesting variables within predisposing factor. The first variable for discussion would start at gender, interactions among gender and other variables in model 3A confirmed that differences between male and female were independently effect to DU. Although this study could not explain the reason of their differences, it could confirm the importance of including gender in any forecasting of demand for dental care in the future, especially when consideration of adolescent and working age but not for other age group, such as elderly which the differences among genders were nearly gone after controlled for other variable (Redondo-Sendino et al., 2006).

In contrast with role in family, even the result from model 1B, which controlled for all IVs together, showed independent effect to DU by the role itself in the same way like gender, after exploring its interaction to other variable in model 4A, we found that different gaps of DU among roles were diminished by education and household size. These result may be confounded by the category of role in family which used in this study, since we grouping all other members into the same group either they were relatives or servants, thus those variables could identify their differences. In short, by category used in this study, education of individual and household size had clearer effect to DU than role in family.

While gender shows an independent effect on DU as indicated by greater odds ratios after controlling for other variables, there is another group of variables that shows stable gaps in odds ratios. We found that even the region of residence, which could be understood to represent the spatial distribution of providers, the effect of household size on DU were still the same with or without statistical controls. In other words, the size of Thai's families had an important influence on DU regardless of the distribution of dental health service providers. This result coincides with Andersen's finding since the initial phase of his study about behavioral model of health care utilization, in which he mentioned to the maximum influence on use of health care by family composition although the equitable distribution of health care were assumed (R. Andersen, 1968).

Regarding the quality of data used in this study, there were some errors of primary data from the NSO that the researcher needed to verify before analysis, for example, some children were recorded to have SSS which actually covers only working

people. Since this set of data was very important information, used to represent many health service situations at the national level, therefore the NSO should verify this data set before sharing to any users. In addition, I would like to suggest the NSO for providing some training course about using this set of data for the new users, because this data set can be applied for many valuable information if the researchers were clearly understanding its details.

This study is the first time of dental heath related study in Thailand that using the large set of data which aggregated from population based surveys, and since the data used in this study was well processed by national level organization, thus there are no sociodemographic differences between our study samples and the actual country population. Furthermore, the category of age group which is used in this study matches that used in actual policy planning and implementation. Therefore, outcomes can reflect real world situations and point to real problems, which can be direct applied for the practical planning of the oral health service system in the future.

Since the samples in this study included all age groups of population, the results should remind us that the whole population is sharing the same service resources, thus some age groups had higher DU than other age groups. In this situation, fragmented planning for each target age groups as the usual pattern may be not appropriate. It is better to view the whole system of oral health services to bring about better oral health outcomes and more efficiency.

The next strength was the technique used for analysis in this study, since the structure of primary sampling design, which using household as a representative unit, therefore the analysis could apply this structure of data for examining any impact of family to their members, such as the impact of family heads' characteristics to DU of their members that using in this study. Furthermore, the technique of considering variable of time, age and cohort, give the possibility of exploring changes of dental use by time, which lead us more understanding this complex association.

However, there are some limitation for this study, the first one is that the study design was imitating to be cohort design but it is still not the real cohort, the sample was only observed by assuming that they were the same group of people by using their birth year as a reference. Under the limitation of resources for the real cohort study among such a big sample size as examining situations at national level, the technique

of analysis as used in this study can help the researchers to find out the focal points of problem, then they can be continuing on the real cohort observation that specify to the actual target groups.

Secondly, even the objective of this study need to explore all characteristics of dental use, which are type, regularity, and place of dental health service use, the main result could find out only probability of dental use which is the crude characteristic. The outcome of predicted model would be more valid if we can adjust for other characteristics. As we found that there were impacts of types of dental health services on numbers of dental visits, which were different among age groups, it follows that the dental health utilization of one age group will be affected by other age groups via the availability of providers. In these complex circumstances, especially when considering the dynamic changes of situation, other tools for analysis will be more appropriate, such as systems dynamic modelling (Meadows, 2008).

Since the nature of data used in this study was survey data, which the NSO does not allow to use primary samples as a sample size of any inferential statistical analysis unless it was weighted for representing the actual structure of population, thus it leads to pretty large size of sample. Even though this study tried to reduce sample size by using proportional weight, our sample sizes still were very large. Therefore, the results include many significant relationships even when the absolute magnitudes involved might not be large at all. Under these circumstances, a researcher tends to over interpret significant results. Researchers should keep in mind that not all significant results in a large survey analysis will be important results. Furthermore, this study did not take into account the multistage, stratified design of the surveys, which means that all standard errors were underestimates of the true standard errors.

The next is limitation of this data set, there was no information about economical or financial characteristic of samples, and also clinical characteristic of their oral health which refer to their need, so the composition of factor mentioned in the behavioral model of health care utilization (Ronald Andersen & Newman, 2005; R. M. Andersen, 1995) which applied for conceptual framework was not completed. Although Andersen mentioned that dental health care has highest level of family discretionary among type of medical care, which means that the decision of dental health care usage

is primarily depend on family by their own, and this characteristic can be explaining by predisposing and enabling factors of the family (R. Andersen, 1968), it would be better if the information about need of care was included in this study which aimed to clearly understand overall influencing factor to dental health care utilization in the context of Thai.

Further study should be considering these limitations, combining information from several data bases may be need for completeness of supported theory, taking into account the multilevel structure of data will be better for represent the real world relationship. Moreover, since the improvement of health information technology, investment for real cohort studies in national level could be the next challenge for policy maker.

### 5.2 Conclusion

Forecasting demand for dental care by considering only differences among age group is not enough, the related variables that improve power of prediction including gender, education of both individual and family head, region of residence, and type of health insurance coverage. Coverage of health insurance alone cannot represent to equal access to dental care, inequality to dental care still exist in Thailand, and it need good evidence for magnifying this problem. Improvement of education and their benefit to health also need more information. Multiple regression analysis is needed when the group of variables are related. Although the available of these set of information is benefit for predicted outcome, while there are a lot of data bases at the present, no linkage among them may be the next challenge for forecasters. Policy makers as the end users of this product should pay more attention to investment in this supporting resources too.

### 5.3 Policy recommendation

The criteria of using dental health care benefit, and the mechanism of payment for provider among public-provided health insurance schemes, especially for working age users, should be re-consider, if not, the different sociodemographic characteristics among Thai will lead to more inequity of access to dental health care, and severe dental

problem which lead to higher cost of treatment will turn out in the next generation of elderly age.

The investment of dental health related resources, such as dental health workforce, needed more attention to the information used in forecasting of future demand. Dental health data center is recommended, the major function is requested for linkage of all related data bases, and analyzing into evident based information.

The NSO should improve the quality of their data before sharing to other organizations. In addition, it will be helpful for researchers who are interested in this data set, if the NSO can provide some course for explaining the details of this data set. Better understanding of the user will help them to transform these data into more valuable information.

Further study should examine changes in oral health status over time, and their related factors. The next findings together with these initial findings will be complete our understanding about patterns of oral health service utilization among Thais, which will be valuable inputs for future oral health service system planning. Moreover, although the multistage of health determinants had been mentioned for a long time, the evidence from this view were hardly found in Thailand, therefore health related researchers should pay more attention on the complexity of the health system, one topic suggested for further study is the association between education and sustainable health outcomes. Differences in oral health service utilization between genders also needs more evidence.

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**APPENDIX**

*Table 27: Full detail of model 0 and 1A for AC, multiple logistic regression model of predicting dental use by including age group or birth cohort, and both variable together.*

| Variable | Model 0 - age group | | | | Model 0 - cohort | | | | Model 1A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Constant | -1.85 | *** | 0.01 | 0.16 | -2.73 | *** | 0.03 | 0.07 | -1.71 | *** | 0.06 | 0.18 |
| Age group | | | | | | | | | | | | |
| Early childhood | -1.32 | *** | 0.03 | 0.27 | | | | | -1.30 | *** | 0.03 | 0.27 |
| Childhood *(reference)* | | *** | | | | | | | | *** | | |
| Adolescent | -0.32 | *** | 0.02 | 0.73 | | | | | -0.36 | *** | 0.02 | 0.70 |
| Early Adult | -0.56 | *** | 0.02 | 0.57 | | | | | -0.67 | *** | 0.03 | 0.51 |
| Adult | -0.54 | *** | 0.02 | 0.58 | | | | | -0.80 | *** | 0.04 | 0.45 |
| Late adult | -0.40 | *** | 0.02 | 0.67 | | | | | -0.82 | *** | 0.04 | 0.44 |
| Elderly | -0.76 | *** | 0.02 | 0.47 | | | | | -1.03 | *** | 0.06 | 0.36 |
| Birth cohort | | | | | | | | | | | | |
| before 1941 *(reference)* | | | | | | *** | | | | *** | | |
| 1941-1950 | | | | | 0.47 | *** | 0.03 | 1.60 | 0.35 | *** | 0.04 | 1.42 |
| 1951-1960 | | | | | 0.51 | *** | 0.03 | 1.67 | 0.31 | *** | 0.05 | 1.36 |
| 1961-1970 | | | | | 0.38 | *** | 0.03 | 1.46 | 0.16 | ** | 0.05 | 1.17 |
| 1971-1980 | | | | | 0.32 | *** | 0.03 | 1.38 | 0.03 | | 0.05 | 1.03 |
| 1981-1990 | | | | | 0.37 | *** | 0.03 | 1.45 | -0.07 | | 0.06 | 0.93 |
| 1991-2000 | | | | | 0.63 | *** | 0.03 | 1.88 | -0.11 | | 0.06 | 0.90 |
| after 2000 | | | | | 0.34 | *** | 0.03 | 1.40 | -0.17 | ** | 0.06 | 0.85 |
| n | 494,437 | | | | 494,437 | | | | 494,437 | | | |
| % of dental use | 8.96 | | | | 8.96 | | | | 8.96 | | | |
| -2 Log likelihood | 294,860 | | | | 297,433 | | | | 294,648 | | | |
| Nagelkerke R Square | 0.015 | | | | 0.003 | | | | 0.016 | | | |
| Hosmer&Lemeshow - χ2 | 0.00, df = 5, p = 1.00 | | | | 0.00, df = 5, p = 1.00 | | | | 7.06, df = 8, p = 0.53 | | | |

Note:
* p < 0.05, ** p < 0.01, *** p < 0.0001, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 28: Full detail of model 0 for each IV, logistic regression model of predicting dental use by including each independent variable singly.*

| Variables in the Equation | Model 0 | | | |
|---|---|---|---|---|
| | B | Sig. | S.E. | OR |
| **Gender** | | | | |
| Constant | -2.53 | *** | 0.01 | 0.08 |
| Female | 0.38 | *** | 0.01 | 1.46 |
| n = 494,437 , % of dental use = 8.96 | | | | |
| -2LL = 296780, Nagelkerke R Square = 0.01 | | | | |
| Hosmer&Lemeshow - χ2 =0.00, df = 0 | | | | |
| **Education of individual** [a] | | | | |
| Constant | -2.48 | *** | 0.01 | 0.08 |
| Primary level *(reference)* | | *** | | |
| Secondary level | 0.14 | *** | 0.01 | 1.16 |
| Tertiary Level | 0.82 | *** | 0.01 | 2.27 |
| n = 493,377 , % of dental use = 8.97 | | | | |
| -2LL = 294232, Nagelkerke R Square = 0.02 | | | | |
| Hosmer&Lemeshow - χ2 = 0.00, df = 1, p = 1.00 | | | | |
| **Work status of individual** | | | | |
| Constant | -1.78 | *** | 0.02 | 0.17 |
| Public-employee *(reference)* | | *** | | |
| Private-employee | -0.62 | *** | 0.02 | 0.54 |
| Self-employee | -0.68 | *** | 0.02 | 0.50 |
| Member of co-operative group | -0.71 | ** | 0.24 | 0.49 |
| No work | -0.47 | *** | 0.02 | 0.63 |
| n = 494,324 , % of dental use = 8.96 | | | | |
| -2LL = 297003, Nagelkerke R Square = 0.01 | | | | |
| Hosmer&Lemeshow - χ2 = 0.00, df = 2, p = 1.00 | | | | |
| **Marital status of individual** | | | | |
| Constant | -2.22 | *** | 0.01 | 0.11 |
| Never married *(reference)* | | *** | | |
| Married | -0.16 | *** | 0.01 | 0.85 |
| Used to married [b] | -0.28 | *** | 0.02 | 0.76 |
| n = 494,396 , % of dental use = 8.96 | | | | |
| -2LL = 297829, Nagelkerke R Square = 0.00 | | | | |
| Hosmer&Lemeshow - χ2 = 0.00, df = 1, p = 1.00 | | | | |
| **Role in family** | | | | |
| Constant | -2.28 | *** | 0.01 | 0.10 |
| Head *(reference)* | | *** | | |
| Spouse | 0.03 | | 0.01 | 1.03 |
| Other | -0.09 | *** | 0.01 | 0.91 |
| n = 494,437 , % of dental use = 8.96 | | | | |
| -2LL = 298086, Nagelkerke R Square = 0.00 | | | | |
| Hosmer&Lemeshow - χ2 = 0.00, df = 1, p = 1.00 | | | | |
| **Household size** | | | | |
| Constant | -2.19 | *** | 0.01 | 0.11 |
| Small size (1-3 members) *(reference)* | | *** | | |
| Medium size (4-6 members) | -0.18 | *** | 0.01 | 0.84 |

