EVALUATION OF WORKPLACE ORAL HEALTH PROMOTION IN KAENGKHOI DISTRICT, SARABURI PROVINCE: A POSITIVE APPROACH

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การประเมินผลการสร้างเสริมสุขภาพช่องปากในที่ทำงาน อำเภอแก่งคอย จังหวัดสระบุรี: วิธีเชิงบวก

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต
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Thesis Title	EVALUATION OF WORKPLACE ORAL HEALTH PROMOTION IN KAENGKHOI DISTRICT,SARABURI PROVINCE: A POSITIVE APPROACH
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Field of Study	Dental Public Health
Thesis Advisor	ProfessorSudaduang Krisdapong, D.D.S., M.Phil., Ph.D.

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หฤทัย สุขเจริญโกศล : การประเมินผลการสร้างเสริมสุขภาพช่องปากในที่ทำงาน อำเภอแก่งคอย จังหวัดสระบุรี: วิธีเชิงบวก (EVALUATION OF WORKPLACE ORAL HEALTH PROMOTION IN KAENGKHOI DISTRICT,SARABURI PROVINCE: A POSITIVE APPROACH) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ศ. ทญ. ดร.สุดาดวง กฤษฎาพงษ์, 150 หน้า.

การศึกษานี้เป็นการดำเนินโครงการสร้างเสริมสุขภาพช่องปากแบบชุมชนมีส่วนร่วมระยะเวลา1 ปีในโรงงาน แล้วประเมินผลลัพธ์ทางสุขภาพช่องปาก นอกจากนั้นยังหาความสัมพันธ์ระหว่างปัจจัยทางสิ่งแวดล้อมของโรงงานกับพฤติกรรม และสุขภาพช่องปากของคนงาน โรงงาน 6 แห่งในจังหวัดสระบุรีที่มีคนงานน้อยกว่า 200 คนเข้าร่วมการศึกษา และถูกกำหนดให้เป็น กลุ่มทดลองหนึ่ง 2 โรงงาน (เข้าร่วม 1 ปี) และกลุ่มทดลองสอง 1 โรงงาน (เข้าร่วม 6 เดือนหลัง) เก็บข้อมูลโดยตรวจช่องปากและสัมภาษณ์ ในช่วงเริ่มต้น 6 เดือน และ 1 ปี ผู้เกี่ยวข้องในโครงการคือผู้จัดการและหัวหน้างาน ซึ่งเข้าร่วมการอภิปรายกลุ่มเกี่ยวกับสภาวะช่องปากของคนงาน หลังจากนั้นร่วมออกแบบและคิดกิจกรรมสำหรับสุขภาพช่องปากของพนักงานในโรงงาน ให้เหมาะสมกับบริบทของโรงงาน หลังจากนั้น 6 เดือน ผู้จัดการและหัวหน้างานแลกเปลี่ยนประสบการณ์ร่วมกัน

พบความแตกต่างของฟันผุ และอนามัยช่องปากของคนงานระหว่างโรงงาน คนงานในโรงงานที่มีอ่างน้ำสำหรับแปรงฟันในห้องน้ำมีจำนวนฟันผุ (DT) น้อยกว่าร้อยละ 60 (IRR= 0.4 (0.2-0.9)) และมีช่องปากสะอาดกว่า 7 เท่า (OR= 7.0 (2.2-22.8)) เมื่อเทียบกับคนงานในโรงงานที่ไม่มีอ่างล้างหน้า คนงานที่ทำงานในโรงงานขนาดกลางและโรงงานที่มีสิทธิประโยชน์ในการประกันสุขภาพเพิ่มเติมมีช่องปากสะอาดกว่าเป็น 3 เท่า หลังจากโครงการเสร็จสิ้นลง กิจกรรมสร้างเสริมสุขภาพช่องปากที่เกิดขึ้นในกลุ่มทดลองหนึ่ง คือ โปสเตอร์ให้ความรู้ การประกาศขณะรวมแถวตอนเช้าก่อนทำงาน หัวหน้างานเตือนให้แปรงฟันหลังอาหารกลางวัน และการจำกัดเวลากินของว่างในช่วงพัก ส่วนกลุ่มทดลองสองมีเพียงโปสเตอร์ให้ความรู้เท่านั้น ช่วงเวลา 6 เดือน กลุ่มทดลองหนึ่ง มีความรู้สูงขึ้นและมีพฤติกรรมดีขึ้นใน 4ประเด็นคือ ความถี่ในการแปรงฟัน การใช้ยาสีฟันผสมฟลูออไรด์ การบริโภคผลไม้และเครื่องดื่ม ช่วง 1 ปีการเปลี่ยนแปลงพฤติกรรมส่วนใหญ่ยังคงดีขึ้น สำหรับกลุ่มทดลองสอง ความรู้และพฤติกรรมดีขึ้นในเรื่องความถี่ในการแปรงฟัน และตรวจช่องปากด้วยตนเอง กลุ่มทดลองทั้งสองมีพฤติกรรมไปตรวจฟันกับทันตแพทย์ดีกว่ากลุ่มควบคุม ในมุมมองของผู้จัดการและหัวหน้างาน โครงการนี้สามารถทำได้ถ้าไม่มีผลต่อผลผลิตของโรงงาน ผู้จัดการคิดว่าการควบคุมการขายขนมในร้านค้าเป็นไปไม่ได้แต่จำกัดเวลาในการกินขนมง่ายกว่า

โดยสรุป ปัจจัยทางสิ่งแวดล้อมมีความสัมพันธ์กับสุขภาพช่องปากของคนงาน การดำเนินโครงการสร้างเสริมสุขภาพช่องปากในโรงงานแบบมีส่วนร่วมสามารถเปลี่ยนสิ่งแวดล้อมได้ และช่วยพัฒนา ความรู้ และพฤติกรรมสุขภาพช่องปากให้กับคนงาน

ภาควิชา ทันตกรรมชุมชน ลายมือชื่อนิสิต .....

สาขาวิชา ทันตสาธารณสุข ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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5376455132 : MAJOR DENTAL PUBLIC HEALTH
KEYWORDS: WORKPLACE / ORAL HEALTH PROMOTION / ENVIRONMENT / ORAL HEALTH / HEALTH EDUCATION / ORAL HYGIENE / DENTAL CARIES / FACTORY

HARUTHAI SUKCHAROENKOSOL: EVALUATION OF WORKPLACE ORAL HEALTH PROMOTION IN KAENGKHOI DISTRICT,SARABURI PROVINCE: A POSITIVE APPROACH. ADVISOR: PROF.SUDADUANG KRISDAPONG, D.D.S., M.Phil., Ph.D., 150 pp.

This study implements a one-year workplace oral health promotion (WOHP) program in factories aiming to determine the impact on the oral health outcomes. Furthermore, it defines association among factory's environment, behaviors and workers' oral health status. Six factories in Kaengkhoi district of Saraburi province with less than 200 workers joined this study and defined to be a two factories of intervention I group (joined 1 year) and one factory intervention II group (joined after 6 months). The manager and head of the worker that participated in a small group discussion about the dental status of their worker were key person in the project. After that, they design and create oral health activities by themselves depending on their factory context. Six months later, they shared experience on oral health activity to each other.

This study found the difference of dental caries and oral hygiene of workers among factories. Workers in factories that have wash basins for toothbrushing in toilets had 60% (IRR= 0.4 (0.2-0.9)) lower number of decayed teeth (DT score) and 7 times (OR= 7.0 (2.2-22.8)) more likely to have good oral hygiene compared with the other. Workers in medium size factories and those working in a factory that provided additional health insurance benefits were three times more likely to have good oral hygiene. After the intervention, oral health promotion activities occurring in Intervention I group were health education posters and morning talks, reminding to brush after lunch by the head of workers and limit of snacks in breaking period. The factory in intervention II group had only educational posters activity. At 6 months, Intervention I group obtained significantly higher scores of four knowledge and behavior items that are the frequency of tooth brushing, use of fluoride toothpaste, eating fruits habit and recommended drinks. At 1 year period, most of the changed behaviors still remain. For the workers in Intervention II improved their knowledge and behaviors on the frequency of tooth brushing and self-examination. Both Intervention groups obtained better behavior on examination by dentists compared to the control group. For managers and head of workers viewpoint, the workplace oral health promotion program was possible to launch only if it does not affect worker productivity. The managers thought that control of selling snack at convenience shop was impossible but to limit the time of snack break was easier.

In conclusion, factory environments associated with workers' oral health. This WOHP with participation can change factory environments and improve workers oral health knowledge and behaviors.

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Field of Study: Dental Public Health
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Student's Signature .....
Advisor's Signature .....

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Finally, I must express my very profound gratitude to my parents and to my brothers and sister for supporting me spiritually and continuous encouragement throughout the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

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Introduction

1.1 Background and Rationale

Thailand is a developing country that focused more on the industrial sector. Workers are shifting from the agricultural to the industrial sector. Factories become the pool of workers that the Ministry of Public Health can approach easily. Factory management depends on executive policy. Factories could promote community and had many past experiences in production and human management. They have survived business cycles and improved profit through various activities, which increase production and effectiveness of organizations such as 5S, Kaizen, QCC, TPM, HAPPY8.

Every organization aims to increase the productivity, quantity and quality of products. To reach that goal, they should have highly capable workers, with minimal absenteeism, resignation and turnover rates. The high quality workers could easily adapt to their new job, and have the ability to produce a high quantity of products.[1, 2] Better wages, benefits on health insurance and working conditions should ensure that workers are more satisfied.[3] Organizations should focus on the worker's quality of life, ensuring that the workers should receive not only fair income, but also other benefits to motivate them not to be absent or quit. These benefits should be of value to them, and may involve their family. Insurance is an organizational benefit. The most important health benefits for workers is prevention, in which the biggest payoffs come from education programs, including to discourage smoking and drinking and to encourage healthier diets.[1]

Workplace health promotion should be of value to workers. It helps them live a healthier lifestyle. Giving workers the opportunity to make decisions about their

jobs, the design of their workplaces and what they need to make products or to deliver service, effectively develops quality of work life.[1] Quality of work life programs propose self-control, satisfaction, involvement, self-respect and performance while productivity programs propose performance, less absenteeism and less turnover but both programs help organization competitiveness, profitability, growth and survival.[4] The basic criteria for the quality of work life are characteristics of the individual's perception of both work experiences and work environment which is determined by a combination of personal and situational characteristics. The basic strategy for improving the quality of work life is to identify and then to "humanize" the workplace.[5] Workers were shaped to idealized images by the messages received during work and reinforced by ongoing environments, including the work organization.[6] It is possible to include workplace health promotion into those benefits for workers, and also oral workplace health promotion. Thai health packages still do not include benefits for illness which do not relate to work for them.

Thailand's Ministry of Public Health has released an oral health promotion program for the pregnant, early childhood, childhood, pre-school, elementary school, high school and the elders, but still provides little benefits for working age groups. The 7th Thai oral health national survey[7] examined the oral health status of 35-44 years old. The survey showed that 80.9 % had tooth loss, and 36.9% experienced restoration and 35.7% showed signs of decay. In addition, 14.1% of this group had normal periodontal, while 8.4% had gingivitis, and 61.8% had calculus. Further, 10.9% had 4-5 millimeters pocket depth, and 4.7% had 6-7 millimeters pocket depth. We had less experience on the process to develop the healthy oral environment in our workplace.

1.2 Research question

What are the differences of main oral health outcomes of two type of workplace oral health promotion (WOHP) intervention?

1.3 Research Objective

1.3.1 To assess associations between factories' environmental factors and workers' oral health status.

1.3.2 To evaluate WOHP by positive approach after 1 year implementation.

1.3.3 To define the important factors leading to outcome of oral health promotion at each step.

1.4 Research Hypothesis

1.4.1 H_0: workers' oral health status with supportive environment would equal to workers' oral health status with non-supportive environment.

1.4.2 H_0: oral health outcome of workers received WOHP by positive approach would equal to oral health outcome of workers not received WOHP by positive approach.

1.5 Variables Definitions

1.5.1 Individual factor compose of 3 item

1.5.1.1 Age was defined in years which count only completed age at the interviewed month.

1.5.1.2 Gender divided into male and female.

1.5.1.3 Education was defined into primary school and secondary school or higher than secondary school.

1.5.2 Factory factors compose of 7 aspects.

1.5.2.1 Factory size[8] is small, medium and large companies belonging to Thai regulation 2002 which define small size as having less than 50 workers or

investment less than 50 million baths, medium size as having 50-200 workers or investment 50-200 million baths and large size as having more than 200 workers or investment more than 200 million baths. In this research we excluded 221 small sizes which have 2,891 workers but included 26 medium sizes which have 2,704 workers and 22 large sizes which have 18,108 workers. Furthermore, included on the criteria are

1) Factories have 50 minimum workers and 200 maximum workers.

2) Factories are voluntary to participate in all process.

1.5.2.2 Location divided into rural, which factory was settled more than 20 kilometers, and urban which factory was settled not more than 20 kilometers.

1.5.2.3 Additional health insurance is factory supported more budget for worker's health than social security scheme that was prescribed by Thai government.

1.5.2.4 Snack shop is factory had local convenience shop in factory.

1.5.2.5 Wash basin in toilet is factory provided wash basin in toilet for workers.

1.5.2.6 Brushing activity and free toothbrush with no eating is factory provided tooth brushing activity and free toothbrush for workers. They were also limited eating during work.

1.5.2.7 Manager attitude is factory that managers had active participation during interview and could create oral health activity for theirs workers. They persuaded and accommodated workers to get oral examination.

1.5.3 Outcomes *are* outcomes which modified from Oral health promotion evaluation outcome model by Watt RG et al.[9] There are 4 issues following:

1.5.3.1 Oral health knowledge for this research was interested in 11 aspects:

1.5.3.1.1 Frequency of toothbrushing

1.5.3.1.2 Duration of toothbrushing

1.5.3.1.3 Type of toothpaste

1.5.3.1.4 Benefit of using mouth rinse

1.5.3.1.5 Benefit of using fluoride mouth rinse

1.5.3.1.6 Frequency of meal

1.5.3.1.7 Eating vegetable with meal

1.5.3.1.8 Type of snack recommended

1.5.3.1.9 Eating fruits habit

1.5.3.1.10 Recommended drinks

1.5.3.1.11 Self-examination is oral self-examination

*1.5.3.2 Oral health behavior*s for this research were interested in 12 aspects:

1.5.3.2.1 Frequency of toothbrushing

1.5.3.2.2 Duration of toothbrushing

1.5.3.2.3 Type of toothpaste

1.5.3.2.4 Using mouth rinse

1.5.3.2.5 Using fluoride mouth rinse

1.5.3.2.6 Frequency of meal

1.5.3.2.7 Eating vegetable with meal

1.5.3.2.8 Type of snack

1.5.3.2.9 Eating fruits habit

1.5.3.2.10 Recommended drinks

1.5.3.2.11 Self-examination is oral self-examination

1.5.3.2.12 Examination by dentist

1.5.3.3 Oral health status is following:

1.5.3.3.1 DMFT[10] this means to numerically express the caries prevalence we have to obtain by calculating the number of decayed (DT), missing (MT) due to decay and filled (FT) in population.

1.5.3.3.2 Oral Hygiene Index Simplified (OHI-S)[11] is an index used to measure oral hygiene status. OHI-S index comprises of DI (debris index) and CI (calculus index). Six teeth were examined for debris and calculus deposits, one surface for each tooth; that is buccal surface of right and left upper first molars, labial surface of right upper incisor and left lower incisor, lingual surface of right and left lower first molars. DI and CI scores range from 0-3: 0 = no debris/ calculus present, 1= debris/ calculus covering not more than one third of tooth surface or presence of extrinsic stains without other debris regardless of surface area covered, 2= debris/ calculus covering from one third up to two thirds of tooth surface, = debris/ calculus covering more than two thirds of tooth surface. Summing up all 6 surface scores and dividing by 6 results in DI and CI scores (maximum score =3). Thereafter, a sum of DI and CI scores is OHI-S score (maximum score = 6). OHI-S scores for oral hygiene status was categorized into good (OHI-S score = 0-1.2), fair (OHI-S score= 1.3-3.0) and poor (OHI-S score 3.1-6.0)

1.5.3.3.3 Oral health related quality of life was interested of problems on chewing, work and talking.

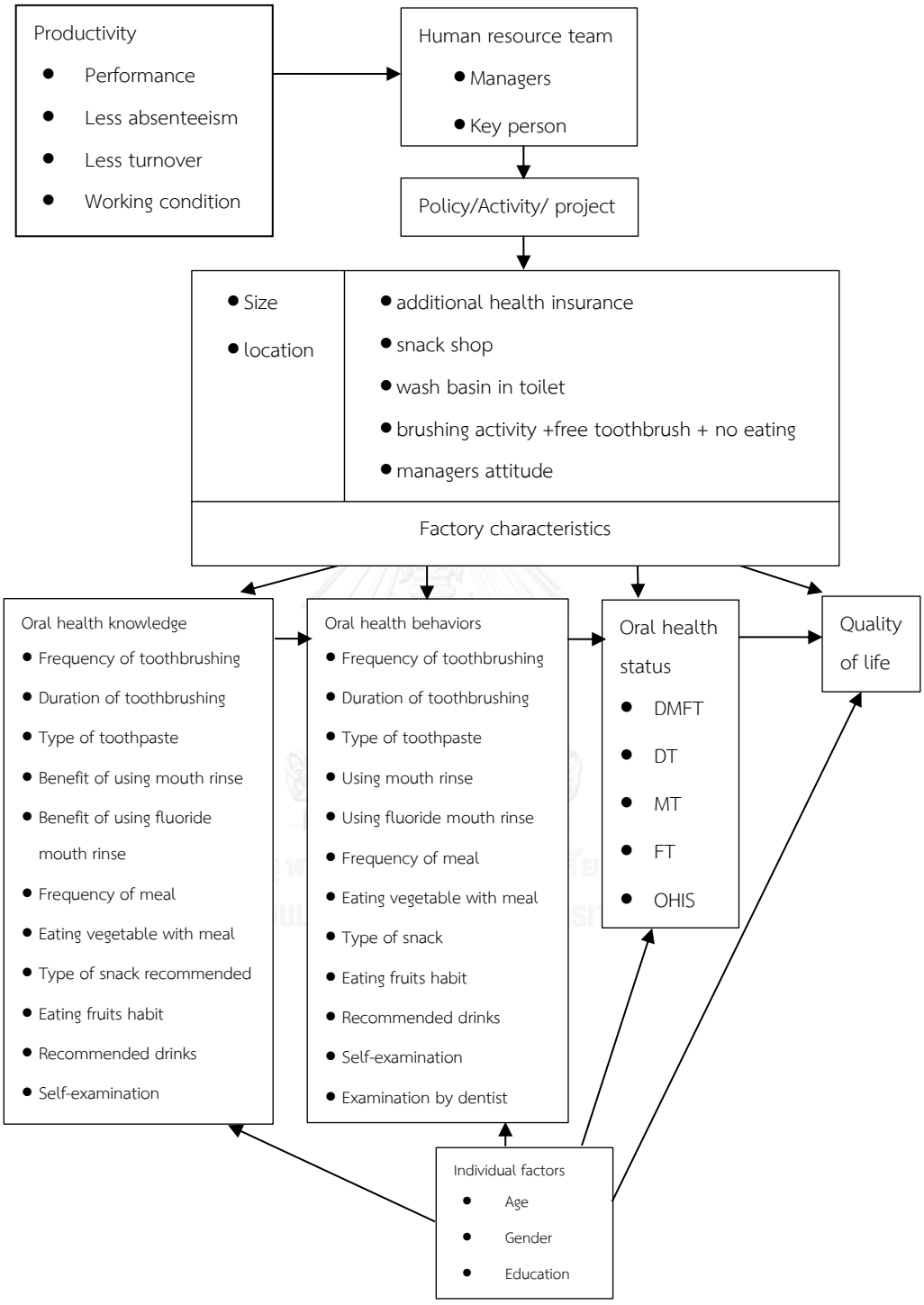
1.5.4 Productivity of factory belongs to performance, less absenteeism and turnover and working condition.

1.5.5 Policy, activity and project are results after group discussion and exchange experience session.

1.6 Scope of Research

Factories in Kaengkhoi district, Saraburi province

1.7 Conceptual frameworks



1.8 Research Design

Experimental study

1.9 Ethical Considerations

This study was approved by the ethical committee, Faculty of Dentistry Chulalongkorn University, Approval No. HREC-DCU 2013-024.

1.10 Benefit from research

Knowing important factors that support managers' decision to create a proper oral health environment in the workplace should help the public health policy maker develop an oral health promotion in the workplace.

1.11 Key words

Workplace, oral health promotion, environment, oral health, health education, oral hygiene, dental caries, factory

Chapter II

Literature review

In this study, Workplace oral health promotion (WOHP) was reviewed in terms of relationship of work, health and oral health, health promotion, workplace health promotion and workplace oral health promotion and participatory approach.

2.1 Relationship of Work, Health and Oral health

This part will explain the basic concept of health, work related to health and oral health that should be understood before proceeding with the study.

2.1.1 Health

World Health Organization (WHO) defines health as a state of complete physical, social and mental well-being, and not merely absence of disease or infirmity.[12] This definition shows the attempt to change the meaning of health in biomedical concept, which focuses only at the physical dimension, to bio-psychosocial concept that includes psychological and social dimensions. However, this meaning discusses about the "absence of disease" which still focuses at the healthy state. Health must include the physical that has no disease, mental and social problems.

In Thailand, Thai National Health Act 2007[13] defines health as a human state that is complete of physical, mental, social and spiritual balance that form to be holistic. Meaning that the bio-psychosocial concept focuses on the wider element; physical, mental, social and spiritual aspects; which all elements must be harmonized. Use holistic concept aims to view all element as one[14, 15] which is in balance with nature[16, 17] and is dynamic all the time.[16, 18] Then holistic health is the

physical, mental, social and spiritual balance in context or culture that is changed by social trends. Therefore, health in each society is defined in different meanings and belongs to that culture. The spiritual health is discovering a sense of meaningfulness in each personal life that has a purpose to fulfill. It may be related with traditional religions such as Christianity, Hinduism or Buddhism and grows in their personal relationships with others.

2.1.2 Relationship of work and health

Work is good for health. It is therapeutic and a reversion of the adverse health effects of unemployment. Employments promote full participation in society, reduce poverty and improve quality of life and well-being. When workers get ill or unemployed, they fight to (re)-enter work as soon as possible. Work is therapeutic and helps workers recover to a normal state or by gaining better health. Therefore they minimize long-term sickness absence and reduce the risk of long-term incapacity. [19] Organizations will be interested in the quality of work life program if it results in increased productivity. [20] The purposes of productivity are performance, less absenteeism and fewer turnovers [4] while the important indicators of occupational status are working conditions and job satisfaction. [21]

In the United Kingdom, half of the population is employed which spend 60% of waking hours in the workplace. [22] In 2003, the Thai workers was at 33.8 million while about 5.4 million was in manufacturing. [23] Though Thai manufacturing workers decreased to 3.7 million in 2009 [8], the number was still considered high.