| Variables in the Equation | Model 0 | | | |
|---|---|---|---|---|
| | B | Sig. | S.E. | OR |
| Large size ( > 6 members) | -0.55 | *** | 0.02 | 0.58 |

n = 494,437 , % of dental use = 8.96

-2LL = 297420, Nagelkerke R Square = 0.00

Hosmer&Lemeshow - χ2 = 0.00, df = 1, p = 1.00

**Education of family head** [a]

| | B | Sig. | S.E. | OR |
|---|---|---|---|---|
| Constant | -2.54 | *** | 0.01 | 0.08 |
| Primary level *(reference)* | | *** | | |
| Secondary level | 0.35 | *** | 0.01 | 1.43 |
| Tertiary Level | 0.95 | *** | 0.01 | 2.59 |

n = 414,475 , % of dental use = 8.92

-2LL = 244962, Nagelkerke R Square = 0.02

Hosmer&Lemeshow - χ2 = 0.00, df = 1, p = 1.00

**Work status of family head**

| | B | Sig. | S.E. | OR |
|---|---|---|---|---|
| Constant | -1.83 | *** | 0.02 | 0.16 |
| Public-employee *(reference)* | | *** | | |
| Private-employee | -0.53 | *** | 0.02 | 0.59 |
| Self-employee | -0.53 | *** | 0.02 | 0.59 |
| Member of co-operative group | -0.63 | ** | 0.18 | 0.53 |
| No work | -0.60 | *** | 0.02 | 0.55 |

n = 415,575 , % of dental use = 8.91

-2LL = 248791, Nagelkerke R Square = 0.01

Hosmer&Lemeshow - χ2 = 0.00, df = 3, p = 1.00

**Marital status of family head**

| | B | Sig. | S.E. | OR |
|---|---|---|---|---|
| Constant | -2.06 | *** | 0.02 | 0.13 |
| Never married *(reference)* | | *** | | |
| Married | -0.26 | *** | 0.02 | 0.77 |
| Used to married [b] | -0.38 | *** | 0.02 | 0.68 |

n = 415,494 , % of dental use = 8.91

-2LL = 249420, Nagelkerke R Square = 0.00

Hosmer&Lemeshow - χ2 = 0.00, df = 1, p = 1.00

**Area of residence**

| | B | Sig. | S.E. | OR |
|---|---|---|---|---|
| Constant | -1.80 | *** | 0.01 | 0.16 |
| Bangkok *(reference)* | | *** | | |
| Urban | -0.53 | *** | 0.02 | 0.59 |
| Rural | -0.63 | *** | 0.01 | 0.53 |

n = 494,437 , % of dental use = 8.96

-2LL = 296230, Nagelkerke R Square = 0.01

Hosmer&Lemeshow - χ2 = 0.00, df = 1, p = 1.00

**Region of residence**

| | B | Sig. | S.E. | OR |
|---|---|---|---|---|
| Constant | -1.80 | *** | 0.01 | 0.16 |
| Bangkok *(reference)* | | *** | | |
| Central | -0.67 | *** | 0.02 | 0.51 |
| Northern | -0.45 | *** | 0.02 | 0.63 |
| Northeastern | -0.65 | *** | 0.02 | 0.52 |
| Southern | -0.56 | *** | 0.02 | 0.57 |

n = 494,437 , % of dental use = 8.96

-2LL = 296056, Nagelkerke R Square = 0.01

| Variables in the Equation | Model 0 | | | |
| --- | --- | --- | --- | --- |
| | B | Sig. | S.E. | OR |
| Hosmer&Lemeshow - $\chi2 = 0.00$, df = 3, p = 1.00 | | | | |
| **Health insurance** | | | | |
| Constant | -2.46 | *** | 0.01 | 0.09 |
| UCS *(reference)* | | *** | | |
| SSS | 0.39 | *** | 0.01 | 1.47 |
| CSMBS | 0.71 | *** | 0.02 | 2.04 |
| Other [c] | 0.75 | *** | 0.03 | 2.12 |
| Not have any health insurance | 0.02 | | 0.03 | 1.02 |
| n = 493,914 , % of dental use = 8.96 | | | | |
| -2LL = 295253, Nagelkerke R Square = 0.01 | | | | |
| Hosmer&Lemeshow - $\chi2 = 0.00$, df = 1, p = 1.00 | | | | |

Notes:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 29: Full detail of model 1A for each IV, multiple logistic regression model of predicting dental use by including each independent variable with age group and birth cohort.*

| Variables in the Equation | Model 1A | | | |
|---|---|---|---|---|
| | B | Sig. | S.E. | OR |
| **Gender** | | | | |
| Constant | -1.95 | *** | 0.06 | 0.14 |
| Male *(reference)* | | *** | | |
| Female | 0.38 | *** | 0.01 | 1.46 |
| n = 494,437 , % of dental use = 8.96 | | | | |
| -2LL = 293,226 (χ2 = 1422.3, df = 1, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.022 | | | | |
| Hosmer&Lemeshow test  p < 0.0001 | | | | |
| **Education of individual [a]** | | | | |
| Constant | -1.40 | *** | 0.06 | 0.25 |
| Primary level *(reference)* | | *** | | |
| Secondary level | 0.39 | *** | 0.02 | 1.48 |
| Tertiary Level | 1.11 | *** | 0.02 | 3.04 |
| n = 493,377 , % of dental use = 8.97 | | | | |
| -2LL = 289,283 (χ2 = 4,856.9, df = 2, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.037 | | | | |
| Hosmer&Lemeshow - χ2 = 83.8, df = 8, p < 0.0001 | | | | |
| **Work status of individual** | | | | |
| Constant | -1.16 | *** | 0.07 | 0.31 |
| Public-employee *(reference)* | | *** | | |
| Private-employee | -0.58 | *** | 0.02 | 0.56 |
| Self-employee | -0.69 | *** | 0.02 | 0.50 |
| Member of co-operative group | -0.71 | ** | 0.24 | 0.49 |
| No work | -0.55 | *** | 0.03 | 0.58 |
| n = 494,324 , % of dental use = 8.96 | | | | |
| -2LL = 293,585 (χ2 = 1,029.3, df = 4, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.020 | | | | |
| Hosmer&Lemeshow - χ2 = 40.2, df = 8, p < 0.0001 | | | | |
| **Marital status of individual** | | | | |
| Constant | -1.61 | *** | 0.06 | 0.20 |
| Never married *(reference)* | | *** | | |
| Married | -0.18 | *** | 0.02 | 0.84 |
| Used to married [b] | -0.25 | *** | 0.03 | 0.78 |
| n = 494,396 , % of dental use = 8.96 | | | | |
| -2LL = 294,485 (χ2 = 138.2, df = 2, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.020 | | | | |
| Hosmer&Lemeshow - χ2 = 23.4, df = 8, p < 0.01 | | | | |
| **Role in family** | | | | |
| Constant | -1.47 | *** | 0.06 | 0.23 |
| Head *(reference)* | | *** | | |
| Spouse | 0.01 | | 0.01 | 1.01 |
| Other | -0.37 | *** | 0.02 | 0.69 |
| n = 494,437 , % of dental use = 8.96 | | | | |
| -2LL = 294,020 (χ2 = 628.3, df = 2, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.020 | | | | |
| Hosmer&Lemeshow - χ2 = 22.9, df = 8, p < 0.01 | | | | |
| **Household size** | | | | |
| Constant | -1.47 | *** | 0.06 | 0.23 |
| Small size (1-3 members) *(reference)* | | *** | | |
| Medium size (4-6 members) | -0.22 | *** | 0.01 | 0.80 |
| Large size ( > 6 members) | -0.57 | *** | 0.02 | 0.56 |
| n = 494,437 , % of dental use = 8.96 | | | | |

| Variables in the Equation | Model 1A | | | |
|---|---|---|---|---|
| | B | Sig. | S.E. | OR |
| -2LL = 293,769 (χ2 = 878.6, df = 2, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.020 | | | | |
| Hosmer&Lemeshow - χ2 = 48.8, df = 8, p < 0.0001 | | | | |
| **Education of family head** [a] | | | | |
| Constant | -1.58 | *** | 0.07 | 0.21 |
| Primary level *(reference)* | | *** | | |
| Secondary level | 0.39 | *** | 0.01 | 1.48 |
| Tertiary Level | 0.99 | *** | 0.01 | 2.69 |
| n = 414,475 , % of dental use = 8.92 | | | | |
| -2LL = 241,597 (χ2 = 4,308.1, df = 2, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.039 | | | | |
| Hosmer&Lemeshow - χ2 = 52.9, df = 7, p < 0.0001 | | | | |
| **Work status of family head** | | | | |
| Constant | -1.12 | *** | 0.07 | 0.33 |
| Public-employee *(reference)* | | *** | | |
| Private-employee | -0.49 | *** | 0.02 | 0.61 |
| Self-employee | -0.53 | *** | 0.02 | 0.59 |
| Member of co-operative group | -0.66 | *** | 0.19 | 0.52 |
| No work | -0.56 | *** | 0.02 | 0.57 |
| n = 415,575 , % of dental use = 8.91 | | | | |
| -2LL = 245,727 (χ2 = 799.5, df = 4, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.021 | | | | |
| Hosmer&Lemeshow - χ2 = 16.4, df = 8, p < 0.05 | | | | |
| **Marital status of family head** | | | | |
| Constant | -1.25 | *** | 0.07 | 0.29 |
| Never married *(reference)* | | *** | | |
| Married | -0.31 | *** | 0.02 | 0.73 |
| Used to married [b] | -0.43 | *** | 0.03 | 0.65 |
| n = 415,494 , % of dental use = 8.91 | | | | |
| -2LL = 246,237 (χ2 = 271.6, df = 2, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.018 | | | | |
| Hosmer&Lemeshow - χ2 = 12.1, df = 8, p = 0.147 | | | | |
| **Area of residence** | | | | |
| Constant | -1.10 | *** | 0.06 | 0.33 |
| Bangkok *(reference)* | | *** | | |
| Urban | -0.56 | *** | 0.02 | 0.57 |
| Rural | -0.67 | *** | 0.01 | 0.51 |
| n = 494,437 , % of dental use = 8.96 | | | | |
| -2LL = 292,494 (χ2 = 2,154.2, df = 2, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.025 | | | | |
| Hosmer&Lemeshow - χ2 = 148.5, df = 8, p < 0.0001 | | | | |
| **Region of residence** | | | | |
| Constant | -1.13 | *** | 0.06 | 0.32 |
| Bangkok *(reference)* | | *** | | |
| Central | -0.69 | *** | 0.02 | 0.50 |
| Northern | -0.49 | *** | 0.02 | 0.61 |
| Northeastern | -0.70 | *** | 0.02 | 0.50 |
| Southern | -0.59 | *** | 0.02 | 0.55 |
| n = 494,437 , % of dental use = 8.96 | | | | |
| -2LL = 292,345 (χ2 = 2,303.3, df = 4, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.026 | | | | |
| Hosmer&Lemeshow - χ2 = 38.1, df = 8, p < 0.0001 | | | | |
| **Health insurance** | | | | |
| Constant | -1.75 | *** | 0.06 | 0.17 |
| UCS *(reference)* | | *** | | |

| Variables in the Equation | Model 1A | | | |
|---|---|---|---|---|
| | B | Sig. | S.E. | OR |
| SSS | 0.55 | *** | 0.02 | 1.74 |
| CSMBS | 0.74 | *** | 0.02 | 2.10 |
| Other [c] | 0.78 | *** | 0.03 | 2.18 |
| Not have any health insurance | 0.07 | * | 0.03 | 1.08 |
| n = 493,914 , % of dental use = 8.96 | | | | |
| -2LL = 291,192 ($\chi2$ = 3,219.1, df = 4, p < 0.0001) | | | | |
| Nagelkerke R Square = 0.030 | | | | |
| Hosmer&Lemeshow - $\chi2$ = 18.3, df = 7, p < 0.01 | | | | |