In the workplace, there are several factors affecting workers' health. [24] The first one is personal health practices and resources. Personal resources are explained by health practices, beliefs, attitudes, values, and hereditary endowment. Personal resources would include an individual's sense of efficacy, their resilience and

‘‘hardiness’’, and the quality and density of the social support that they believe is available to them. The social support is like ‘‘brokers’’ between the organization of work and health practices. Such resources can ward off the negative effects of the work organization on health practices (and conditions) but they can also be defeated by themselves if these negative effects are relentless and sustained. Personal health practices such as eating, exercising, sleeping, drinking, smoking, coping with stress are ‘‘risk factors’’ for various disorders, diseases, or incapacities, as well as being a risk factor for absenteeism and its associated health care costs.

The next is organization of work. It is a physical environment of work in the context of occupational health and safety and psychosocial environment of work. The organizational structure of a company affects both health and productivity. It affects health through management practices and productivity through the design of physical and psychosocial work systems. However, physical and psychosocial environment also have effects to health.

The relationship of two factors effects each worker’s health and productivity. Besides, health of a worker affects productivity too. (Figure1)

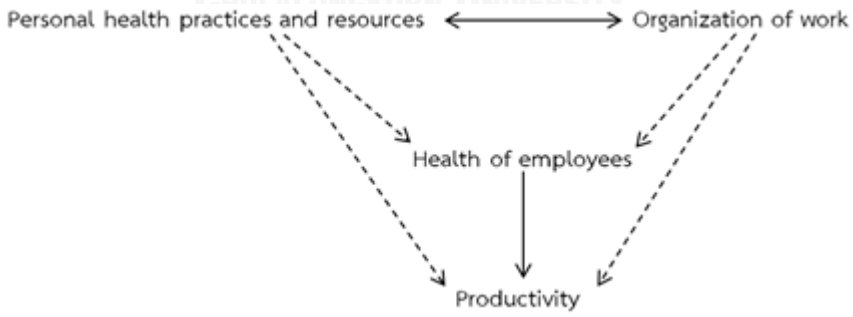


Figure 1 The relationship between health and productivity in workplace. (Shain&Kramer, 2004)

2.1.3 Relationship of work and oral health

There were several studies that reported the oral health status of a worker. For the caries aspect, the male has no caries prevalence that is different from female but older age group tend to have more caries.[25] The 35-44 year olds have maximum dental caries (69.2%) and 25-34 year olds males have maximum mean of 2.6 decaying teeth.[26] However, Masalin K. et al[27] have found biscuit group workers having significantly higher DMFS values than the controls and secondary caries was mostly in the biscuit group (1.0±1.2) but the least on sweet production group (0.5±1.1). For the periodontal aspect, most dentulous workers had gingivitis and half of their teeth had gingivitis and calculus especially in the oldest age group who had gingivitis and pocket more than 5 mm.[25] Lie T. et al[28] compared oral health status between workers and administers and found that 77.7% of total number of surfaces in 172 dentate individuals had supragingival plaque (79.3% in workers and 74.2% in administers) and the oldest age group had highest plaque score but there were no statistical differences between age groups or workers and administrators. Furthermore, they found workers (57.9%) had significantly more bleeding than administrators (49.9%) ($p<0.05$) and had higher percentage of greater than or equal to 4 mm probing depth than administrators and significant difference for teeth ($p<0.05$). However, the mean number of administrators missing teeth (7.7) was higher than workers (6.6). Nevertheless, workers had highest score of calculus (CPITN2).[29]

For health, the environment of the company effects worker's health but in the oral health area, there are only two studies that have emphasized on this aspect. First, in 1983, there was a study about the effect of the workplace environment to oral health in the Danish chocolate factory.[25] It found that high level of sugar dust induced poor periodontal conditions. Moreover, in 1990, there was an unsupported report about the airborne sugar in the Finnish confectionery industry.[27] It showed

that it was not an occupational hazard for dental health. However, this may raise more concern and their safety-conscious lifestyle may lead to lower risk in sweet factory than control.

2.2 Health promotion

This part includes health promotion concept and Ottawa charter, a way to reach its aim. Moreover, health promotion evaluation is emphasized by the outcome of the model.

2.2.1 Health promotion concept

The meaning of health is extended to cover physical, mental, social and spiritual aspects under the current cultural changes that happen all the time. Health promotion is the social, educational and policy process. It fosters public awareness of health and influences people to have proper lifestyles and social actions. The public was induced to get healthy and the health promotion empowered community in changing the environment, system and policy to bring in good health and life.[30] Health promotion is an increasing ability process to induce human health control determinant and promote health. The World Health Organization defines health promotion as the process of enabling people to increase control over, and to improve their health.[12]

2.2.2 Ottawa charter

A way to promote health is the Ottawa charter. It is composed of three strategies and five priority action areas.[12] First strategy, “advocacy” advocates society through the media to get social acceptance and begins a social movement, including

lobbying policy makers to support the movement and lobbying state law to foster health consciousness. The next strategy is “enabling” which is empowering a community to develop the ability to promote and prevent health issues in the community. The last strategy is “mediating” which reconciles conflict or problems in health assets that may occur between groups and stakeholders from promoting health activity.

The three strategies above are the basic part of the five action areas to influence health promotion. The first action area is to build a healthy public policy concerning health and equity. This activity creates a supportive environment that encourages a healthy life for people and creates healthy choices that are easily accessible. The second action area is to create a supportive environment to prevent harm toward health and increases ability to access health care resources. The third action area is to strengthen the community action for health that increases the control over the health determinant and health care. This activity takes action in enforcing community activities in decision making, planning and processing activities to promote health consciousness by community participation. The fourth action area is to develop personal skills that will help in changing the behaviors of each person for controlling and developing latency in a living and producing changing environment by themselves. The fifth activity is to re-orientate health services which are changing attitudes in servicing and service systems, including a paying system and consistency with people.

In Thailand, there are no action areas of the Ottawa charter for oral health in the workplace. However, the dental public health department used it in all action areas. For example, the healthy public policy aspect used to control sugar consumption that has impact to health and oral health. Legislation is avoiding adding sugar in milk for infants of ages 1-6 months old[31] this has impacted the child

environment in feeding only non-added sugar milk. It is not only to protect them from sweeten addiction which may be the cause of overweight and diabetes mellitus but also decrease caries risk when they grow up. This shows that oral health promotion processes do not focus directly on oral health but at broader views and comprehensive for health. Those caused from the same determinant. The individual skill development, such as training a mother to brush her child in a well-child clinic, is also part of the promotion.[32] Furthermore, community is strengthened by being influenced to participate in community activities, such as those people in a village of Nan province to avoid buying snacks.[33] Finally, the budget allocation has changed in the health service system by the National Health Security Office to support health promotion by dividing budgets based on an area for prevention and promotion[34], and currently for oral health, the budget will come from the dental fund.[35] All workers use social insurance for illness that is not from work. The dental services that it covers include restoration, extraction and scaling. All above processes created by advocates enable and mediate strategies to achieve oral health promotion goals.

Preceding the above paragraph, I will remark health promotion in two main issues to introduce a successful process, participatory and empowerment.

Participation

Participatory is a process that stakeholders cooperate to look after their community by managing resources, making decisions, controlling projects and specifying policies.[36, 37] Effective participation composes of every part that has equality with respect to each other, discloses act, equal rights to presentation and decision, and encourages to promote mutual learning and empowerment while cooperating together.[36]

Participation is recognized as a social empowerment, that builds beneficiary capacity, improves project effectiveness and project cost sharing.[37] Each person will

pay varying attention in a cooperated project, therefore, participation has many levels.[36] The first three levels are no or less participation; manipulation, passive participation, participation in information giving. The next three are moderate participation; participation by consultation, participation for material incentives, functional participation. The last three are high participation; interactive participation, partnership and self-mobilization/ active participation.

In manipulation level, people do not participate but the outsider has control over the project. For passive participation, people only get information while the outsider still has control over the project. And as for participation in information giving, people cooperate in giving information through surveying but do not cooperate in managing while the outsider has the control over the project.

For participation by consultation, people cooperate in opinion through two-way communication but the outsider takes action as the operator that may conform to people's opinion. For participation for material incentives, people cooperate when there is repayment so they join in limited periods to receive benefits and stop cooperation afterwards. For functional participation, people cooperate in brain storming, decision making and management but the important decisions belong to the outsider.

For interactive participation, people cooperate in analysis to form a plan and strengthen an organization or build a new organization. People have the power to make decisions for someone or some group that does not dare show up or are unwilling. For partnership, people and outsiders have equal power to decide together to achieve their aim and find out a better way for both sides. For self-mobilization/ active participation, people independently think over while the outsider provides only resources and necessary technical consultancy but the people are the resources controller themselves.

Therefore people should get into an interactive participation level, for minimum participation, which shows their power in control over all processes of the project although someone may not convey their power.

Empowerment

Empowerment is a social, cultural, psychological or political process that makes people or society express their needs, present their concerns, revise decision-making, and achieve political, social and cultural actions to achieve their needs which are the goals of life. Empowered communities increase the power and control for health determinants and quality of life. Therefore WHO define empowerment as a process through which people gain greater control over decisions and actions affecting their health.[12] It brings the community self-esteem by empowerment on the access to knowledge, access to decisions, access to networks and access to resources.[38] Power in this sense refers to the empowerment that is the ability to bring about a state of affairs beneficial to the actor, the possession of the capacity to do or effect something which is called "power to".[39, 40]

Empowerment, in the view of capacity to make effective choices, depends on the agency and opportunity structure. Agency is the ability to create useful choices that are measured by asset endowment. Opportunity structure is formal and informal context (rule and norm) that shows the ability in changing agency into effective action.[41, 42] It is considered from the opportunity to make choices, opportunity to use choices and result of using choices.[41] The opportunity to make effective choices has been enabled by three factors; revenue sources, size and flexibility of budgets, and costs of participation. Empowerment occurs when the proportion of its own sourcing revenues and total revenues is high, proportion of owning controlling budgets to government's is high, and the costs of choosing to participate is low. Therefore decentralization has the impact to create an empowerment level by influencing

people to access and authorize in expenditure, and aid community to gain power over the government.[42]

Further sustainable development, which is the development of conforming to present needs but do not concern the ability of the next generation, that is able to fulfill future needs, composes of six morals; love, responsibility, diligence, belief, cooperation and discipline. Moreover, the essential and necessary attributes of sustainable development is an appropriate technology, cooperative economy, natural resources (raw materials), moral strength and social cohesiveness.[43]

Sustainable health promotion not only needs those morals but also requires attention in building a healthy public policy and enhancing a healthy environment to improve living conditions, promote healthy lifestyles and achieve present equity and future health.[12]

2.2.3 Health promotion evaluation

Health promotion evaluation is an assessment of the extent to which health promotion actions achieve a "valued" outcome.[12] When health promotion actions enable individuals or communities to control their health, health promotion evaluation should be done but it is difficult to trace the path which links health promotion activities to health outcomes because it involves complex "real-life" situations. There are three levels of activity outcomes that are evaluated. First, health promotion outcomes represent the first point of assessment and reflect modifications to those personal, social and environmental factors which are a means to improve people's control over their health. They include health literacy, healthy public policy, and community action for health. They represent the most immediate results of health promotion activities that change in the determinant of health, not in health status. However, there is also "value" placed on the process by which

different outcomes are achieved. In terms of valued processes, evaluations of health promotion activities may be participatory, interdisciplinary, integrated into all stages of the development and implementation of a health promotion initiative, and help build the capacity of individuals, communities, organizations and governments to address important health problems. Participatory is involving all those with a vested interest in the initiative. Interdisciplinary involves variety of disciplinary perspectives. Second, intermediate health outcomes are changes in the determinants of health, notably changes in lifestyles and living conditions. They are attributable to a planned intervention or interventions including health promotion, disease prevention and primary health care. Finally health outcomes are changes in health status of an individual, group or population. They will normally be assessed using health indicators.

Impact is defined as the immediate effect that health promotion programs have on people, stakeholders and settings to influence the determinants of health. Health promotion programs may have a range of immediate effects on individuals and on social and physical settings. Qualitative methods commonly used in impact evaluation are: focus groups, in-depth interviews, open-ended survey questions and participant observation. Quantitative methods are developing program-specific questionnaires and checklists but quantitative data collection tools are more useful.[44]

Nutbeam D[45] has proposed a health promotion evaluation outcome model (Figure 2) which has three different levels of outcome. They are health and social outcomes, intermediate health outcomes and health promotion outcomes. The first outcomes are the top of hierarchy that is the end point of health and medical interventions such as quality of life, functional independence and equity. The second outcomes are intermediate health outcomes which represent the determinants of

health and social outcomes. These determinants are represented as healthy environments that have direct impact on health and social outcomes and indirectly influence a healthy lifestyle. The appropriate access of health services are also an important determinant of health status. The last outcomes reflect modification to the personal, social and environmental factors that improve people's control and change the determinants of health. Health literacy, the cognitive and social skills determine the motivation and ability of individuals to gain access to, understand and use information to promote and maintain good health. Social influence and action includes organized efforts to promote actions and control of social groups over determinants of health and also mobilization of human and material resources in social action to overcome structural barriers to health, to enhance social support and to reinforce social norms conducive to health. Healthy public policy and organizational practices which policies, that influence organizational practice, intended to create environments to support health.

For oral health promotion, the study in 2006 provides this theoretical framework for evaluating a range of interventions including policy development, community action and education over an appropriate time scale.[9] The model describes a variety of evaluation measures including health promotion outcomes, intermediate health outcomes and health and social outcomes. The example for health promotion outcomes, healthy public policy development is the change in number of schools with food policy. The level of community support results in the change of public support for water fluoridation. Improvements in health knowledge change the oral health knowledge and skill. The example of intermediate health outcomes is the change in the number of schools selling healthy snacks which is an environmental change. Alterations to lifestyle practices are the change in milk or water consumption at school. The example of health and social outcomes are the

change in dmft level. Change in the number of episodes of toothache is the disease markers and quality of life indicators. (Figure 3) Such an evaluation model recognizes the importance of the social determinants of health and the need for interventions to utilize a complementary range of strategies to promote sustainable health improvements and reduce inequalities. However, the lack of appropriate and high-quality outcome measures is hampering the development of oral health promotion.

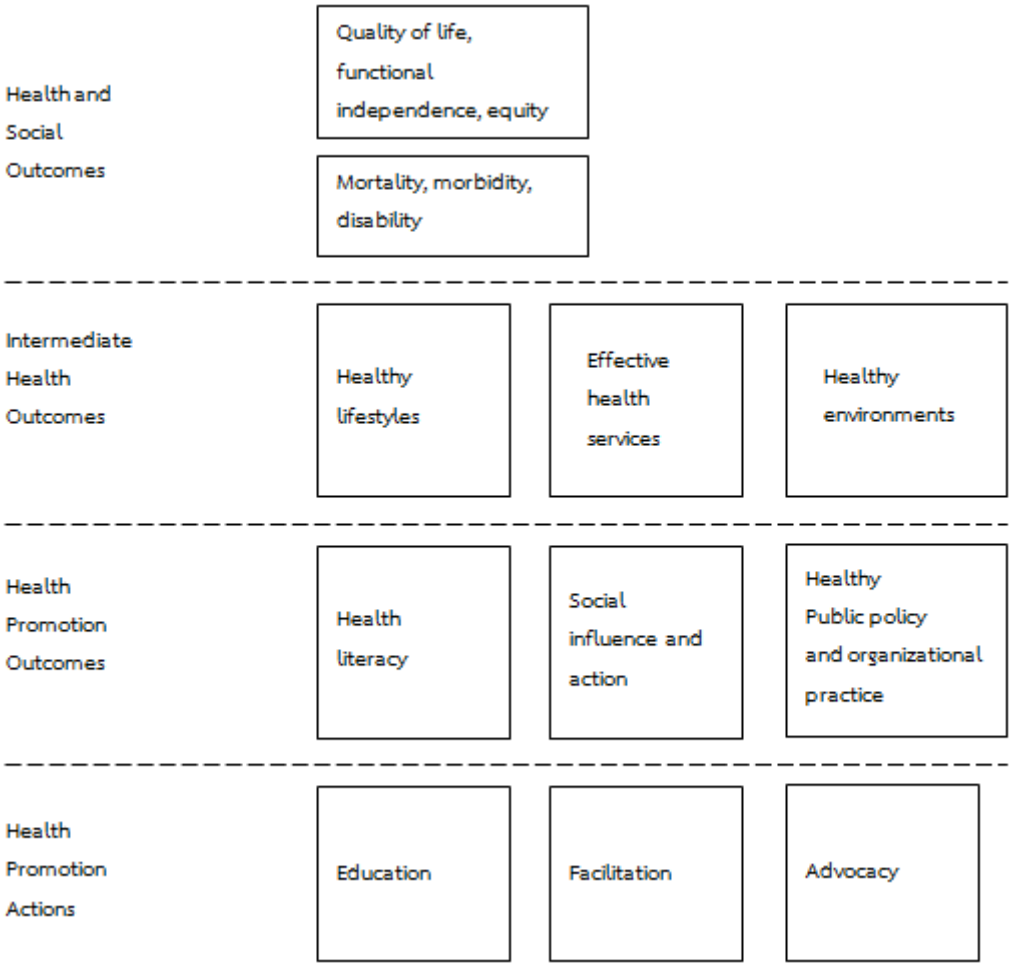


Figure 2 An outcome model for health promotion. (Nutbeam D, 1998)

Health Social Outcomes	**Quality of life and Equity** e.g. change in dmft level	**Mortality, Morbidity, Disability** e.g. change in no. of episodes of toothache	**Equity** e.g. reduction in oral health inequalities
Intermediate Health Outcomes	**Healthy lifestyles** e.g. change in milk or water consumption at pre-school	**Effective health services** e.g. change in no. of fissure sealant programs	**Healthy environments** e.g. change in no. of schools selling healthy snacks
Health Promotion Outcomes	**Health literacy** e.g. change in oral health knowledge and skills	**Social influence and action** e.g. change in public support for water fluoridation	**Healthy public policy and organisational practice** e.g. change in no. of school with food policy
Health Promotion Actions	**Education** e.g. in service training for school teachers on oral health issues	**Facilitation** e.g. formation of student schools nutrition action	**Advocacy** e.g.lobbying for improvements in food labelling

Figure 3 Oral health promotion evaluation outcome model (modified from Nutbeam D by Watt RG et al 2006)

2.3 Workplace health promotion and workplace oral health promotion

This part represents health promotion and oral health promotion in the workplace. The first one is explained into two aspects; problem-based approach and positive approach. The other is explained in five aspects which belong to the Ottawa charter; personal skill perspectives, environmental perspective, strengthen community perspective, health service perspective and policy perspective.

2.3.1 Workplace health promotion

Members of the workplace should understand the meaning of health which belongs to social, educational and policy process that influence them on the awareness of health and introduce good health behaviors for living. To achieve those goals, members of the workplace should possess a thinking process that is able to change the organizational environment and culture and assign related health policies for them.[46] All processes must be supported by employers, friends and colleagues to become a social and health policy of the organization that may be added to with the support of the government. This is to enable health care skill and knowledge under proper environment or good environmental model that is easy to access. Members of the organization need to join forces to analyze their health problems which may be mediated by the government's representatives or employers if they cannot agree with each other. Finally, organization will change its use of health services to include prevention and promotion besides treating diseases alone. Therefore, the contract with health insurance company will include health promotion program.[47]

Members should be confident that they can have their control over their health and decide how to handle the situation together with the company to

achieve what is the best for their health.[48] Health promotion in the workplace needs to shift from an exclusive focus on individual's lifestyle to a more comprehensive approach that includes whole-organization activity to maximize the impact.[24, 49]

2.3.1.1 Workplace health promotion focus on worker health problem

Most of the workplace health promotion focuses primarily on worker's health problems which the program was designed to improve stress management, weight control, cardiopulmonary resuscitation, accident prevention, smoking cessation, alcohol /chemical abuse, high blood pressure control and physical fitness.[46, 47] When workers are exposed to illness states such as obesity, hypertension, alcoholism, stress and mental or emotional upset, they pay attention to health care to get back to a normal living and working life. Those states come from their lifestyles and behaviors that are developed. They will reach the state of well-being through the health promotion that includes creating healthy environment and self-caring lifestyle through a societal norm to develop healthful living standards. Health personnel should empower workers to plan their health management by themselves.[47]

Workplace health promotion programs include teaching technical skills, laboratory testing, counseling and health education. Laboratory testing is a way to know current health status which is a starting point of finding health problems that should be resolved by the other components. When workers known their health problem they will find out environmental triggering events and learn to develop a healthy behavior pattern. Employers should specify flextime, programs, marketing strategies and ease the access to support these new behaviors. Workplace should assure its workers of their control over their health. The program that responds to a workers' need in learning to develop better behaviors must be accepted and supported by friends, colleagues and employers to create a new corporate culture

attitude, policy and value of organization. Environment and corporate culture which can be developed by everyone in workplace has the impact on workers' participation in the workplace health promotion program.[47]

In 1999, there was a study review on health promotion interventions in the workplace. This shows eight educational and skill development interventions, one environmental intervention, six comprehensive interventions and eleven uses of partnership in development of intervention.[50] In 2010, there was a study review on effect of workplace health promotion interventions on worker diets. Eight programs focused on worker education, and the remainder targeted change to the workplace environment, either alone or in combination with education.[51]

Workplace health promotion reports on policy aspect such as non-smoking policy. Non-smoking policy may range from eliminating smoking in designated areas to a total ban on smoking within the building. Physicians could play a key role in implementing such a policy by first meeting with management and various worker groups to educate all parties involved in the health benefits of such a policy.[52] In New Zealand, comprehensive smoke free environments legislation will have beneficial effects on the health of indigenous groups and could contribute to reducing inequalities in health within societies. Self-reported second hand smoking (SHS) exposure from others smoking indoors at work was reported to be decreasing among all employed adults.[53] Moreover there was a study on a small portion size of hot meals in addition to the existing size in the workplace cafeteria. When offering a small meal in addition to the existing size, a percentage of consumers, that was considered reasonable, were inclined to replace the large meal with the small meal. Proportional prices did not have an additional effect.[54]