Notes:

The model for each variable was included age group and birth cohort (AC), but the co-efficient values of AC were not showed in table because they were not applicable.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

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*Table 30: Full detail of model 1B for whole population, logistic regression model of predicting dental use by including all independent variables together (except area of residence).*

| Variables in the Equation | Model 1B | | | |
|---|---|---|---|---|
| | B | Sig. | S.E. | OR |
| Constant | -0.94 | *** | 0.08 | 0.39 |
| Age group | | | | |
| Childhood *(reference)* | | *** | | |
| Adolescent | -0.71 | *** | 0.03 | 0.49 |
| Early Adult | -1.06 | *** | 0.04 | 0.35 |
| Adult | -1.32 | *** | 0.05 | 0.27 |
| Late adult/ Early elderly | -1.38 | *** | 0.05 | 0.25 |
| Elderly | -1.60 | *** | 0.07 | 0.20 |
| Early childhood | -1.28 | *** | 0.03 | 0.28 |
| Birth cohort | | | | |
| before 1941 *(reference)* | | *** | | |
| 1941-1950 | 0.23 | *** | 0.04 | 1.26 |
| 1951-1960 | 0.06 | | 0.05 | 1.06 |
| 1961-1970 | -0.17 | ** | 0.05 | 0.84 |
| 1971-1980 | -0.41 | *** | 0.06 | 0.66 |
| 1981-1990 | -0.57 | *** | 0.06 | 0.56 |
| 1991-2000 | -0.47 | *** | 0.07 | 0.63 |
| after 2000 | -0.59 | *** | 0.07 | 0.55 |
| Gender | | | | |
| Male *(reference)* | | | | |
| Female | 0.46 | *** | 0.01 | 1.58 |
| Education of individual [a] | | | | |
| Primary level *(reference)* | | *** | | |
| Secondary level | 0.20 | *** | 0.02 | 1.22 |
| Tertiary Level | 0.59 | *** | 0.02 | 1.80 |
| Work status of individual | | | | |
| Public-employee *(reference)* | | *** | | |
| Private-employee | -0.10 | ** | 0.03 | 0.91 |
| Self-employee | 0.06 | | 0.03 | 1.06 |
| Member of co-operative group | -0.07 | | 0.28 | 0.94 |
| No work | 0.02 | | 0.03 | 1.02 |
| Marital status of individual | | | | |
| Never married *(reference)* | | *** | | |
| Married | -0.18 | *** | 0.02 | 0.84 |
| Used to married [b] | -0.29 | *** | 0.03 | 0.75 |
| Role in family | | | | |
| Head *(reference)* | | *** | | |
| Spouse | -0.15 | *** | 0.02 | 0.86 |
| Other | -0.36 | *** | 0.02 | 0.69 |
| Household size | | | | |
| Small size (1-3 members) *(reference)* | | *** | | |
| Medium size (4-6 members) | -0.13 | *** | 0.01 | 0.88 |
| Large size ( > 6 members) | -0.40 | *** | 0.03 | 0.67 |

| Variables in the Equation | Model 1B | | | |
|---|---|---|---|---|
| | B | Sig. | S.E. | OR |
| Education of family head [a] | | | | |
|    Primary level *(reference)* | | *** | | |
|    Secondary level | 0.18 | *** | 0.02 | 1.20 |
|    Tertiary Level | 0.42 | *** | 0.02 | 1.52 |
| Work status of family head | | | | |
|    Public-employee *(reference)* | | *** | | |
|    Private-employee | -0.08 | ** | 0.03 | 0.93 |
|    Self-employee | 0.05 | * | 0.03 | 1.06 |
|    Member of co-operative group | 0.03 | | 0.20 | 1.03 |
|    No work | -0.06 | * | 0.03 | 0.94 |
| Marital status of family head | | | | |
|    Never married *(reference)* | | *** | | |
|    Married | 0.15 | *** | 0.03 | 1.17 |
|    Used to married [b] | 0.14 | *** | 0.03 | 1.15 |
| Region of residence | | | | |
|    Bangkok *(reference)* | | *** | | |
|    Central | -0.56 | *** | 0.02 | 0.57 |
|    Northern | -0.27 | *** | 0.02 | 0.76 |
|    Northeastern | -0.44 | *** | 0.02 | 0.64 |
|    Southern | -0.40 | *** | 0.02 | 0.67 |
| Health insurance | | | | |
|    UCS *(reference)* | | *** | | |
|    SSS | 0.36 | *** | 0.02 | 1.43 |
|    CSMBS | 0.35 | *** | 0.02 | 1.42 |
|    Other [c] | 0.43 | *** | 0.04 | 1.54 |
|    Not have any health insurance | -0.11 | ** | 0.04 | 0.90 |
| n | 413,707 | | | |
| % of dental use | 8.92 | | | |
| -2 Log likelihood | 236,338 | | | |
| Nagelkerke R Square | 0.065 | | | |
| Hosmer&Lemeshow - $\chi 2$ | 84.4, df = 8, p < 0.0001 | | | |

Notes:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 31: Summary of odd ratio of each variable to dental service utilization of early childhood.*

| Variable | Model 0 OR | Model 0 Sig. | Model 1A OR | Model 1A Sig. | Model 1B OR | Model 1B Sig. |
|---|---|---|---|---|---|---|
| Age (year) | 1.54 | *** | 1.53 | *** | 1.52 | *** |
| Birth cohort | | | | | | |
| 1991-2000 *(reference)* | | | | | | |
| after 2000 | 0.56 | *** | 0.89 | | 0.85 | * |
| Gender | | | | | | |
| Male *(reference)* | | | | | | |
| Female | 1.07 | | 1.06 | | 1.05 | |
| Household size | | | | | | |
| Small size (1-3 members) *(reference)* | | *** | | *** | | ** |
| Medium size (4-6 members) | 0.83 | ** | 0.86 | * | 0.87 | * |
| Large size ( > 6 members) | 0.59 | *** | 0.65 | *** | 0.72 | ** |
| Education of family head [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | *** |
| Secondary level | 1.51 | *** | 1.56 | *** | 1.48 | *** |
| Tertiary Level | 2.08 | *** | 2.04 | *** | 1.78 | *** |
| Work status of family head | | | | | | |
| Public-employee *(reference)* | | ** | | | | |
| Private-employee | 0.71 | ** | 0.75 | * | 1.19 | |
| Self-employee | 0.74 | ** | 0.77 | * | 1.36 | * |
| Member of co-operative group | 0 | | 0 | | 0 | |
| No work | 0.64 | *** | 0.7 | ** | 1.34 | * |
| Marital status of family head | | | | | | * |
| Never married *(reference)* | | ** | | *** | 1.62 | |
| Married | 1.46 | | 1.53 | | 1.27 | |
| Used to married [b] | 1.06 | | 1.09 | | | |
| Area of residence | | | | | | |
| Bangkok *(reference)* | | *** | | *** | | |
| Urban | 0.65 | *** | 0.65 | *** | | |
| Rural | 0.63 | *** | 0.61 | *** | | |
| Region of residence | | | | | | |
| Bangkok *(reference)* | | *** | | *** | | *** |
| Central | 0.61 | *** | 0.6 | *** | 0.61 | *** |
| Northern | 0.7 | *** | 0.68 | *** | 0.63 | *** |
| Northeastern | 0.67 | *** | 0.65 | *** | 0.65 | *** |
| Southern | 0.54 | *** | 0.52 | *** | 0.44 | *** |
| Health insurance | | | | | | |
| UCS *(reference)* | | *** | | *** | | *** |
| CSMBS | 1.96 | *** | 1.87 | *** | 1.62 | *** |
| Other [c] | 1.22 | | 1.24 | | 0.84 | |
| Not have any health insurance | 0.65 | ** | 0.87 | | 0.63 | ** |

Notes: Model 0 was included each independent variable singly. Model 1A was included each independent variable together with age and cohort (AC), noted that OR of A and C were come from the model included AC only, OR of AC from all other combination did not show. Model 1B was included all independent variables together except for area of residence.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* p < 0.05, ** p < 0.01, *** p < 0.0001, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 32: The association of DU and groups of independent variables for early childhood.*

| Variables in the Equation | Model 2 | | | | Model 4 | | | | Model 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Constant | -4.53 | *** | 0.11 | 0.01 | -4.79 | *** | 0.35 | 0.01 | -4.06 | *** | 0.14 | 0.02 |
| Age (year) | 0.42 | *** | 0.02 | 1.53 | 0.42 | *** | 0.02 | 1.53 | 0.42 | *** | 0.02 | 1.52 |
| Birth cohort | | | | | | | | | | | | |
| 1991-2000 *(reference)* | | | | | | | | | | | | |
| after 2000 | -0.15 | * | 0.08 | 0.86 | -0.15 | * | 0.08 | 0.86 | -0.15 | * | 0.08 | 0.86 |
| Education of family head [a] | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.44 | *** | 0.07 | 1.56 | 0.39 | *** | 0.07 | 1.48 | 0.43 | *** | 0.07 | 1.53 |
| Tertiary Level | 0.71 | *** | 0.08 | 2.04 | 0.66 | *** | 0.08 | 1.93 | 0.57 | *** | 0.09 | 1.76 |
| Household size | | | | | | | | | | | | |
| Small size (1-3 members) *(reference)* | | | | | | ** | | | | | | |
| Medium size (4-6 members) | | | | | -0.14 | * | 0.07 | 0.87 | | | | |
| Large size ( > 6 members) | | | | | -0.31 | ** | 0.11 | 0.73 | | | | |
| Marital status of family head | | | | | | | | | | | | |
| Never married *(reference)* | | | | | | * | | | | | | |
| Married | | | | | 0.45 | | 0.33 | 1.57 | | | | |
| Used to married [b] | | | | | 0.23 | | 0.34 | 1.26 | | | | |
| Region of residence | | | | | | | | | | | | |
| Bangkok *(reference)* | | | | | | | | | | *** | | |
| Central | | | | | | | | | -0.50 | *** | 0.10 | 0.61 |
| Northern | | | | | | | | | -0.42 | *** | 0.10 | 0.66 |
| Northeastern | | | | | | | | | -0.40 | *** | 0.09 | 0.67 |
| Southern | | | | | | | | | -0.78 | *** | 0.11 | 0.46 |
| Health insurance | | | | | | | | | | | | |
| UCS *(reference)* | | | | | | | | | | *** | | |
| CSMBS | | | | | | | | | 0.38 | *** | 0.10 | 1.46 |
| Other [c] | | | | | | | | | -0.16 | | 0.26 | 0.85 |
| Not have any health insurance | | | | | | | | | -0.45 | ** | 0.16 | 0.64 |
| n | 28,922 | | | | 28,914 | | | | 28851 | | | |
| % of dental use | 4.1 | | | | 4.1 | | | | 4.1 | | | |
| -2 Log likelihood | 10,361 | | | | 10,343 | | | | 10,281 | | | |
| Nagelkerke R Square | 0.070 | | | | 0.071 | | | | 0.078 | | | |
| Hosmer&Lemeshow - χ2 | 13.1, df = 8, p = 0.11 | | | | 24.7, df = 8, p < 0.01 | | | | 57.1, df = 8, p < 0.0001 | | | |

Notes:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* p < 0.05, ** p < 0.01, *** p < 0.0001, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 33: Summary of odd ratio of each variable to dental service utilization of childhood.*