There is a study on lifestyle intervention that was shown developing personal skill. The intervention such as counseling, group education and exercise had a strong

effect on body fat and body weight. There were benefits to the population with an elevated risk of cardiovascular disease.[55] Moreover, the messages for health promotion at workplaces increased responses in vegetable intake and physical activity. There were interventions with a combination of media and simple visual messages.[56] A study on health literacy found the higher health literacy group was more likely to have regular eating patterns and exercise weekly, and tended to have been a never smoker. There were more likely to actively solve the problems or seek support from others in coping with job stress.[57] The other study was a training program to reduce body weight and increase physical activity. It reduced body weight, body fat, waist circumference and blood pressure as well as increased aerobic fitness in the intervention group that showed great potential of workplace health promotion among this high-risk workgroup.[58]

For the strengthening community, there was a study on participation levels in health promotion interventions at the workplace. The overall view was that female workers were more likely to participate in health promotion programs than male workers. Implications for raising participation levels in workplace health promotion programs (WHPPs) were the provision of incentives, or a broad array of program offers. To what degree these strategies affected and also compliance to an intervention program should be considered.[59] Furthermore there was a study that suggested that the communication climate and social capital of organizations were important determinants of a company's innovative climate. A key component of workplace health management was the incorporation of health promotion objectives into the corporate philosophy. Worker's health became an integral corporate objective and part of the company's values.[60]

For the health service system, economic evaluations of tobacco control interventions showed that tobacco control programs and policies were either cost-

saving or highly cost-effective.[61] The physicians who were educators in smoking cessation not only performed that duty but also consulted to achieve the program.[52]

Workplace health promotion brings out better attitudes that help develop healthy morale, increased productivity, decreased illness, decreased absence of using medical services and increased better caliber of applicants. Workplace health promotions create models of healthy environment those workers who have social power get embraced in change wholeheartedly due to the benefits which they gain then they extend the boundary to their family and community, therefore, workplace health promotion will yield a long term impact to community health promotion.[47]

2.3.1.2 Workplace health promotion focus on positive approach

There are several approaches to organization, not only focusing on health problems, but also focusing on positive aspects.

For six decades, impactful approaches have been developed to support community development but have not been systematically blended in with project management. Community development approaches are Freirian Approach of Conscientization, participatory Action Research (PAR); participatory Learning for Action; Farmer Field School (FFS); Grameen Bank Approach; and Rural Livelihood Improvement Approach (RLIP). Project management approaches are Project Cycle Management (PCM), Deming Cycle (PDCA), Kaizen, and Appreciative Inquiry (AI) which are psychological and organizational development approaches. They focus on strengthening the confidence of clients and inducing change as an internally driven process. Since 1998, Asian Productivity Organization (APO) considers the capacity of development, sustainability development, productivity enhancement, integration, and people's participation as core elements of Integrated Community Development (ICD) Program. This program has developed a methodology suitable for strengthening

the capacities of communities in Asia which have led to the identification of seven key concepts in dealing with the challenges faced in the community development, Seven D Approach, that is: 1 Solution-Focused Brief Therapy (SFBT) and Appreciative Inquiry (AI), 2 Participatory Rural Appraisal (PRA), 3 Kaizen, 4 PDCA (Plan, Do, Check, Act) Cycle, 5 Logical Framework Approach (LFA) & Project Cycle Management (PCM), 6 Experimental Learning and Knowledge Spiral, 7 Facilitation.[62]

Solution-Focused Brief Therapy (SFBT) and Appreciative Inquiry (AI) value insights on how to enable communities to discover their potentials, to motivate and energize individuals, groups, and the whole community to unleash their energy for improving the situation of a community.

Participatory Rural Appraisal (PRA) enables the rural community to identify and analyze their situation, map their existing resources, and develop appropriate solutions. Kaizen which core idea is starting small and continuously improving encourages communities toward small quick interventions for continuous progress. PDCA (Plan, Do, Check, Act) Cycle provides crucial insight on how the processes should be designed and implemented so that continuous learning can take place.

Logical Framework Approach (LFA) & Project Cycle Management (PCM) provide systematic and analytical approaches for strategic planning activities and for monitoring the implementation of activities and their outcomes. Therefore provide excellent frameworks for mobilizing external funds necessary for community development.

Experimental Learning and Knowledge Spiral provide key insight on how to design a community development process as a knowledge-generation process and to promote learning so that the community is able to generate necessary knowledge for their benefit by utilizing their implicit and explicit knowledge.

Facilitation provides a rich body of experience and knowledge on how external actors can contribute effectively to internal self-development and capacity development of human systems. It is helpful in supporting communities to strengthen their own capacity.

In Thailand, “Happy 8 project” was used to develop workers to reach quality of life and happiness at work in 2005 by Thai Health Promotion foundation.[63] There were 8 elements of Happy, happy body, happy heart, happy money, happy relax, happy brain, happy soul, happy family and happy society. The aim of this project was creating happy life in the workplace by participation of the worker.[64] The key success factor for the project included construction, context, conception, contact, contribution, control and continuity.[65] Each element provides positive concept to reach the goals of a happy workplace. However each workplace had experience on project management such as PDCA, Four house project, 5S, Quality of Work Life, Human resource development, Organization value, Best practice reward, allowing workers to cooperate in environment and community development around the factory, welfare and relaxing and exercising activities, TQM, Save up project, Blood donor, stop drink during Lent. From these experiences, most workplaces can apply old projects or activities with Happy 8 to improve quality of life in the workplace easier. It is the frame that factories should aim for to improve workers’ life.

2.3.2 Workplace oral health promotion (WOHP)

Workplace health promotion uses many approaches such as disease and well-being approach, community development, project management and, in Thailand, Thai health approach. It emphasizes the workplace as a community then WOHP should take part in such process; create policy, develop personal skills, create environment, empower worker, and reorient the health system. However, there is

only disease and well-being approach being used in WOHP, the other approaches, such as community development and project management, are not used. Also in Thailand, there is no part of oral health aspect in Thai health approach. Oral health promotion in the workplace also focuses on oral health education such as oral hygiene instruction, oral health examination, oral prophylaxis and prevention of oral disease. Oral hygiene instruction composes of tooth brushing, flossing, interdental brushing which may be disclosed by disclosing solution. Oral health education in the workplace may recommend fluoride use and distribute pamphlets of oral health care. The measurements of oral health examination are periodontal and caries measurement. Periodontal measurements are community periodontal index (CPI), community periodontal index of treatment needs (CPITN), Bleeding on probing (BOP) and pocket depth (PD). Caries measurements are number of decay teeth and Decayed, missing and filled teeth (DMFT) index. Nevertheless, some WOHP programs take questionnaires about past experience workplace oral health examination. These are contributed to various interventions for workers in the workplace.

2.3.2.1 Personal skill perspective

Personal skills were developed by health education. The health education can be used alone or include services. Services may add feedback information. Moreover health education may be promoted by campaign. Use of fluoride shows personal skill to improve oral health.

2.3.2.1.1 <u>Health education without service</u>

Three studies were included in this review; health education is only a part of dental care, comparison of modes of oral hygiene instruction in improving gingival health, and relationship between receiving a workplace oral health examination including oral health instructions and oral health status. These studies representing

health education should take part in dental health service to improve oral health status. However various modes of oral hygiene instruction were not different in results.

The first study emphasized workers in all age groups required subgingival scale and prophylaxis with oral hygiene instruction although they have low levels of disease and minor treatment need.[26] The study of appropriate dental care was done in 241 manual workers and senior management from staff of a food processing and manufacturing company in Brisbane. Initial examination included periodontal examination and panoramic radiograph which is a teaching aid for patient education. 25-34 year olds workers need maximum mean number of restorations required (3.1) and 60.6% of all workers required restorative treatments. While periodontal treatment needs, subgingival scale and prophylaxis with oral hygiene instruction, was required in all age groups with more than 67% in each group requiring this treatment alone. No prosthetic treatment needs required while five workers with full upper/lower dentures appeared satisfactory. No soft tissue abnormalities and small number of ulceration and laceration workers. All of the ten workers needed 43 extractions but two due to dental caries.

The next study in comparison of modes of oral hygiene instruction in improving gingival health found no significant difference between various modes of oral hygiene group and a combination of more than one approach to oral hygiene education did not appear to show significant advantages.[66] The 195 male and female, 25-44 years of age, Hong Kong's telephone company workers were studied. Four modes were personal instruction (one to one basis), self-educational manual (booklet), video on oral hygiene script closely that of self-manual and combination 2 or more modes of instruction. Recall appointment for those modes were hygienist reinforced and reinstructed for personal instruction, respective educational materials

review advice for not cleaning effectively sites in self-educational manual and video groups. Mean plaque scores was significantly reduced from 49.5-55.0% at baseline to 25.8-35.0% at 2 weeks and maintained at 4 months and 10 months ($p<0.05$). Two third of greater than 40% plaque levels workers at baseline reduced to one third of greater than 40% plaque levels workers at 10 months. Bleeding scores were significantly reduced from 29.5-38.4% at baseline to 19.0-27.2% at 2 weeks but slightly deteriorated at 4 months and 10 months ($p<0.05$). However, there was no significant difference between various modes of oral hygiene group at all in the recall period and a combination of more than one approach to oral hygiene education as used in this study on the other hand did not appear to confer significant advantages.

The study of relationship between receiving a workplace oral health examination including oral health instruction and oral health status represents a certain suppressive effect on periodontal disease by encouraging workers to visit dental clinics and increasing their awareness of oral health.[67] The 3449 male and 1035 female, 35-74 year of age, were studied in Japan. The workers who received annual workplace oral health examination had a significantly lower risk for having teeth with deep periodontal pockets than those received the first time. They found that Odd Ratios that were greater than or equal to 10% of teeth with PD greater than or equal to 4 mm were significantly lower in workers who received a workplace oral examination every year (0.63,CI 0.41-0.97) and workers that brushed their teeth greater than or equal to 3 times per day (0.59, CI 0.37-0.94). Furthermore, ORs for having decayed teeth was significantly lower in workers who brushed their teeth (0.66, CI 0.44-0.98) and visited the dental clinic more frequently (0.16, CI 0.08-0.31). The workplace oral health examination including oral health instruction played a role in encouraging workers to visit dental clinics and increasing their awareness of oral health so it might have a certain suppressive effect on periodontal disease.

2.3.2.1.2 Health education with service

Three studies were included in this study. They contained various services on periodontal disease such as prophylaxis but no other treatment; prophylaxis with removal calculus, prophylaxis lower anterior teeth and scaling lower anterior teeth. Two of these represent a positive effect on oral health.

A preventive dental care program study of 241 workers from an industrial group in Brisbane represents improvements in dental health especially in the younger age groups who showed greater response to regular prophylaxis and one-to-one counseling.[68] Medical history included examination, instruction, professional cleaning of teeth, daily home cleaning to remove dental plaque, color photographs of various stages of periodontal disease and hand-held mirror and toothbrushing technique. Initial prophylaxis included removal of gross calculus deposits, examination, a second subgingival clean, supragingival clean with bristle brushes and stannous fluoride prophylaxis paste, hand scalers and prophylaxis at twelve to sixteen week intervals. The program provided oral hygiene aid samples which were toothbrushes, toothpaste, chlorhexidine gel, proximal tooth brushes and pamphlets to identify periodontal disease and its effects. However, if there was no treatment available worker would be referred to a dentist of choice. The proportion of CPITN scores of 0 increased greatest in the 25-34 age group (44.5%). Maximum final percentage of CPITN scores of 0 was in the 15-24 age group (76.1%). CPITN scores of 1 decreased and greatest reduced in the 15-24 age group in which 34.8 per cent of sextants at the initial and 9.4 per cent at the final examination. Maximum reduction of CPITN scores of 2 occurred in the groups that were more than 55 year-old (39.5%). An alternative system of oral health care implemented in the workplace can produce improvements in dental health and the younger age groups showed greater response to regular prophylaxis and one-to-one counseling. Service free-of-charge

was the incentive and enthusiastic support was given to the project by the General Manager and his management staff who were a very important factor in the success of the program.

The effectiveness of an oral health promotion program study[69] represents both male and female, who participated three times or more, had significant fewer caries experience and male had significant fewer caries experience than none. The percentages of CPI score 3 and 4 in male workers were significant lower in the group participating three times or more than once. The 1315 males and 683 females from 43 companies started the 20 minute program including clinical examination; caries experience and periodontal status; oral hygiene instruction; disclosing dental plaque, tooth brushing method suitable for each worker, provided toothbrushes, toothpaste and pamphlet about oral health care, interdental brushes and/or dental flosses (if necessary); and anterior lower teeth prophylaxis. This found that the male and female participants with three times or more participation (10.90±5.14, 11.01±4.86) had significant fewer caries experience than once (13.26±6.01, 12.60±5.09) ($p<0.001$) and male had significant fewer caries experience than none (12.66±5.29) ($p<0.05$). The percentage of CPI, score 3 and 4, in male workers were significant lower in the group participating three times or more (19.0) than once (25.7) ($p<0.01$).

Further the cost-benefit of WOHP study[70] studied in 357 male workers which had participated in oral health checkup 3 minutes, oral hygiene instruction 7 minutes and lower anterior scaling 10 minutes but there was no result on oral health status.

2.3.2.1.3 Health education with service and feedback information

There was a study educated with service and feedback information. Corporation-based computerized preventive dentistry program[71] represents dental awareness of the participants greatly improved and a majority are receiving

comprehensive dental care. It was studied in 186 Johnson & Johnson Dental Products Co. workers and family. Initial phase composes of bitewing radiographs, oral health education, scaling, extensive oral examination, pit and fissure sealants and fluoride therapy. Maintenance phase, every 3 months, included scaling, oral hygiene reinforcement, evaluation of gingival and periodontal status, bitewing radiographs, periodic oral examination and sealant and fluoride. Computerized charting and information system collect and process information on problems and health status using CRT (cathode ray tube). Initial chart composes of dental examination and problems separately for clinical and radiologic examinations. Maintenance chart includes information list from initial chart and current chart that showed progress through the program. Charting system allowed automatic problem lists and preventive progress sheets that patients were encouraged for their dentists for treatment of all diagnosed problems. The 73 per cent of requiring dental treatment patients received the needed dental care within the first year of the prevention program. Initial data significantly improve periodontal health (change in gingivitis 66%, pocket 16%) and reduction in carious lesions (51%) ($p<0.005$).

2.3.2.1.4 Health education with service, feedback information and campaign

Finally, there was a campaign study. Workplace preventive program effects on periodontal health represents the campaign achieved the objective of reducing gingival inflammation in the majority of the test group and producing shift in oral hygiene practice of adults which contributed to the periodontal health of worker with low to moderate risk of disease.[72] The 98 workers from 4 workplaces participated in the program of 7-8 minutes clinical examination then continued 7-8 minutes program including feedback based on recorded information screening, information sheet and disclosing tablets. During the screening week, the campaign

provided manned display, leaflet distribution and the incentive of prize sale of oral hygiene aid for test group while the control workplace did not receive feedback, information or campaign until second visit, after six weeks. Maximal effect of the program was achieved after 6 weeks and the program was equally effective for all ethnic and age groups, smokers and non-smokers, and for men and women. There was 31% reduction of bleeding on probing in test group but slightly increased in control group. And there was 13% reduction of probing depth more than 3.5 mm in test group while only 3% reduction in control. Females responded better by mean of 4.6 sites bleeding on probing more than males.

2.3.2.1.5 Use of fluoride

There are four studies on fluoride aspect but no result about relation between fluoride and caries. Those fluorides are fluoride mouth rinse, fluoride paste, fluoride therapy and the other not mention type of fluoride.

Self-administered use of 0.2% NaF study only represents the high percentage of workers who participated in the fluoride program especially workers with positive dental behavior profile.[73] It was studied among 82 dentate Danish chocolate workers. The study collected dental health behavior, knowledge and attitudes (ordinal scales and additive indices) and frequency participated in the fluoride program. Workers used fluoride rinse weekly only 3%, fortnight 37%, every month 21% and seldom or never 40%. While they used fluoride toothpaste 93% which 49% of them used twice a day and the other used more than 2 times a day and seldom or never (37%, 14% respectively). Only 6% of them brushed 2 times a day at work, 12% of them brushed once a day and most of them brushed irregularly. However 21% of them never brushed at work. Furthermore, 41% of them consumed chocolate at work daily and the other consumed several times a week, once or twice a week and seldom (20%,

17% and 22% respectively). This found that a high percentage of workers that participated in fluoride program especially workers with positive dental behavior profile and, high risk workers with negative dental attitudes, frequent chocolate consumption at work and irregular toothbrushing habits should apply professional fluoride.

The next study of evaluating oral health promotion effects on dental care costs and frequency of dental visits,[74] the program included a 20 minute orientation session, 15 minute initial regimen, four 10-min sessions of personal instruction and 20 minute group counseling. The initial regimen composed of 5 minute oral examinations and 10 minute of oral hygiene education that included tooth brushing, dental floss, interdental brush, fluoride use and observe oral bacteria.

A preventive dental care program study[68] collected medical history and initial prophylaxis included removal of gross calculus deposits, examination, a second subgingival clean, supragingival clean with bristle brushes and stannous fluoride prophylaxis paste, hand scalers and prophylaxis. The program also provided oral hygiene aids samples such as toothbrushes, toothpaste, chlorhexidine gel, proximal tooth brushes and pamphlets.

Initial phase of corporation-based computerized preventive dentistry program[71] composes of bitewing radiographs, oral health education, scaling, extensive oral examination, pit and fissure sealants and fluoride therapy. The maintenance phase, every 3 months, included scaling, oral hygiene reinforcement, evaluation of gingival and periodontal status, bitewing radiographs, periodic oral examination and sealant and fluoride.

Therefore fluoride is still an interesting aspect while it is not interested in the effect of fluoride to dental health in health promotion program.

2.3.2.2 Environmental perspective

There were some studies focusing on workplace environment that affected oral health. The study in a Danish chocolate factory which found high level of sugar dust induced accumulation of plaque that caused poor periodontal conditions.[25] After a certain work time period, 4 years or more, workers increased in mean DMFT to 4.7 ($p<0.001$). On the other hand, the study in Finnish confectionery industry suggested that airborne sugar is not an occupational hazard for dental health.[27] This was due to the founding of no statistically significant differences in salivary characteristics and microbiological findings, which was caries promoting factors, between the exposed groups and the control group. The workers of the exposed groups came from three factories; sweets, bakery and biscuit while those of the control group came from another factory. Sweets group had lower maximum risk scores (10.3) than the controls (12.0) while the bakery and biscuit groups had the largest numbers of high risk workers (25.9, 22.4 respectively).

However there was no study about relation between changing the workplace environment of the company, such as healthy canteen or brushing station, and oral health status. Some studies promoted use of fluoride but there was no report on the effect of it to oral hygiene directly.

2.3.2.3 Strengthen community perspective

There was no study to strengthen workers directly but there are five studies that studied on the frequency of participation. Most of those studied in Japan which counted in the number of visits, number of visits per year, number of visits during program. And the other counted in weekly. Only one study reported the result of oral health status.

The cost-benefit of WOHP[70] divided the frequency of participants into a 0 visit, light group(1 visit/ 7 years), medium group (2-4 visit/ 7 years) and heavy group

(5-6 visit/ 7 years). The effectiveness of an oral health promotion program study[69] divided number of times participated in the program into once, twice and three times or more.

Self-administered use of 0.2% NaF study[73] divided frequency participated in fluoride rinse program into weekly, fortnight, every month and seldom or never. Further this study divided frequency in using fluoride toothpaste into more than 2 times/day, 2 times/day and seldom or never and frequency in toothbrushing at work into 2 times/day, 1 times/day, irregularly and never. Finally, chocolate consumption at work was divided into daily, several times a week, once or twice a week and seldom.

Evaluation of oral health promotion in the workplace shows participation by frequency of dental visits.[74] Prior mean frequency of dental visits in participant group (3.8) was higher than that in control group (2.6). Third year after the program mean frequency of dental visits in participant group (2.7) was significantly lower than that in control group (3.3).

All studies above do not show the effect of participation on oral health status. While the study of relationship between receiving a workplace oral health examination including oral health instruction and oral health status represents a certain suppressive effect on periodontal disease by encouraging workers to visit dental clinics and increasing their awareness of oral health.[67] The 3449 males and 1035 females, 35-74 years of age, was studied in Japan. The workers who received annual workplace oral health examination had a significantly lower risk for having teeth with deep periodontal pockets than those received the first time. They found that ORs for having greater than or equal to 10% of teeth with PD greater than or equal to 4mm had been significantly lower in workers who received a workplace oral examination every year (0.63,CI 0.41-0.97)and workers who brushed their teeth

greater than or equal to 3 times/day (0.59, CI 0.37-0.94). Furthermore, ORs for having decayed teeth had been significantly lower in workers who brushed their teeth (0.66, CI 0.44-0.98) and visited a dental clinic more frequently (0.16, CI 0.08-0.31). The workplace oral health examination including oral health instruction played a role in encouraging workers to visit dental clinics and increasing their awareness of oral health so it might have a certain suppressive effect on periodontal disease.

2.3.2.4 Health service perspective

There is no study on re-orient health service system but most studies on service aspect report on the economic effect. This study review represents subsidization influence on people using more services and workplace oral health program reduce service cost. There was a study on cost-benefit under certain frequency of participation.

2.3.2.4.1 Subsidization influence people using more services

There are two studies of health service subsidization influencing people using more services and another emphasizes stabilization of treatment-mix, proportion of treatment such as extraction, scaling, restoration, periodontal therapy. These represent subsidization supported workers to use more service and, in a certain time, it stabilized the amount of each treatment.

Refinery workers' dental benefit scheme, mainly due to subsidization, had in fact improved their dental visiting.[75] This emphasized dental knowledge, attitudes towards oral health care and utilization of dental services among 38-65 years. 325 male oil refinery workers received an employer-provided dental benefit scheme while 174 controls on the same basis from other industrial workers at 3 companies in the same region (dental care provider density 1/1100) received any employer-

provided dental benefit scheme. This study found that 60% of the workers had visited a dentist within the past 12 months, but 91% of the subsidized workers had done so in the past two years. Treatment charge of subsidized workers (70%) were slightly more of an obstacle to dental visit than control (66%). The possibility of visits during working hours in subsidization influenced their current dental visiting pattern. Moreover, possibility of dental visits during working hours was the other intrinsic factor in the dental benefit scheme which may have affected the utilization pattern and costs of dental treatment paid directly from the sickness fund.

One study supported positive relationship between subsidized dental care and periodontal status.[29] This study emphasized periodontal status among 403 male industrial workers in southern Finland with access to subsidized dental care. The cost of dental treatment was paid directly to the dentist from the workers' sickness fund and workers allowed to dental visit during working hours for the test group. On the other hand, 254 workers without access to subsidized dental care paid their own treatment without any reimbursement from their employer or the state and made dental visits outside working hours. Dental check-up was gingival bleeding, dental calculus and highest score CPITN. Workers had a last dental visit within past 2 years ($p<0.01$) and a recall or check-up visit on their own initiative ($p<0.01$) had significantly more than controls. The probability of calculus was negatively associated with access to subsidized dental care 0.5 (CI 0.3-0.7) and tooth brushing at least once a day 0.3 (CI 0.1-0.6) and positively associated with smoking 2 (CI 1.2-3.4). The probability of having periodontal pockets was greater than or equal to 4 mm was negatively associated with recall or self-initiated check-up as the reason for the last dental visit 0.6 (0.4-1.0) and positively associated with smoking 2.1 (1.3-3.5). The maintenance and improvement of periodontal conditions in workers requires less treatment by dentists than controls.