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Age (year) | 0.92 | *** | 0.90 | *** | 0.90 | *** |
| Birth cohort | | | | | | |
|   1981-1990 | | * | | *** | | *** |
|   1991-2000 | 1.21 | ** | 0.91 | | 0.92 | |
|   after 2000 | 1.18 | * | 0.75 | *** | 0.73 | *** |
| Gender | | | | | | |
|   Male *(reference)* | | | | | | |
|   Female | 1.19 | *** | 1.19 | *** | 1.17 | *** |
| Household size | | | | | | |
|   Small size (1-3 members) *(reference)* | | *** | | *** | | *** |
|   Medium size (4-6 members) | 0.93 | ** | 0.90 | *** | 0.91 | ** |
|   Large size ( > 6 members) | 0.60 | *** | 0.56 | *** | 0.64 | *** |
| Education of family head [a] | | | | | | |
|   Primary level *(reference)* | | *** | | *** | | *** |
|   Secondary level | 1.24 | *** | 1.28 | *** | 1.27 | *** |
|   Tertiary Level | 1.84 | *** | 1.86 | *** | 1.75 | *** |
| Work status of family head | | | | | | |
|   Public-employee *(reference)* | | *** | | *** | | ** |
|   Private-employee | 0.62 | *** | 0.62 | *** | 0.95 | |
|   Self-employee | 0.71 | *** | 0.71 | *** | 1.08 | |
|   Member of co-operative group | 0.49 | | 0.47 | * | 0.73 | |
|   No work | 0.60 | *** | 0.60 | *** | 0.99 | |
| Marital status of family head | | | | | | |
|   Never married *(reference)* | | *** | | *** | | ** |
|   Married | 1.52 | *** | 1.45 | ** | 1.47 | ** |
|   Used to married [b] | 1.29 | * | 1.26 | | 1.39 | ** |
| Area of residence | | | | | | |
|   Bangkok *(reference)* | | *** | | *** | | |
|   Urban | 0.81 | *** | 0.83 | *** | - | - |
|   Rural | 0.93 | | 0.93 | | - | - |
| Region of residence | | | | | | |
|   Bangkok *(reference)* | | *** | | *** | | *** |
|   Central | 0.72 | *** | 0.72 | *** | 0.74 | *** |
|   Northern | 1.22 | *** | 1.25 | *** | 1.29 | *** |
|   Northeastern | 0.91 | * | 0.92 | * | 1.01 | |
|   Southern | 0.79 | *** | 0.79 | *** | 0.85 | ** |
| Health insurance | | | | | | |
|   UCS *(reference)* | | *** | | *** | | *** |
|   CSMBS | 1.64 | *** | 1.65 | *** | 1.28 | *** |
|   Other [c] | 1.85 | *** | 1.85 | *** | 1.37 | ** |
|   Not have any health insurance | 0.95 | | 0.91 | | 0.92 | |

Notes: Model 0 was included each independent variable singly. Model 1A was included each independent variable together with age and cohort (AC), noted that OR of A and C were come from the model included AC only, OR of AC from all other combination did not show. Model 1B was included all independent variables together except for area of residence.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 34: The association of DU and groups of independent variables for childhood.*

| Variables in the Equation | Model 2 | | | | Model 4 | | | | Model 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Constant | -0.77 | *** | 0.10 | 0.46 | -1.03 | *** | 0.16 | 0.36 | -0.92 | *** | 0.10 | 0.40 |
| Age (year) | -0.11 | *** | 0.01 | 0.90 | -0.11 | *** | 0.01 | 0.90 | -0.11 | *** | 0.01 | 0.90 |
| Birth cohort | | | | | | | | | | | | |
| 1981-1990 *(reference)* | | *** | | | | *** | | | | *** | | |
| 1991-2000 | -0.09 | | 0.07 | 0.92 | -0.09 | | 0.07 | 0.91 | -0.08 | | 0.07 | 0.92 |
| after 2000 | -0.32 | *** | 0.07 | 0.73 | -0.34 | *** | 0.07 | 0.71 | -0.31 | *** | 0.07 | 0.74 |
| Education of family head [a] | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.25 | *** | 0.03 | 1.28 | 0.21 | *** | 0.03 | 1.24 | 0.27 | *** | 0.03 | 1.30 |
| Tertiary Level | 0.62 | *** | 0.04 | 1.86 | 0.59 | *** | 0.04 | 1.80 | 0.58 | *** | 0.04 | 1.79 |
| Gender | | | | | | | | | | | | |
| Male *(reference)* | | *** | | | | *** | | | | *** | | |
| Female | 0.16 | *** | 0.03 | 1.17 | 0.16 | *** | 0.03 | 1.17 | 0.15 | *** | 0.03 | 1.17 |
| Household size | | | | | | | | | | | | |
| Small size (1-3 members) *(reference)* | | | | | | *** | | | | | | |
| Medium size (4-6 members) | | | | | -0.11 | *** | 0.03 | 0.89 | | | | |
| Large size ( > 6 members) | | | | | -0.50 | *** | 0.05 | 0.61 | | | | |
| Marital status of family head | | | | | | | | | | | | |
| Never married *(reference)* | | | | | | *** | | | | | | |
| Married | | | | | 0.44 | *** | 0.12 | 1.56 | | | | |
| Used to married [b] | | | | | 0.36 | ** | 0.12 | 1.43 | | | | |
| Region of residence | | | | | | | | | | | | |
| Bangkok *(reference)* | | | | | | | | | | *** | | |
| Central | | | | | | | | | 0.14 | * | 0.06 | 1.15 |
| Northern | | | | | | | | | -0.14 | ** | 0.04 | 0.87 |
| Northeastern | | | | | | | | | 0.46 | *** | 0.04 | 1.58 |
| Southern | | | | | | | | | 0.20 | *** | 0.04 | 1.22 |
| Health insurance | | | | | | | | | | | | |
| UCS *(reference)* | | | | | | | | | | *** | | |
| CSMBS | | | | | | | | | 0.24 | *** | 0.05 | 1.27 |
| Other [c] | | | | | | | | | 0.32 | ** | 0.10 | 1.37 |
| Not have any health insurance | | | | | | | | | -0.08 | | 0.09 | 0.92 |
| n | 55,639 | | | | 55,620 | | | | 55,549 | | | |
| % of dental use | 14 | | | | 14 | | | | 14.1 | | | |
| -2 Log likelihood | 41,055 | | | | 40,929 | | | | 40,736 | | | |
| Nagelkerke R Square | 0.024 | | | | 0.028 | | | | 0.034 | | | |
| Hosmer&Lemeshow - χ2 | 65.3, df = 8, p < 0.0001 | | | | 42.7, df = 8, p < 0.0001 | | | | 38.4, df = 8, p < 0.0001 | | | |

Notes:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* p < 0.05, ** p < 0.01, *** p < 0.0001

*Table 35: Summary of odd ratio of each variable to dental service utilization of adolescent.*

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Age (year) | 1.04 | *** | 1.05 | *** | 1.02 | ** |
| Birth cohort | | | | | | |
|   1971-1980 *(reference)* | | | | ** | | * |
|   1981-1990 | 1.10 | | 1.35 | * | 1.32 | |
|   1991-2000 | 1.10 | | 1.49 | ** | 1.42 | * |
| Gender | | | | | | |
|   Male *(reference)* | | | | | | |
|   Female | 1.72 | *** | 1.69 | *** | 1.95 | *** |
| Education of individual [a] | | | | | | |
|   Primary level *(reference)* | | *** | | *** | | *** |
|   Secondary level | 1.42 | *** | 1.36 | *** | 1.36 | *** |
|   Tertiary Level | 1.75 | *** | 1.52 | *** | 1.36 | ** |
| Household size | | | | | | |
|   Small size (1-3 members) *(reference)* | | *** | | *** | | * |
|   Medium size (4-6 members) | 0.93 | * | 0.95 | | 0.98 | |
|   Large size ( > 6 members) | 0.75 | *** | 0.76 | *** | 0.81 | ** |
| Education of family head [a] | | | | | | |
|   Primary level *(reference)* | | *** | | *** | | *** |
|   Secondary level | 1.43 | *** | 1.39 | *** | 1.22 | *** |
|   Tertiary Level | 2.42 | *** | 2.34 | *** | 1.74 | *** |
| Work status of family head | | | | | | |
|   Public-employee *(reference)* | | *** | | *** | | *** |
|   Private-employee | 0.67 | *** | 0.66 | *** | 0.83 | * |
|   Self-employee | 0.67 | *** | 0.67 | *** | 0.97 | |
|   Member of co-operative group | 0.11 | | 0.11 | | 0.20 | |
|   No work | 0.61 | *** | 0.59 | *** | 0.80 | ** |
| Marital status of family head | | | | | | |
|   Never married *(reference)* | | *** | | *** | | * |
|   Married | 0.82 | ** | 0.88 | * | 0.92 | |
|   Used to married [b] | 0.63 | *** | 0.68 | *** | 0.82 | * |
| Area of residence | | | | | | |
|   Bangkok *(reference)* | | *** | | *** | | |
|   Urban | 0.61 | *** | 0.62 | *** | - | - |
|   Rural | 0.46 | *** | 0.47 | *** | - | - |
| Region of residence | | | | | | |
|   Bangkok *(reference)* | | *** | | *** | | *** |
|   Central | 0.48 | *** | 0.49 | *** | 0.52 | *** |
|   Northern | 0.57 | *** | 0.58 | *** | 0.60 | *** |
|   Northeastern | 0.48 | *** | 0.50 | *** | 0.48 | *** |
|   Southern | 0.54 | *** | 0.55 | *** | 0.61 | *** |
| Health insurance | | | | | | |
|   UCS *(reference)* | | *** | | *** | | *** |
|   CSMBS | 1.75 | *** | 1.82 | *** | 1.33 | *** |
|   Other [c] | 3.92 | *** | 3.86 | *** | 3.11 | *** |
|   Not have any health insurance | 1.26 | ** | 1.25 | * | 1.02 | |

Notes: Model 0 was included each independent variable singly. Model 1A was included each independent variable together with age and cohort (AC), noted that OR of A and C were come from the model included AC only, OR of AC from all other combination did not show. Model 1B was included all independent variables together except area of residence.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 36: The association of DU and groups of independent variables for adolescent.*

| Variables in the Equation | Model 2 | | | | Model 4 | | | | Model 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig | S.E. | OR | B | Sig | S.E. | OR | B | Sig | S.E. | OR |
| Constant | -3.73 | *** | 0.23 | 0.02 | -3.78 | *** | 0.25 | 0.02 | -3.28 | *** | 0.25 | 0.04 |
| Age (year) | 0.02 | ** | 0.01 | 1.02 | 0.03 | ** | 0.01 | 1.03 | 0.02 | * | 0.01 | 1.02 |
| Birth cohort | | | | | | | | | | | | |
| 1981-1990 *(reference)* | | | | | | | | | | | | |
| 1991-2000 | 0.14 | | 0.15 | 1.15 | 0.15 | | 0.15 | 1.16 | 0.26 | | 0.16 | 1.30 |
| after 2000 | 0.19 | | 0.15 | 1.21 | 0.20 | | 0.15 | 1.22 | 0.33 | * | 0.16 | 1.39 |
| Education of family head [a] | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.33 | *** | 0.04 | 1.39 | 0.31 | *** | 0.05 | 1.37 | 0.23 | *** | 0.05 | 1.26 |
| Tertiary Level | 0.88 | *** | 0.05 | 2.40 | 0.86 | *** | 0.05 | 2.35 | 0.60 | *** | 0.06 | 1.82 |
| Education of individual [a] | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.35 | *** | 0.06 | 1.42 | 0.34 | *** | 0.06 | 1.41 | 0.32 | *** | 0.06 | 1.38 |
| Tertiary Level | 0.42 | *** | 0.09 | 1.51 | 0.41 | *** | 0.09 | 1.51 | 0.34 | *** | 0.09 | 1.40 |
| Gender | | | | | | | | | | | | |
| Male *(reference)* | | | | | | | | | | | | |
| Female | 0.64 | *** | 0.04 | 1.90 | 0.64 | *** | 0.04 | 1.90 | 0.66 | *** | 0.04 | 1.94 |
| Household size | | | | | | | | | | | | |
| Small size (1-3 members) *(reference)* | | | | | | | | | | | | |
| Medium size (4-6 members) | | | | | -0.01 | | 0.04 | 0.99 | | | | |
| Large size ( > 6 members) | | | | | -0.19 | * | 0.08 | 0.83 | | | | |
| Marital status of family head | | | | | | | | | | | | |
| Never married *(reference)* | | | | | | * | | | | | | |
| Married | | | | | 0.08 | | 0.07 | 1.09 | | | | |
| Used to married [b] | | | | | -0.06 | | 0.08 | 0.94 | | | | |
| Region of residence | | | | | | | | | | | | |
| Bangkok *(reference)* | | | | | | | | | | *** | | |
| Central | | | | | | | | | -0.64 | *** | 0.06 | 0.53 |
| Northern | | | | | | | | | -0.47 | *** | 0.06 | 0.63 |
| Northeastern | | | | | | | | | -0.69 | *** | 0.06 | 0.50 |
| Southern | | | | | | | | | -0.46 | *** | 0.07 | 0.63 |
| Health insurance | | | | | | | | | | | | |
| UCS *(reference)* | | | | | | | | | | *** | | |
| CSMBS | | | | | | | | | 0.33 | *** | 0.07 | 1.40 |
| Other [c] | | | | | | | | | 1.13 | *** | 0.10 | 3.11 |
| Not have any health insurance | | | | | | | | | 0.01 | | 0.10 | 1.01 |
| n | 28,611 | | | | 28,603 | | | | 28,450 | | | |
| % of dental use | 10 | | | | 10 | | | | 10 | | | |
| -2 Log likelihood | 21,513 | | | | 21,497 | | | | 20,987 | | | |
| Nagelkerke R Square | 0.041 | | | | 0.042 | | | | 0.058 | | | |
| Hosmer&Lemeshow - χ2 | 44.2, df = 8, p < 0.0001 | | | | 18.2, df = 8, p < 0.05 | | | | 21.7, df = 8, p < 0.01 | | | |

Notes: [a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.
[b] Including widowed, divorced, separated, and married but unknown status.
[c] Nonpublic-provided health insurances such as insurance company, and employer pay.
* p < 0.05, ** p < 0.01, *** p < 0.0001

*Table 37: Summary of odd ratio of each variable to dental service utilization of early adult.*

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Age (year) | 1.02 | *** | 1.02 | *** | 0.99 | ** |
| Birth cohort | | | | | | |
| 1961-1970 *(reference)* | | *** | | | | *** |
| 1971-1980 | 0.83 | ** | 0.87 | * | 0.68 | *** |
| 1981-1990 | 0.76 | *** | 0.88 | * | 0.55 | *** |
| 1991-2000 | 0.65 | *** | 0.85 | * | 0.59 | *** |
| Gender | | | | | | |
| Male *(reference)* | | | | | | |
| Female | 2.09 | *** | 2.06 | *** | 2.14 | *** |
| Education of individual [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | *** |
| Secondary level | 1.42 | *** | 1.52 | *** | 1.38 | *** |
| Tertiary Level | 3.07 | *** | 3.24 | *** | 2.23 | *** |
| Work status of individual | | | | | | |
| Public-employee *(reference)* | | *** | | *** | | *** |
| Private-employee | 0.61 | *** | 0.63 | *** | 1.04 | |
| Self-employee | 0.52 | *** | 0.53 | *** | 1.22 | ** |
| Member of co-operative group | 0.52 | | 0.53 | | 0.72 | |
| No work | 0.72 | *** | 0.72 | *** | 1.29 | *** |
| Marital status of individual | | | | | | |
| Never married *(reference)* | | *** | | *** | | *** |
| Married | 0.88 | *** | 0.79 | *** | 0.77 | *** |
| Used to married [b] | 0.8 | *** | 0.71 | *** | 0.79 | ** |
| Role in family | | | | | | |
| Head *(reference)* | | *** | | *** | | *** |
| Spouse | 1.04 | | 1.04 | | 0.84 | *** |
| Other | 0.64 | *** | 0.65 | *** | 0.59 | *** |
| Household size | | | | | | |
| Small size (1-3 members) *(reference)* | | *** | | *** | | *** |
| Medium size (4-6 members) | 0.7 | *** | 0.7 | *** | 0.9 | *** |
| Large size ( > 6 members) | 0.49 | *** | 0.49 | *** | 0.69 | *** |
| Education of family head [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | *** |
| Secondary level | 1.62 | *** | 1.63 | *** | 1.18 | *** |
| Tertiary Level | 3.13 | *** | 3.11 | *** | 1.42 | *** |
| Work status of family head | | | | | | |
| Public-employee *(reference)* | | *** | | *** | | *** |
| Private-employee | 0.59 | *** | 0.6 | *** | 0.78 | *** |
| Self-employee | 0.51 | *** | 0.52 | *** | 0.91 | |
| Member of co-operative group | 0.43 | | 0.43 | | 1.14 | |
| No work | 0.54 | *** | 0.54 | *** | 0.88 | * |
| Marital status of family head | | | | | | |
| Never married *(reference)* | | *** | | *** | | *** |
| Married | 0.68 | *** | 0.67 | *** | 1.23 | *** |
| Used to married [b] | 0.63 | *** | 0.62 | *** | 1.31 | *** |
| Area of residence | | | | | | |

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Bangkok *(reference)* | | *** | | *** | | |
| Urban | 0.57 | *** | 0.58 | *** | | |
| Rural | 0.48 | *** | 0.49 | *** | | |
| Region of residence | | | | | | |
| Bangkok *(reference)* | | *** | | *** | | *** |
| Central | 0.5 | *** | 0.51 | *** | 0.61 | *** |
| Northern | 0.56 | *** | 0.57 | *** | 0.81 | *** |
| Northeastern | 0.45 | *** | 0.46 | *** | 0.68 | *** |
| Southern | 0.56 | *** | 0.57 | *** | 0.77 | *** |
| Health insurance | | | | | | |
| UCS *(reference)* | | *** | | *** | | *** |
| SSS | 1.7 | *** | 1.7 | *** | 1.36 | *** |
| CSMBS | 2.42 | *** | 2.32 | *** | 1.28 | *** |
| Other [c] | 1.57 | *** | 1.56 | *** | 1.11 | |
| Not have any health insurance | 1.04 | | 1.02 | | 0.82 | * |

Notes: Model 0 was included each independent variable singly. Model 1A was included each independent variable together with age and cohort (AC), noted that OR of A and C were come from the model included AC only, OR of AC from all other combination did not show. Model 1B was included all independent variables together except for area of residence.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

$* p < 0.05$, $** p < 0.01$, $*** p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 38: The association of DU and groups of independent variables for early adult.*

| Variables in the Equation | Model 2 B | Sig. | S.E. | OR | Model 3 B | Sig. | S.E. | OR | Model 4 B | Sig. | S.E. | OR | Model 5 B | Sig. | S.E. | OR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constant | -2.89 | *** | 0.13 | 0.06 | -2.37 | *** | 0.13 | 0.09 | -2.35 | *** | 0.13 | 0.10 | -2.54 | *** | 0.13 | 0.08 |
| Age (year) | 0.00 | | 0.00 | 1.00 | 0.00 | | 0.00 | 1.00 | -0.01 | ** | 0.00 | 0.99 | 0.00 | | 0.00 | 1.00 |
| Birth cohort | | | | | | | | | | | | | | | | |
| 1961-1970 *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
| 1971-1980 | -0.37 | *** | 0.06 | 0.69 | -0.37 | *** | 0.06 | 0.69 | -0.39 | *** | 0.06 | 0.68 | -0.39 | *** | 0.06 | 0.68 |
| 1981-1990 | -0.57 | *** | 0.07 | 0.56 | -0.57 | *** | 0.07 | 0.57 | -0.60 | *** | 0.07 | 0.55 | -0.59 | *** | 0.07 | 0.56 |
| 1991-2000 | -0.50 | *** | 0.08 | 0.60 | -0.51 | *** | 0.08 | 0.60 | -0.54 | *** | 0.08 | 0.58 | -0.52 | *** | 0.08 | 0.60 |
| Education of family head [a] | | | | | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.40 | *** | 0.03 | 1.49 | 0.20 | *** | 0.03 | 1.22 | 0.20 | *** | 0.03 | 1.23 | 0.36 | *** | 0.03 | 1.43 |
| Tertiary Level | 0.65 | *** | 0.04 | 1.92 | 0.38 | *** | 0.04 | 1.46 | 0.39 | *** | 0.04 | 1.48 | 0.60 | *** | 0.04 | 1.82 |
| Education of individual [a] | | | | | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.29 | *** | 0.03 | 1.33 | 0.37 | *** | 0.04 | 1.45 | 0.36 | *** | 0.04 | 1.43 | 0.26 | *** | 0.03 | 1.30 |
| Tertiary Level | 0.84 | *** | 0.04 | 2.32 | 0.96 | *** | 0.04 | 2.61 | 0.98 | *** | 0.04 | 2.65 | 0.71 | *** | 0.04 | 2.03 |
| Gender | | | | | | | | | | | | | | | | |
| Male *(reference)* | | | | | | | | | | | | | | | | |
| Female | 0.73 | *** | 0.02 | 2.07 | 0.76 | *** | 0.03 | 2.14 | 0.75 | *** | 0.03 | 2.12 | 0.72 | *** | 0.02 | 2.06 |
| Marital status of individual | | | | | | | | | | | | | | | | |
| Never married *(reference)* | | | | | | *** | | | | | | | | | | |
| Married | | | | | -0.26 | *** | 0.03 | 0.77 | | | | | | | | |
| Used to married [b] | | | | | -0.20 | ** | 0.07 | 0.82 | | | | | | | | |
| Role in family | | | | | | | | | | | | | | | | |
| Head *(reference)* | | | | | | *** | | | | *** | | | | | | |
| Spouse | | | | | -0.09 | * | 0.04 | 0.92 | -0.15 | *** | 0.04 | 0.86 | | | | |
| Other | | | | | -0.48 | *** | 0.03 | 0.62 | -0.32 | *** | 0.04 | 0.72 | | | | |
| Household size | | | | | | | | | | | | | | | | |
| Small size (1-3 members) *(reference)* | | | | | | | | | | *** | | | | | | |
| Medium size (4-6 members) | | | | | | | | | -0.14 | *** | 0.03 | 0.87 | | | | |
| Large size ( > 6 members) | | | | | | | | | -0.45 | *** | 0.06 | 0.63 | | | | |
| Region of residence | | | | | | | | | | | | | | | | |
| Bangkok *(reference)* | | | | | | | | | | | | | | *** | | |
| Central | | | | | | | | | | | | | -0.49 | *** | 0.03 | 0.62 |
| Northern | | | | | | | | | | | | | -0.18 | *** | 0.04 | 0.83 |
| Northeastern | | | | | | | | | | | | | -0.39 | *** | 0.04 | 0.68 |
| Southern | | | | | | | | | | | | | -0.24 | *** | 0.04 | 0.79 |
| Health insurance | | | | | | | | | | | | | | | | |
| UCS *(reference)* | | | | | | | | | | | | | | *** | | |
| SSS | | | | | | | | | | | | | 0.19 | *** | 0.03 | 1.21 |
| CSMBS | | | | | | | | | | | | | 0.20 | *** | 0.05 | 1.22 |
| Other [c] | | | | | | | | | | | | | 0.08 | | 0.09 | 1.08 |
| Not have any health insurance | | | | | | | | | | | | | -0.18 | * | 0.08 | 0.83 |
| n | 79,659 | | | | 79,657 | | | | 79,659 | | | | 79,559 | | | |
| % of dental use | 8.2 | | | | 8.2 | | | | 8.2 | | | | 8.2 | | | |
| -2 Log likelihood | 54,289 | | | | 54,043 | | | | 54,047 | | | | 53,979 | | | |
| Nagelkerke R Square | 0.068 | | | | 0.074 | | | | 0.074 | | | | 0.075 | | | |
| Hosmer&Lemeshow - χ2 | 53.4, df = 8, p < 0.0001 | | | | 30.1, df = 8, p < 0.0001 | | | | 37.9, df = 8, p < 0.0001 | | | | 45.4, df = 8, p < 0.0001 | | | |

Note:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* p < 0.05, ** p < 0.01, *** p < 0.0001

*Table 39: Summary of odd ratio of each variable to dental service utilization of adult.*