There is a study of a preventive dental care program that also supports this subsidization. These found service free-of-charge was an incentive and enthusiastic support given to the project by the General Manager which is key to the success factor of the program.[68]

The subsidized dental program contributed stability of treatment-mix in older attenders which showed achieving a relatively stable dental treatment need for low occurrence of caries.[76] In 1997, employer-provided dental care for 268 Finnish male industrial workers which it's 32 workers attended the company's dental clinic during 1989-1993 (new attenders) and 236 workers attended the company's dental clinic prior to 1989 (old attenders) were analyzed in a 5-year retrospective study. The workers had adopted a regular attendance pattern of initial check-up and treatment. The clinical treatment records composed of time spent on dental treatment, treatment-mix, number of teeth per year, and number of carious teeth per year. Proportion of new attenders' first-year diagnostic and preventive treatment (31.4%) was statistically a significant difference with that of the 5-year average of old attenders (46.6%) ($p<0.001$). Within the first 2 years of treatment, new attenders decreased the annual treatment time to the same level of old attenders and decreased other procedures except diagnostic and preventive procedures. Mean time spent on first-year treatment of the new attenders (170 min) differed significantly from overall 5-year mean treatment time of old attenders (61min) ($p<0.01$). New attenders' mean number of carious teeth (2.7) was significantly higher than the 5-year mean in old attenders (0.5) ($p<0.001$) but declined to the same level after the first year of treatment.

2.3.2.4.2 Workplace oral health program reduce service cost

The study of evaluating the oral health promotion effects on dental care costs and frequency of dental visits in 348 workers[74] showed that dental care cost increased after intervention because of risk detection but the second and third year after the program dental care cost for the participant group and frequency of dental visits were significantly lower than that in control group. And in the 2-year period after the program, oral health promotion program in the workplace saved costs associated with dental care visits. The program included 20 minutes orientation sessions about epidemiology, etiology of dental disease, the prevention of disease and a 15 minute initial regimen; 5 minute oral examination, 10 minute oral hygiene education in subgroup of 5 persons about tooth brushing, dental floss, interdental brush and fluoride use and observation of oral bacteria under a phase contrast microscope; four 10-min sessions of personal instruction about oral hygiene instruction and prevention (face to face). Finally, 20 minute of group counseling under the direction of a dentist or a dental hygienist every 6 months recalled for 2 years. Prior dental care cost in participant group (21,317¥) was higher than that in the control group (17,116¥). The second and third year after the program, dental care cost in participant group (18,305¥, 16911¥ respectively) was lower than costs in control group (22,841¥, 21,920¥ respectively). Further in the second and third year after the program, the percentage of workers in the high cost category in participant group (14.9, 11.5 respectively) was lower than that in control group (18.8, 15.7 respectively).

2.3.2.4.3 Cost-benefit under certain frequency of participation

The cost-benefit of WOHP[70] represents that participation once a year did not decrease dental expenses but only risk detection for treatment. And continuous

participation may have changed oral health behavior while frequent visits in heavy group increased cost that maybe leading to inefficiency. This was studied in 357 male workers which had participated in the oral health checkup 3 minute, oral hygiene instruction 7 minutes and lower anterior scaling 10 minutes. They found that the light group (1 visit/ 7 years) had benefit-cost ratio -2.45 and the difference between cost and benefit was -104.18 $. While the medium group (2-4 visit/ 7 years) had benefit-cost ratio 1.46 and the difference between cost and benefit was 38.75 $, the heavy group (5-6 visit/ 7 years) had benefit-cost ratio 0.73 and the difference between cost and benefit -42.61 $.

All of the above may conclude that most oral health promotion focused on health education to increase knowledge and develop personal skill to inhibit gingival disease and decay. There are other aspects belonging to Ottawa charter but not exactly especially healthy public policy which no one studied on this aspect.

In real-life, workers have to contact outside the workplace so they still receive stimulation or social current from the outsider. Therefore changing the workplace environment and policy should be created, not only in trained workers to increase skill in self-care, thought, and choosing the best thing for their lives.

2.4 Participatory approach

To receive the goal of workplace oral health promotion, workers should take place on every part of the activities. Then they should be empowered to create their own actions to solve and prevent oral health. All of these, outsiders have many processes to influence them through various approaches. In this study I represent some approach such as PAR (Participatory Action Research), AI (Appreciative Inquiry), and AIC (Appreciation Influence Control).

2.4.1 PAR (Participatory Action Research)

PAR[36] involves bringing people from various social and political contexts and backgrounds to identify, investigate and take appropriate action on conditions that affect them as community members. It is a continuous cycle in which insiders and outsiders get together to decide what needs to be researched, design the research to be undertaken (what will be measured and how) and collect the necessary information. Then the information is put into practical applications or used to identify new research ideas. It alters a top-down approach to research by collaboratively engaging in deciding what information is needed in a problematic situation, collecting and analyzing information, and in taking action to manage, improve or contribute to a sustainable society by using four principles. Those are empowerment of participants, collaboration through participation, and acquisition of knowledge and social change which is based on two theoretical assumptions. The assumptions include the social construction or relativistic nature of reality and the accumulation of power by those who control the mechanisms of knowledge creation.

PAR give disenfranchised groups the ability to generate knowledge and power through research activities. Then it observes that elite groups disproportionately to control the mechanisms of knowledge development, and use this power (knowledge) to exploit or oppress certain groups. PAR is an empowerment tool for developing the skills of disenfranchised groups to independently sustain their actions and work toward the realization of their legitimate causes. It has four steps; planning, acting, observing and reflecting.

Planning is a constructive process that arises during discussions among the participants. It is composed of examined action by each of the participants and includes evaluation of the change. Acting occurs when the plan is put into place and hope for improvement to the social situation happens. The action or change is

happening in reality and not as an experiment that is waited to prove. Observing the changes is outlined in the plan for observing its effects and the context of the situation by using research tools, such as questionnaires to ensure proper scientific methods. Finally, reflecting is a process that research participants examine and construct, then evaluate and reconstruct their concerns. Using tools such as keeping a research journal, document collection and analysis, participant observation recordings, questionnaire surveys, structured and unstructured interviews, and case studies is used to reflect it.

PAR is a more holistic approach to problem-solving, rather than a single method for collecting and analyzing data. However, facilitators should understand the local power structure and local issues. Nevertheless, they are aware of the potential for damage and the disempowerment in the community that could result from implementation of the research project. Thus, they have clear status and relationship with the community and can command resources for a long-term commitment.

2.4.2 AI (Appreciative Inquiry)

AI turns the problem-solving approach on its head by focusing on a community's achievements instead of its deficits.[36, 77] It identifies and builds on past achievements and existing strengths within a community, establish consensus around a shared vision of the future, and construct strategies and partnerships to achieve that vision. AI is rooted in a philosophical belief that the past successes of individuals, communities, and organizations are the basis for future success. The six principles to explain the power behind the appreciative approach is constructionist, simultaneity, poetic, anticipatory, positive and wholeness.[36]

The constructionist principle that believes the real world is created through social discourse. Thus, words used to describe a situation as critical to conceiving and constructing its current and future state. The principle of simultaneity recognizes that inquiry and change occur together such that inquiry is intervention. The seeds of change, the things people think and talk about, the things people discover and learn, and the things that inform dialogue and inspire images of the future, are implicit in the first questions asked. The poetic principle states that human organizations, including communities, are an open book that is constantly being co-authored. Story-telling is valued as a way of gathering holistic information that includes not only facts but also feelings. The anticipatory principle postulates that current behavior is guided by future images that people expect ahead of themselves that brings the future powerfully into the present as a mobilizing agent. The positive principle reflects a belief that momentum for change requires positive thinking and social bonding. People and communities move in the direction of a positive image of the future then effective changes will occur. The principle of wholeness reflects a belief that everyone in a community fully collaborate then an Appreciative Inquiry will be successful.

This approach has four steps; discovery, dream, design and delivery.[36, 77]

Discovery, the first stage of the appreciative cycle focuses on discovering periods of excellence and achievement. Through interviews and storytelling, participants discover and explore times when their organization or community was at its best. Then identify and analyze the unique factors—such as leadership, relationships, technologies, core processes, structures, values, learning processes, external relations or planning methods. The key steps in this phase are to identify stakeholders; formulate a list of appreciative questions and develop an appreciative interview guide; conduct individual and group interviews using various participatory

methods, asking probing questions to reveal underlying values, strengths and factors that led to success; document the stories; and analyze the stories to identify strengths and enabling conditions.

Dream, the second stage, individuals, groups and/or communities dream the ideal community. Based on the values, strengths and hopes discovered through the storytelling and analysis activities, a vision of a desired future is created. It represents a challenge and requires the participants to do something by a large group conference or workshop.

Design, the third stage, the new structures and processes required to achieve the Dream takes place at three levels: action planning on short-term objectives; discussion on long-term strategies to achieve more challenging goals; and consideration of structural changes. This stage uses a small team of trained and empowered participants to design ways of creating the community's dreamed future.

Finally, delivery, involves delivering the dream, and beginning the cycle of inquiry again. In this stage, people act on their provocative propositions, establishing roles and responsibilities, developing strategies, forging institutional linkages and mobilizing resources to achieve their dream. Continuous learning and adjustment take place as new information, perspectives and community strengths are discovered, thereby renewing the appreciative cycle.

AI helps the community understand their capabilities and develop positive vision for their future. However it depends on the skills of the facilitator to engage participants in positive thinking and focus on strengths.[36]

AI that is used in health aspect almost aims to facilitate health personal to reach a goal of caring patient. It is used to change organization concept from negative to positive approach. The first study found that AI explored the parts of historical past of nursing college that should maintain a vision of excellence for

nursing college, the ways it could be realized into practice, and fulfill expectations of shared vision.[78] The stakeholders, external and internal community of interest, were asked with the description of four steps AI. It emphasized that college faculty and its ability providing educational program are major strengths. They saw themselves to keep the college's history, reputation alive as a leader and supported the college.

And also the second study emphasized AI is a powerful tool to shift mental health organization culture on the recovery model in mental health agencies.[79] This study found that urban mental health center which used the medical model for recovery forced them to feel uncomfortable and uncontrollable in the decision-making process. AI made organization change for the better and turned to a new culture by empowering staff and creating a constructive recovery culture. Furthermore, rural mental health agencies used AI to make staff collaborate in the new program and transform top-down management to flattened decision-making culture. AI made empowering staff envision possibilities.

The third study found that Four-3-hour AI sessions as a knowledge translation intervention promoted change pain management based on positive examples in the unit and staff action plan implementation.[80] AI session made staff nurses and nurse leaders be relished, fun, exciting, rewarding and empowering. Its process was a means to create unit practicing ways. Further, the context and culture of study unit have been important in the moderating factor to overcoming barriers.

There is a study in Thailand that used AI to discover Phon hospital personal health activity that improved better health.[81] The staff members design 1 activity and 4 projects to improve health. It was not only improved but also reduced the cost of medical treatment. Furthermore it changed the norm of organization and early morning exercise.