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Age (year) | 1.01 | *** | 1.00 | | 0.99 | ** |
| Birth cohort | | | | | | |
| 1951-1960 *(reference)* | | *** | | *** | | *** |
| 1961-1970 | 0.86 | *** | 0.86 | *** | 0.79 | *** |
| 1971-1980 | 0.76 | *** | 0.76 | *** | 0.59 | *** |
| Gender | | | | | | |
| Male *(reference)* | | | | | | |
| Female | 1.58 | *** | 1.58 | *** | 1.73 | *** |
| Education of individual [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | *** |
| Secondary level | 1.32 | *** | 1.40 | *** | 1.22 | *** |
| Tertiary Level | 2.89 | *** | 3.06 | *** | 1.87 | *** |
| Work status of individual | | | | | | |
| Public-employee *(reference)* | | *** | | *** | | *** |
| Private-employee | 0.51 | *** | 0.52 | *** | 0.79 | *** |
| Self-employee | 0.47 | *** | 0.47 | *** | 0.93 | |
| Member of co-operative group | 0.31 | * | 0.31 | * | 0.45 | |
| No work | 0.53 | *** | 0.53 | *** | 0.84 | * |
| Marital status of individual | | | | | | |
| Never married *(reference)* | | *** | | *** | | ** |
| Married | 0.87 | *** | 0.85 | *** | 0.95 | |
| Used to married [b] | 0.83 | *** | 0.81 | *** | 0.80 | ** |
| Role in family | | | | | | |
| Head *(reference)* | | *** | | *** | | *** |
| Spouse | 1.06 | * | 1.06 | * | 0.91 | ** |
| Other | 0.74 | *** | 0.76 | *** | 0.71 | *** |
| Household size | | | | | | |
| Small size (1-3 members) *(reference)* | | *** | | *** | | *** |
| Medium size (4-6 members) | 0.80 | *** | 0.80 | *** | 0.85 | *** |
| Large size ( > 6 members) | 0.60 | *** | 0.60 | *** | 0.68 | *** |
| Education of family head [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | *** |
| Secondary level | 1.40 | *** | 1.45 | *** | 1.09 | * |
| Tertiary Level | 2.91 | *** | 3.01 | *** | 1.34 | *** |
| Work status of family head | | | | | | |
| Public-employee *(reference)* | | *** | | *** | | * |
| Private-employee | 0.55 | *** | 0.56 | *** | 1.00 | |
| Self-employee | 0.53 | *** | 0.54 | *** | 1.14 | * |
| Member of co-operative group | 0.73 | | 0.74 | | 2.15 | |
| No work | 0.49 | *** | 0.50 | *** | 1.06 | |
| Marital status of family head | | | | | | |
| Never married *(reference)* | | *** | | *** | | |
| Married | 0.68 | *** | 0.67 | *** | 0.95 | |
| Used to married [b] | 0.62 | *** | 0.61 | *** | 1.07 | |
| Area of residence | | | | | | |

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Bangkok *(reference)* | | *** | | *** | | |
| Urban | 0.55 | *** | 0.55 | *** | - | - |
| Rural | 0.49 | *** | 0.48 | *** | - | - |
| Region of residence | | | | | | |
| Bangkok *(reference)* | | *** | | *** | | *** |
| Central | 0.51 | *** | 0.51 | *** | 0.56 | *** |
| Northern | 0.56 | *** | 0.55 | *** | 0.70 | *** |
| Northeastern | 0.45 | *** | 0.44 | *** | 0.61 | *** |
| Southern | 0.57 | *** | 0.57 | *** | 0.7 | *** |
| Health insurance | | | | | | |
| UCS *(reference)* | | *** | | *** | | *** |
| SSS | 1.74 | *** | 1.80 | *** | 1.44 | *** |
| CSMBS | 2.54 | *** | 2.51 | *** | 1.46 | *** |
| Other [c] | 2.43 | *** | 2.42 | *** | 1.63 | *** |
| Not have any health insurance | 0.92 | | 0.90 | | 0.71 | ** |

Notes: Model 0 was included each independent variable singly. Model 1A was included each independent variable together with age and cohort (AC), noted that OR of A and C were come from the model included AC only, OR of AC from all other combination did not show. Model 1B was included all independent variables together except for area of residence.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

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*Table 40: The association of DU and groups of independent variables for adult.*

| Variables in the Equation | Model 2 | | | | Model 3 | | | | Model 4 | | | | Model 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR |
| Constant | -2.56 | *** | 0.19 | 0.08 | -2.20 | *** | 0.19 | 0.11 | -2.11 | *** | 0.19 | 0.12 | -2.23 | *** | 0.19 | 0.11 |
| Age (year) | 0.00 | | 0.00 | 1.00 | -0.01 | | 0.00 | 0.99 | -0.01 | ** | 0.00 | 0.99 | 0.00 | | 0.00 | 1.00 |
| Birth cohort | | | | | | | | | | | | | | | | |
| 1951-1960 *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
| 1961-1970 | -0.25 | *** | 0.04 | 0.78 | -0.24 | *** | 0.04 | 0.78 | -0.26 | *** | 0.04 | 0.77 | -0.23 | *** | 0.04 | 0.80 |
| 1971-1980 | -0.52 | *** | 0.05 | 0.59 | -0.51 | *** | 0.05 | 0.60 | -0.54 | *** | 0.05 | 0.58 | -0.49 | *** | 0.05 | 0.61 |
| Education of family head [a] | | | | | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.24 | *** | 0.04 | 1.28 | 0.13 | ** | 0.04 | 1.14 | 0.14 | ** | 0.04 | 1.14 | 0.19 | *** | 0.04 | 1.21 |
| Tertiary Level | 0.53 | *** | 0.04 | 1.70 | 0.36 | *** | 0.05 | 1.43 | 0.36 | *** | 0.05 | 1.43 | 0.44 | *** | 0.05 | 1.56 |
| Education of individual [a] | | | | | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.20 | *** | 0.04 | 1.22 | 0.28 | *** | 0.04 | 1.33 | 0.28 | *** | 0.04 | 1.32 | 0.14 | ** | 0.04 | 1.14 |
| Tertiary Level | 0.76 | *** | 0.04 | 2.13 | 0.88 | *** | 0.05 | 2.41 | 0.89 | *** | 0.05 | 2.44 | 0.54 | *** | 0.05 | 1.71 |
| Gender | | | | | | | | | | | | | | | | |
| Male *(reference)* | | | | | | | | | | | | | | | | |
| Female | 0.50 | *** | 0.02 | 1.66 | 0.56 | *** | 0.03 | 1.74 | 0.54 | *** | 0.03 | 1.72 | 0.50 | *** | 0.03 | 1.65 |
| Marital status of individual | | | | | | | | | | | | | | | | |
| Never married *(reference)* | | | | | | *** | | | | | | | | | | |
| Married | | | | | -0.17 | *** | 0.04 | 0.84 | | | | | | | | |
| Used to married [b] | | | | | -0.22 | *** | 0.06 | 0.81 | | | | | | | | |
| Role in family | | | | | | | | | | | | | | | | |
| Head *(reference)* | | | | | | *** | | | | *** | | | | | | |
| Spouse | | | | | -0.11 | ** | 0.03 | 0.89 | -0.10 | ** | 0.03 | 0.91 | | | | |
| Other | | | | | -0.39 | *** | 0.04 | 0.67 | -0.27 | *** | 0.04 | 0.76 | | | | |
| Household size | | | | | | | | | | | | | | | | |
| Small size (1-3 members) *(reference)* | | | | | | | | | | *** | | | | | | |
| Medium size (4-6 members) | | | | | | | | | -0.17 | *** | 0.03 | 0.85 | | | | |
| Large size ( > 6 members) | | | | | | | | | -0.37 | *** | 0.07 | 0.69 | | | | |
| Region of residence | | | | | | | | | | | | | | | | |
| Bangkok *(reference)* | | | | | | | | | | | | | | *** | | |
| Central | | | | | | | | | | | | | -0.54 | *** | 0.04 | 0.59 |
| Northern | | | | | | | | | | | | | -0.29 | *** | 0.04 | 0.75 |
| Northeastern | | | | | | | | | | | | | -0.44 | *** | 0.04 | 0.64 |
| Southern | | | | | | | | | | | | | -0.32 | *** | 0.04 | 0.73 |
| Health insurance | | | | | | | | | | | | | | | | |
| UCS *(reference)* | | | | | | | | | | | | | | *** | | |
| SSS | | | | | | | | | | | | | 0.25 | *** | 0.03 | 1.28 |
| CSMBS | | | | | | | | | | | | | 0.38 | *** | 0.04 | 1.47 |
| Other [c] | | | | | | | | | | | | | 0.46 | *** | 0.08 | 1.58 |
| Not have any health insurance | | | | | | | | | | | | | -0.33 | ** | 0.10 | 0.72 |
| n | 93,865 | | | | 93,861 | | | | 93,865 | | | | 93,805 | | | |
| % of dental use | 8.3 | | | | 8.3 | | | | 8.3 | | | | 8.3 | | | |
| -2 Log likelihood | 50,560 | | | | 50,450 | | | | 50,408 | | | | 50,179 | | | |
| Nagelkerke R Square | 0.049 | | | | 0.052 | | | | 0.053 | | | | 0.058 | | | |
| Hosmer&Lemeshow - χ2 | 27.1, df = 8, p < 0.01 | | | | 23.7, df = 8, p < 0.01 | | | | 18.6, df = 8, p < 0.05 | | | | 20.7, df = 8, p < 0.01 | | | |

Note:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* p < 0.05, ** p < 0.01, *** p < 0.0001

*Table 41: Summary of odd ratio of each variable to dental service utilization of late adult.*

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Age (year) | 0.99 | ** | 0.97 | *** | 0.98 | *** |
| Birth cohort | | | | | | |
| before 1941 *(reference)* | | *** | | *** | | *** |
| 1941-1950 | 1.18 | | 1.08 | | 0.98 | |
| 1951-1960 | 1.14 | | 0.92 | | 0.77 | * |
| 1961-1970 | 0.99 | | 0.71 | ** | 0.54 | *** |
| Gender | | | | | | |
| Male *(reference)* | | | | | | |
| Female | 1.24 | *** | 1.24 | *** | 1.53 | *** |
| Education of individual [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | *** |
| Secondary level | 1.62 | *** | 1.67 | *** | 1.33 | *** |
| Tertiary Level | 2.97 | *** | 3.06 | *** | 1.81 | *** |
| Work status of individual | | | | | | |
| Public-employee *(reference)* | | *** | | *** | | ** |
| Private-employee | 0.52 | *** | 0.53 | *** | 0.87 | |
| Self-employee | 0.50 | *** | 0.51 | *** | 1.11 | |
| Member of co-operative group | 0.64 | | 0.63 | | 0.94 | |
| No work | 0.62 | *** | 0.64 | *** | 1.14 | |
| Marital status of individual | | | | | | |
| Never married *(reference)* | | *** | | *** | | *** |
| Married | 0.81 | *** | 0.81 | *** | 1.16 | |
| Used to married [b] | 0.78 | *** | 0.78 | *** | 0.81 | * |
| Role in family | | | | | | |
| Head *(reference)* | | *** | | *** | | *** |
| Spouse | 0.96 | | 0.95 | | 0.77 | *** |
| Other | 0.78 | *** | 0.79 | *** | 0.71 | *** |
| Household size | | | | | | |
| Small size (1-3 members) *(reference)* | | *** | | *** | | *** |
| Medium size (4-6 members) | 0.84 | *** | 0.83 | *** | 0.81 | *** |
| Large size ( > 6 members) | 0.56 | *** | 0.55 | *** | 0.64 | *** |
| Education of family head [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | ** |
| Secondary level | 1.47 | *** | 1.51 | *** | 1.07 | |
| Tertiary Level | 2.80 | *** | 2.88 | *** | 1.30 | *** |
| Work status of family head | | | | | | |
| Public-employee *(reference)* | | *** | | *** | | * |
| Private-employee | 0.57 | *** | 0.58 | *** | 1.07 | |
| Self-employee | 0.54 | *** | 0.54 | *** | 1.07 | |
| Member of co-operative group | 0.85 | | 0.84 | | 1.84 | |
| No work | 0.62 | *** | 0.63 | *** | 0.94 | |

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Marital status of family head | | | | | | |
|     Never married *(reference)* | | *** | | *** | | * |
|     Married | 0.69 | *** | 0.68 | *** | 0.82 | * |
|     Used to married [b] | 0.65 | *** | 0.65 | *** | 0.96 | |
| Area of residence | | | | | | |
|     Bangkok *(reference)* | | *** | | *** | | |
|     Urban | 0.51 | *** | 0.52 | *** | - | - |
|     Rural | 0.45 | *** | 0.44 | *** | - | - |
| Region of residence | | | | | | |
|     Bangkok *(reference)* | | *** | | *** | | *** |
|     Central | 0.44 | *** | 0.44 | *** | 0.54 | *** |
|     Northern | 0.53 | *** | 0.53 | *** | 0.68 | *** |
|     Northeastern | 0.43 | *** | 0.43 | *** | 0.57 | *** |
|     Southern | 0.51 | *** | 0.51 | *** | 0.62 | *** |
| Health insurance | | | | | | |
|     UCS *(reference)* | | *** | | *** | | *** |
|     SSS | 1.83 | *** | 1.86 | *** | 1.44 | *** |
|     CSMBS | 2.18 | *** | 2.17 | *** | 1.50 | *** |
|     Other [c] | 2.42 | *** | 2.38 | *** | 1.62 | *** |
|     Not have any health insurance | 1.51 | *** | 1.44 | *** | 1.15 | |

Notes: Model 0 was included each independent variable singly. Model 1A was included each independent variable together with age and cohort (AC), noted that OR of A and C were come from the model included AC only, OR of AC from all other combination did not show. Model 1B was included all independent variables together except for area of residence.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 42: The association of DU and groups of independent variables for late adult.*

| Variables in the Equation | Model 2 | | | | Model 3 | | | | Model 4 | | | | Model 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR |
| Constant | -1.14 | *** | 0.26 | 0.32 | -1.02 | *** | 0.27 | 0.36 | -0.83 | ** | 0.26 | 0.43 | -0.86 | ** | 0.26 | 0.42 |
| Age (year) | -0.02 | *** | 0.00 | 0.98 | -0.02 | *** | 0.00 | 0.98 | -0.03 | *** | 0.00 | 0.97 | -0.02 | *** | 0.00 | 0.98 |
| Birth cohort | | | | | | | | | | | | | | | | |
| before 1941 *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
| 1941-1950 | 0.03 | | 0.10 | 1.03 | 0.01 | | 0.10 | 1.02 | 0.01 | | 0.10 | 1.01 | 0.02 | | 0.10 | 1.02 |
| 1951-1960 | -0.20 | | 0.11 | 0.82 | -0.22 | * | 0.11 | 0.80 | -0.24 | * | 0.11 | 0.79 | -0.20 | | 0.11 | 0.82 |
| 1961-1970 | -0.58 | *** | 0.12 | 0.56 | -0.60 | *** | 0.12 | 0.55 | -0.63 | *** | 0.12 | 0.53 | -0.55 | *** | 0.12 | 0.58 |
| Education of family head [a] | | | | | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.12 | * | 0.05 | 1.12 | 0.14 | ** | 0.05 | 1.15 | 0.15 | ** | 0.05 | 1.16 | 0.04 | | 0.05 | 1.04 |
| Tertiary Level | 0.42 | *** | 0.06 | 1.53 | 0.45 | *** | 0.06 | 1.57 | 0.44 | *** | 0.06 | 1.55 | 0.28 | *** | 0.06 | 1.32 |
| Education of individual [a] | | | | | | | | | | | | | | | | |
| Primary level *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
| Secondary level | 0.43 | *** | 0.06 | 1.54 | 0.41 | *** | 0.06 | 1.50 | 0.40 | *** | 0.06 | 1.50 | 0.31 | *** | 0.06 | 1.37 |
| Tertiary Level | 0.80 | *** | 0.06 | 2.22 | 0.75 | *** | 0.07 | 2.13 | 0.77 | *** | 0.07 | 2.15 | 0.58 | *** | 0.06 | 1.79 |
| Gender | | | | | | | | | | | | | | | | |
| Male *(reference)* | | | | | | | | | | | | | | | | |
| Female | 0.29 | *** | 0.03 | 1.34 | 0.45 | *** | 0.03 | 1.57 | 0.37 | *** | 0.03 | 1.45 | 0.29 | *** | 0.03 | 1.33 |
| Marital status of individual | | | | | | | | | | | | | | | | |
| Never married *(reference)* | | | | | | *** | | | | | | | | | | |
| Married | | | | | -0.06 | | 0.06 | 0.95 | | | | | | | | |
| Used to married [b] | | | | | -0.27 | *** | 0.06 | 0.76 | | | | | | | | |
| Role in family | | | | | | | | | | | | | | | | |
| Head *(reference)* | | | | | | *** | | | | *** | | | | | | |
| Spouse | | | | | -0.26 | *** | 0.04 | 0.77 | -0.16 | *** | 0.03 | 0.85 | | | | |
| Other | | | | | -0.42 | *** | 0.05 | 0.66 | -0.33 | *** | 0.05 | 0.72 | | | | |
| Household size | | | | | | | | | | | | | | | | |
| Small size (1-3 members) *(reference)* | | | | | | | | | | *** | | | | | | |
| Medium size (4-6 members) | | | | | | | | | -0.18 | *** | 0.03 | 0.83 | | | | |
| Large size ( > 6 members) | | | | | | | | | -0.42 | *** | 0.07 | 0.65 | | | | |
| Region of residence | | | | | | | | | | | | | | | | |
| Bangkok *(reference)* | | | | | | | | | | | | | | *** | | |
| Central | | | | | | | | | | | | | -0.58 | *** | 0.04 | 0.56 |
| Northern | | | | | | | | | | | | | -0.32 | *** | 0.04 | 0.73 |
| Northeastern | | | | | | | | | | | | | -0.51 | *** | 0.04 | 0.60 |
| Southern | | | | | | | | | | | | | -0.44 | *** | 0.05 | 0.65 |
| Health insurance | | | | | | | | | | | | | | | | |
| UCS *(reference)* | | | | | | | | | | | | | | *** | | |
| SSS | | | | | | | | | | | | | 0.25 | *** | 0.05 | 1.28 |
| CSMBS | | | | | | | | | | | | | 0.38 | *** | 0.04 | 1.47 |
| Other [c] | | | | | | | | | | | | | 0.49 | *** | 0.10 | 1.63 |
| Not have any health insurance | | | | | | | | | | | | | 0.15 | | 0.10 | 1.16 |
| n | 85,408 | | | | 85,394 | | | | 85,408 | | | | 85,360 | | | |
| % of dental use | 9.5 | | | | 9.5 | | | | 9.5 | | | | 9.5 | | | |
| -2 Log likelihood | 43,762 | | | | 43,635 | | | | 43,609 | | | | 43,400 | | | |
| Nagelkerke R Square | 0.037 | | | | 0.040 | | | | 0.041 | | | | 0.047 | | | |
| Hosmer&Lemeshow - χ2 | 20.9, df = 8, p < 0.01 | | | | 33.3, df = 8, p < 0.0001 | | | | 27.0, df = 8, p < 0.01 | | | | 26.5, df = 8, p < 0.01 | | | |

Note:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* p < 0.05, ** p < 0.01, *** p < 0.0001

*Table 43: Summary of odd ratio of each variable to dental service utilization of elderly.*

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Age (year) | 0.95 | *** | 0.95 | *** | 0.96 | *** |
| Birth cohort | | | | | | |
| before 1941 *(reference)* | | | | | | |
| 1941-1950 | 1.46 | *** | 1.00 | | 0.94 | |
| Gender | | | | | | |
| Male *(reference)* | | | | | | |
| Female | 0.93 | | 0.96 | | 1.15 | * |
| Education of individual [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | ** |
| Secondary level | 2.51 | *** | 2.35 | *** | 1.49 | ** |
| Tertiary Level | 3.72 | *** | 3.48 | *** | 1.21 | |
| Work status of individual | | | | | | |
| Public-employee *(reference)* | | *** | | | | |
| Private-employee | 0.68 | | 0.68 | | 0.87 | |
| Self-employee | 0.67 | | 0.68 | | 0.95 | |
| Member of co-operative group | 1.01 | | 0.97 | | 1.89 | |
| No work | 0.50 | * | 0.62 | | 0.90 | |
| Marital status of individual | | | | | | |
| Never married *(reference)* | | *** | | | | |
| Married | 0.99 | | 0.98 | | 1.00 | |
| Used to married [b] | 0.79 | * | 0.92 | | 1.09 | |
| Role in family | | | | | | |
| Head *(reference)* | | *** | | *** | | *** |
| Spouse | 0.96 | | 0.89 | * | 0.86 | * |
| Other | 0.63 | *** | 0.73 | *** | 0.56 | *** |
| Household size | | | | | | |
| Small size (1-3 members) *(reference)* | | *** | | *** | | *** |
| Medium size (4-6 members) | 0.67 | *** | 0.68 | *** | 0.69 | *** |
| Large size ( > 6 members) | 0.55 | *** | 0.57 | *** | 0.57 | *** |
| Education of family head [a] | | | | | | |
| Primary level *(reference)* | | *** | | *** | | *** |
| Secondary level | 1.82 | *** | 1.79 | *** | 1.29 | * |
| Tertiary Level | 2.72 | *** | 2.70 | *** | 1.94 | *** |
| Work status of family head | | | | | | |
| Public-employee *(reference)* | | | | | | * |
| Private-employee | 1.18 | | 1.07 | | 1.62 | * |
| Self-employee | 1.18 | | 1.04 | | 1.50 | * |
| Member of co-operative group | 0.39 | | 0.33 | | 0.28 | |
| No work | 1.08 | | 1.05 | | 1.19 | |
| Marital status of family head | | | | | | |
| Never married *(reference)* | | | | | | |
| Married | 0.97 | | 0.89 | | 1.10 | |
| Used to married [b] | 0.88 | | 0.89 | | 0.98 | |
| Area of residence | | | | | | |
| Bangkok *(reference)* | | *** | | *** | | |
| Urban | 0.45 | *** | 0.46 | *** | - | - |
| Rural | 0.39 | *** | 0.40 | *** | - | - |
| Region of residence | | | | | | |
| Bangkok *(reference)* | | *** | | *** | | *** |
| Central | 0.39 | *** | 0.39 | *** | 0.45 | *** |

| Variable | Model 0 | | Model 1A | | Model 1B | |
|---|---|---|---|---|---|---|
| | OR | Sig. | OR | Sig. | OR | Sig. |
| Northern | 0.44 | *** | 0.44 | *** | 0.55 | *** |
| Northeastern | 0.41 | *** | 0.41 | *** | 0.56 | *** |
| Southern | 0.42 | *** | 0.43 | *** | 0.53 | *** |
| Health insurance | | | | | | |
| UCS *(reference)* | | *** | | *** | | *** |
| SSS | 2.36 | *** | 1.99 | *** | 1.20 | |
| CSMBS | 1.97 | *** | 2.02 | *** | 1.53 | *** |
| Other [c] | 1.87 | ** | 1.88 | ** | 1.23 | |
| Not have any health insurance | 2.09 | *** | 2.24 | *** | 1.64 | ** |

Notes: Model 0 was included each independent variable singly. Model 1A was included each independent variable together with age and cohort (AC), noted that OR of A and C were come from the model included AC only, OR of AC from all other combination did not show. Model 1B was included all independent variables together except for area of residence.

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Including widowed, divorced, separated, and married but unknown status.

[c] Nonpublic-provided health insurances such as insurance company, and employer pay.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.0001$, Symbol in reference line meaning to significant level of that variable in the whole picture.

*Table 44: The association of DU and groups of independent variables for elderly.*

| Variables in the Equation | Model 2 | | | | Model 4 | | | | Model 5 | | | | Model 5A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR | B | Sig. | S.E. | OR |
| Constant | 0.72 | * | 0.35 | 2.06 | 0.79 | * | 0.36 | 2.21 | 1.18 | ** | 0.36 | 3.25 | 0.98 | *** | 0.27 | 2.66 |
| Age (year) | -0.05 | *** | 0.00 | 0.95 | -0.05 | *** | 0.00 | 0.96 | -0.05 | *** | 0.00 | 0.95 | -0.04 | *** | 0.00 | 0.96 |
| Birth cohort | | | | | | | | | | | | | | | | |
|   before 1941 *(reference)* | | | | | | | | | | | | | | | | |
|   1941-1950 | -0.07 | | 0.06 | 0.93 | -0.10 | | 0.06 | 0.91 | -0.03 | | 0.06 | 0.97 | | | | |
| Education of family head [a] | | | | | | | | | | | | | | | | |
|   Primary level *(reference)* | | *** | | | | *** | | | | | | | | | | |
|   Secondary level | 0.10 | | 0.10 | 1.11 | 0.38 | *** | 0.11 | 1.46 | -0.02 | | 0.10 | 0.98 | | | | |
|   Tertiary Level | 0.45 | *** | 0.10 | 1.57 | 0.88 | *** | 0.12 | 2.41 | 0.20 | | 0.11 | 1.23 | | | | |
| Education of individual [a] | | | | | | | | | | | | | | | | |
|   Primary level *(reference)* | | *** | | | | *** | | | | *** | | | | *** | | |
|   Secondary level | 0.78 | *** | 0.10 | 2.19 | 0.51 | *** | 0.12 | 1.67 | 0.60 | *** | 0.11 | 1.83 | 0.57 | *** | 0.07 | 1.76 |
|   Tertiary Level | 0.79 | *** | 0.12 | 2.20 | 0.35 | ** | 0.14 | 1.42 | 0.56 | *** | 0.12 | 1.75 | 0.79 | *** | 0.08 | 2.21 |
| Role in family | | | | | | | | | | | | | | | | |
|   Head *(reference)* | | | | | | *** | | | | | | | | | | |
|   Spouse | | | | | -0.07 | | 0.06 | 0.93 | | | | | | | | |
|   Other | | | | | -0.45 | *** | 0.08 | 0.64 | | | | | | | | |
| Household size | | | | | | | | | | | | | | | | |
|   Small size (1-3 members) *(reference)* | | | | | | *** | | | | | | | | | | |
|   Medium size (4-6 members) | | | | | -0.36 | *** | 0.05 | 0.70 | | | | | | | | |
|   Large size ( > 6 members) | | | | | -0.50 | *** | 0.12 | 0.61 | | | | | | | | |
| Region of residence | | | | | | | | | | | | | | | | |
|   Bangkok *(reference)* | | | | | | | | | | *** | | | | *** | | |
|   Central | | | | | | | | | -0.73 | *** | 0.08 | 0.48 | -0.72 | *** | 0.07 | 0.49 |
|   Northern | | | | | | | | | -0.50 | *** | 0.08 | 0.60 | -0.50 | *** | 0.07 | 0.61 |
|   Northeastern | | | | | | | | | -0.53 | *** | 0.07 | 0.59 | -0.54 | *** | 0.07 | 0.58 |
|   Southern | | | | | | | | | -0.54 | *** | 0.09 | 0.58 | -0.56 | *** | 0.08 | 0.57 |
| Health insurance | | | | | | | | | | | | | | | | |
|   UCS *(reference)* | | | | | | | | | | *** | | | | *** | | |
|   SSS | | | | | | | | | 0.22 | | 0.21 | 1.25 | 0.21 | | 0.20 | 1.23 |
|   CSMBS | | | | | | | | | 0.44 | *** | 0.06 | 1.55 | 0.44 | *** | 0.05 | 1.55 |
|   Other [b] | | | | | | | | | 0.25 | | 0.23 | 1.29 | 0.30 | | 0.20 | 1.34 |
|   Not have any health insurance | | | | | | | | | 0.51 | ** | 0.15 | 1.66 | 0.43 | ** | 0.14 | 1.54 |
| n | 42,079 | | | | 42,079 | | | | 42,061 | | | | 49,610 | | | |
| % of dental use | 6.9 | | | | 6.9 | | | | 6.9 | | | | 6.9 | | | |
| -2 Log likelihood | 15,674 | | | | 15,557 | | | | 15,514 | | | | 18,018 | | | |
| Nagelkerke R Square | 0.040 | | | | 0.049 | | | | 0.052 | | | | 0.050 | | | |
| Hosmer&Lemeshow - χ2 | 17.8, df = 8, p < 0.05 | | | | 22.3, df = 8, p < 0.01 | | | | 30.4, df = 8, p < 0.0001 | | | | 29.1, df = 8, p < 0.0001 | | | |

Note:

[a] Primary educational level was a grouping of no education, pre-primary school, and primary school. Secondary educational level was a grouping of junior high school, senior high school, and vocational certificate. Tertiary educational level was a grouping of high vocational/ technical certificate, bachelor degree, and higher than bachelor degree.

[b] Nonpublic-provided health insurances such as insurance company, and employer pay.

* p < 0.05, ** p < 0.01, *** p < 0.0001

*Table 45:Data dictionary*

| Variable name | Label | Value |
|---|---|---|
| cohort_group | categorized of cohort | 1 = before 1941 |
| | | 2 = 1941-1950 |
| | | 3 = 1951-1960 |
| | | 4 = 1961-1970 |
| | | 5 = 1971-1980 |
| | | 6 = 1981-1990 |
| | | 7 = 1991-2000 |
| | | 8 = after 2000 |
| AGE | age in year | |
| SEX | gender | 0 = male |
| | | 1 = female |
| edu | educational level | 0 = no education |
| | | 1= Pre-primary education |
| | | 2= Primary education |
| | | 3= Lower-secondary education |
| | | 4 = Upper-secondary education Level |
| | | 5 = Upper-vocational education |
| | | 6 = High vocational / Technical |
| | | 7 = Bachelor degree |
| | | 8= higher than Bachelor degree |
| | | 9 = other |
| | | 99 = unknown |
| edu_group | categorized of edu | 0 = primary *(from edu value 0,1,2)* |
| | | 1 = secondary *(from edu value 3,4,5)* |
| | | 2 = tertiary *(from edu value 6,7,8)* |
| | | 9 = unknown *(from edu value 9,99)* |
| work | working status | 0 = no work |
| | | 1 = Employer |
| | | 2 = Own- account worker |
| | | 3 = Unpaid family worker |
| | | 4 = Employee - government |
| | | 5 = State enterprise employee |
| | | 6 = Private company employee |
| | | 7 = Member of co-operative group |
| | | 9 = unknown |
| work_group | categorized of work | 0 = no work *(from work value 0)* |
| | | 1 = self-employed *(from work value 1,2,3)* |
| | | 2 = public employed *(from work value 4,5)* |
| | | 3 = private employed *(from work value 6)* |
| | | 4 = Member of co-operative group *(from work value 7)* |
| | | 9 = unknown *(from work value 9)* |

| Variable name | Label | Value |
|---|---|---|
| marital | marital status | 1 = Never married<br>2 = Married<br>3 = Widowed<br>4 = Divorced<br>5 = Separated<br>6 = Married but unknown status<br>9 = unknown |
| marital_group | categorized of marital | 0 = Never married *(from marital value 1)*<br>1 = Married *(from marital value 2)*<br>2 = Used to married *(from marital value 3-6)*<br>9 = unknown *(from marital value 9)* |
| role | role in family | 1 = head<br>2 = Spouse<br>3 = Unmarried son or daughter<br>4 = Married son or daughter<br>5 = Son or daughter-in-law<br>6 = Grandchild<br>7 = Parents, spouse's parents, grandparent<br>8 = Brother or sister and other relative<br>9 = Non- relative, Servant and household workers |
| role_group | categorizedd of role | 1 = head *(from role value 1)*<br>2 = spouse *(from role value 2)*<br>3 = others *(from role value 3-9)* |
| HH_size | numbers of family members | |
| HH_size_group | categorizedd of HH_size | 1 = small size (1-3 members)<br>2 = medium size (4-6 members)<br>3 = large size (>6 members) |
| EDU_HEAD | educational level of head of family | 0 = no education<br>1= Pre-primary education<br>2= Primary education<br>3= Lower-secondary education<br>4 = Upper-secondary education<br>5 = Upper-vocational education<br>6 =High vocational / Technical<br>7 = Bachelor degree<br>8= higher than Bachelor degree<br>9 = other<br>99 = unknown |
| EDU_HEAD_group | categorized of EDU_HEAD | 0 = primary *(from EDU_HEAD value 0,1,2)*<br>1=secondary *(from EDU_HEAD value 3,4,5)*<br>2 = tertiary *(from EDU_HEAD value 6,7,8)* |

| Variable name | Label | Value |
|---|---|---|
| | | 9 = unknown (from EDU_HEAD value 9,99) |
| WORK_HEAD | working status of head of family | 0 = no work<br>1 = Employer<br>2 = Own- account worker<br>3 = Unpaid family worker<br>4 = Employee - government<br>5 = State enterprise employee<br>6 = Private company employee<br>7 = Member of co-operative group<br>9 = unknown |
| WORK_HEAD_group | categorized of WORK_HEAD | 0 = no work *(from WORK_HEAD value 0)*<br>1 = self-employed *(from WORK_HEAD value 1,2,3)*<br>2 = public employed *(from WORK_HEAD value 4,5)*<br>3 = private employed *(from WORK_HEAD value 6)*<br>4 = Member of co-operative group *(from WORK_HEAD value 7)*<br>9 = unknown *(from WORK_HEAD value 9)* |
| MARITAL_HEAD | marital status of head of family | 1= Never married<br>2 = Married<br>3 = Widowed<br>4 = Divorced<br>5 = Separated<br>6 = Married but unknown status<br>9 = unknown |
| MARITAL_HEAD_group | categorized of MARITAL_HEAD | 0-= Never married *(from MARITAL_HEAD value 1)*<br>1 = Married *(from MARITAL_HEAD value 2)*<br>2 = Used to married *(from MARITAL_HEAD value 3-6)*<br>9 = unknown *(from MARITAL_HEAD value 9)* |
| INSURE | type of main health insurance | 1 = not have any health insurance<br>2 = UCS<br>3 = SSS<br>4 = CSMBS<br>5 = insurance company<br>6 = employer pay<br>7 = others<br>9 = unknown |
| INSURE_regroup | categorized of INSURE | 0 = not have any health insurance *(from INSURE value 0)*<br>1 = UCS *(from INSURE value 2)* |

| Variable name | Label | Value |
|---|---|---|
| | | 2 = SSS *(from INSURE value 3)* |
| | | 3 = CSMBS *(from INSURE value 4)* |
| | | 4 = other *(from INSURE value 5-7)* |
| AREA | area of residence | 0 = BKK |
| | | 1 = inside municipality |
| | | 2 = outside municipality |
| REG | region of residence | 1 = BKK |
| | | 2 = central |
| | | 3 = northern |
| | | 4 = northern-east |
| | | 5 = southern |
| dent_use | dental use in past 12 months | 0 = no |
| | | 1 = yes |
| dent_visit | number of dental visits in past 12 months | 0 = 1 visit |
| | | 1 = > 1 visit |
| dent_place_full | place of dent use (before recode) | 01 = health center, without dental personnel |
| | | 02 = health center, with dental personnel |
| | | 03 = district hospital |
| | | 04 = provincial hospital/ general hospital |
| | | 05 = university's hospital |
| | | 06 = other public hospital |
| | | 07 = private hospital |
| | | 08 = private clinic |
| | | 09 = motorcycle/ pick up doctor |
| | | 10 = mobile service (from any organization) |
| | | 11 = school |
| | | 12 = others |
| | | 99 = don't know |
| | | 998 = missing |
| dent_place | categorized of dent_place_full | 1 = public *(from dent_place_full value 1-6,10-11)* |
| | | 2 = private *(from dent_place_full value 7,8)* |
| | | 9 = others *(from dent_place_full value 9,12,99)* |
| dent_type_full | type of dental service use in last visit | 1 = scaling, polishing, periodontal treatment |
| | | 2 = tooth filling |
| | | 3 = root canal treatment |
| | | 4 = tooth extraction |
| | | 5 = sealant |
| | | 6 = prosthodontic |
| | | 7 = orthodontic |

| Variable name | Label | Value |
|---|---|---|
| | | 8 = oral screening |
| | | 9 = apply topical fluoride |
| | | 10 = cannot remember |
| | | 11 = others |
| | | 99 = unknown |
| | | 998 = missing |
| dent_type_group | categorized of dent_type_full | 0 = not use any dental service *(from dent_type_full value 998)*<br>1 = tooth extraction *(from dent_type_full value 4)*<br>2 = scaling, polishing, periodontal treatment *(from dent_type_full value 1)*<br>3 = tooth filling *(from dent_type_full value 2)*<br>4 = root canal treatment *(from dent_type_full value 3)*<br>5 = prosthodontic *(from dent_type_full value 6)*<br>6 = orthodontic *(from dent_type_full value 7)*<br>7 = oral health prevention *(from dent_type_full value 5,8,9)*<br>9 = other & unknown *(from dent_type_full value 10,11,99)* |
| Dent_type_regroup | New categorized of dent_type | 0 = Oral health prevention (from dent_type_group value7)<br>1 = Simple dental treatment (from dent_type_group value 1 - 3)<br>2 = Complicated dental treatment (from dent_type_group value 4 - 6) |

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