2.4.3 AIC (Appreciation Influence Control)

AIC is a workshop-based technique that encourages stakeholders to consider the social, political, and cultural factors along with technical and economic aspects that influences a given project or policy. AIC helps workshop participants to identify a common purpose, and creates an enabling forum for stakeholders to pursue that purpose collaboratively. Activities focus on building appreciation through listening, influence through dialogue, and control through action. AIC process is encouraged to be appreciated through listening, influence through dialogue and control through action.[82] It uses five principles; value of small, value of homogeneous groups, value of symbols, value of the written word and importance of a strong facilitator.

The small groups are to interrupt the normal mood and opened participants to new ideas and difference perspectives. The values of homogeneous groups, these groups consolidate the expertise of like stakeholders, each of whom has recently learned the perspectives of the other stakeholders at the conference. The value of symbols, participants often begin by creating nonverbal representations of their experience and understanding, drawing and pictures, to ease communication and to elicit creative thinking. The value of the written word, groups' progress in writing helps participants to understand their individual responsibilities in context and to move forward on their commitments. Finally, the importance of a strong facilitator, who is trained in navigating around tough spots, guiding the entire group through new experiences, and stimulating open discussions and negotiation, is a catalyst for setting the AIC conference in motion and for steering participants toward a conference closure that leads to action.

The step of A.I.C. approach is illustrated below:[37]

Step 1 Identification group

Step 2 Dividing the participants into three groups; men only, women only, and a combined group of both men and women

Step 3 Each person drawing pictures

Step 4 Each person drawing a future picture to identifying ways and means

Step 5 Consolidate all the drawings into a single picture with all the details. This helps to enhance team spirit in the community towards achieving goals

Step 6 Each group listing its priority needs and identifying a range of activities that could be undertaken to address those needs

Step 7 Consolidate the three lists and asking all participants to arrive at a consensus on a single list of proposed activities for implementing

Step 8 Dividing the proposed activities into groups

Step 9 Prioritizing the proposed activities

Step 10 Requesting each participant to indicate the activities in which he/she is willing to participate and/or take the responsibility for its implementation and also provide details of his/her inputs

Step 11 Asking each group to elect a project manager who is entrusted with the task of preparing a work plan for implementation and presenting it

However, AIC is easy to use but takes time (3 days) and suitable for area of coverage is not large. Further facilitator must have expertise in managing activities.

2.4.4 Group discussion

The processes above; PAR, AI, AIC; include the importance basic of group discussion or dialogue. It bases itself on a group process which group is defined as two or more individuals who are connected to one another by social relationships.[83]

It can be classified into four types: function group, task group, interest group, friendship group.[84]

Function group is a group formed through the formal authority relationships that exist in an organization. Task group is a collection of people brought together to accomplish a specific task. Interest group is individuals who band together to promote a self-fulfilling interest. Friendship group is a group formed on the basis of something that members have in common.

Group interactions to fulfill a task or solve a problem can be considered in term of the natural process the group goes through in reaching a conclusion, the norms which regulate their behavior included effects on cohesiveness and conformity, processes taken in problem solving, technique of decision making, networks used for communication among members, roles performed by various members, leadership, and environment.[85]

Group decisions can be made by consensus, majority vote, compromise, or minority control, or by an individual group member. Decision by consensus has the greatest strength of all type of decisions because of the unanimous support of all group members. Decision by majority vote is frequently used to reach a decision that at least 51 percent of the group participants agree upon. Decision by compromise occurs when the group has polarized views on an issue and is unable or willing to resolve the problem by voting. Decision by minority control may occur when a subcommittee of the group is designated to consider the issues and determine the best decision. Decision by an individual group member who is an expert or authority may be designated to make a decision for group when given their opinion for the leader to consider in reaching a decision.[85]

A list of functional roles divided into three categories:[86, 87] group task, group maintenance, individual. Group task roles focus on the task at hand and include roles

such as the “elaborator”, the “coordinator” and the “orienteer”. Group maintenance roles focus on keeping the group together and include roles such as the “encourager”, the “harmonizer” and the “compromiser”. These two functions are positive roles that help the group pursue its goals. Individual roles include the “aggressor”, the “dominator” and the “recognition seeker” which are negative functional roles and do not help the group move toward its goals.

Table 1 Bales’s Interaction Process Analysis coding scheme

Categories	Specific Examples
Positive Reactions	
1. Shows solidarity	Jokes, gives help, rewards others
2. Shows tension release	Laughs, shows satisfaction
3. Shows agreement	Understands, concurs, complies, passively accepts
Attempted Answers	
4. Gives suggestion	Directs, proposes, controls
5. Gives opinion	Evaluates, analyzes, expresses feelings or wishes
6. Gives information	Orients, repeats, clarifies, confirms
Questions	
7. Asks for information	Requests orientation, repetition, confirmation, clarification
8. Asks for opinion	Requests evaluation, analysis, expression of feeling or wishes
9. Asks for suggestion	Requests directions, proposals
Negative Reactions	
10.Shows disagreement	Passively rejects, resorts to formality, withholds help
11.Shows tension	Asks for help, withdraws
12.Shows antagonism	Deflates others, defends or asserts self

A necessary set of functions or actions that a group must perform to reach its goals and solve its problems are critical for groups to maintain equilibrium and solve their orientation, evaluation and control problems. Then groups need to balance the proportion and sequence of these statements for maintaining cohesiveness and solving task problems. The list of functions measures the communication that occurred during the group meeting. This coding scheme shows in Table 1 which function1, 2, 3 are positive reactions but function 10, 11, 12 are negative reactions that endanger group cohesiveness.[86]

Democratic values are basic to the welfare of our political system: respect or belief in the dignity and worth of the individual, fairness or belief in equality of opportunity, freedom coupled with responsible exercise of freedom, and belief in each person's ability to understand the nature of democracy. Four "moralities" or ethical guidelines[88] rooted in those values are development the habit of search stemming from recognition, cultivate the habit of justice by selecting and presenting fact and opinion fairy, prefer public to private motivations, and cultivate the habit of respect for dissent by allowing and encouraging diversity of argument and opinion.

The ethics of motivational and emotional appeal is a persuasive technique. Ethical standards for the type of small group communication which is task-oriented toward reaching a mutually agreeable decision or solving a problem are participants should be allowed to make up their own minds without being coerced, duped, or manipulated and be encouraged to grow and to develop their own potential. More over sound reasoning and relevant value judgments are to be encouraged, and conflicts and disagreements that focus on participants as persons rather than on ideas or information should be avoided. Furthermore, participants who manipulate group members solely or primarily for their own selfish ends are unethical and, in the role of advisor, they should present information honestly, fairly and accurately.

They should reveal their sources. They should allow others to scrutinize their evidence and arguments. Lying is unethical because it breaks the trust necessary for participants to access information. With respect to external groups or individuals, participants within the group should be committed to defending true statements of fact, praiseworthy value statements, and sound advice. However, they should communicate with each other as they would want others to communicate with them in which communication practices in the group should be judged within a framework of all relevant values and ethical criteria, not solely or primarily by the worth of the end or goal to be reached.

Furthermore, a number of guidelines for ethical communication in small group discussion[88] are a communicator which has a responsibility for defending the policy decisions of groups in whose deliberations he participated. If he cannot, he should make his refusal of support clear at the time the decision is reached. And the communicator has a responsibility to be well informed and accurate. To present a few facts as the whole story, tentative findings as firmly established conclusions, or partial understanding as authoritative is to mislead the group. A communicator has a responsibility to encourage actively the comments of others and to seek out all viewpoints, including unpopular ones. Communicator should openly reveal his own biases, and should identify his sources of information and any prejudices of such sources. Uninhibited lying, fabrication of evidence, inventing of sources, deliberate misquoting, and falsification of facts are obviously dishonest practices. The ethical group member does not attempt to manipulate the talk unfairly so that his selfish ends are served and the group wishes frustrated. The ethical communicator avoids use of tactics to intentionally cloud analysis: name-calling, emotionally loaded language, guilt-by-association, hasty generations, shifting definitions, and oversimplified either-or alternatives.

Group climate which is the emotional tone or atmosphere that exists within a group is an important element that helps shape a group's culture. Three factors that contribute heavily to group climate are trust, cohesiveness and supportiveness. Trust means that members believe they can rely on each other to get things done. Trust regarding the task means members can count on each other to get thing done. And interpersonal trust means that members believe the others are operating with the best interests of the group in mind and not from hidden agendas. Cohesiveness is the attachment members feel toward each other and the group. When a group is cohesive, members feel a strong sense of belonging to the group, they value their relationship with each other and they consider the group attractive. Finally, supportive climate is an atmosphere of openness created by members' mutual respect and caring. Then members feel safe to express themselves because they believe that others value their opinions.[89]

There are some studies that use group discussion to be part of intervention. One study evaluates that neonatal mortality can be reduced through systemic changes to the provision and promotion of healthcare. The intervention in the trial has two key elements: a community health promotion campaign and a system to contract out healthcare to non-public institutions. The health promotion campaign will include a health education campaign, participatory discussion groups, training of village health workers and midwives, and improved coordination of antenatal services. The participatory discussion groups of a maximum size between 15 and 20 individuals can encourage each other to access the trial services and serve as a group that provides valuable feedback about the various interventions. The sessions of 1–2 hour at a time and venue suitable to a majority of the women contain ice-breakers, a review of the last meeting's content, presentation of new themes, reinforcement of

themes through activities, demonstrations games and a small assignment. However, there is no result represented.[90]

The second study explores the effectiveness of a health education meeting in recruiting women for a cervical screening program which is an innovative approach in a primary-care setting in rural Crete. It has been suggested that small group discussion sessions, use innovative methods and are led by peer educators can also be effective in changing behavior. The women who participated in the educational discussion meeting recruit all the initial participants in high compliance rate. Furthermore, the lay women who participated in small group discussion meeting, in the capacity of lay messengers convinced an additional 32 women to participate in a screening program for cervical cancer as a member of a team. The program composes of a brochure; with a 30 minute lecture based on specific questions and problem based learning method. The key messages of this health education discussion were that cervical screening reduces the risk of developing cervical cancer. They were asked which participants had been screened before for cervical cancer by those who had not done that previously. Those who participated in educational discussion meeting were invited to organize a group visit in the next 15 days.[91]

Only the process of a participatory dental health education program was not sufficient to prevent early childhood caries. A study of the intensive moderator-training programs in the vaccination program was done for 520 mother or caregiver of 6-19-month-old children. The staffs transferring were empowered three times group on discussions of 6-8 mothers or caregivers in oral health, cause and prevention caries for three month interval. Each session took 40-60 minutes. The health center staff in the intervention group had better knowledge and attitude to early childhood caries than control but no statistically significant level. And mother or caregiver understood that candy and no brushing behavior caused of its while control

understood less. Furthermore, the proportions of brushing with fluoride toothpaste and using proper amounts of it were significantly higher than control at one-year follow-up ($p<0.001$). However, children in both groups had the same magnitude of increase in cavitated carious lesions during this period.[92]

Group discussions can illicit good process feedback, particularly with a less literate participant group.[93] This process is suitable to workers in various education levels and helps to achieve good relationship with each other.

Therefore, to reach the aim of oral health, workers should promote strategies that belong to Ottawa Charter with five action area. Furthermore, they should be encouraged with strong empowerment to achieve active participation which their environmental policy would be fostered to create by themselves to support oral health within their context. So, this study tried to develop WOHP by using five action areas of Ottawa charter on positive approach.

Chapter III

Methodology

This research is quantitative and qualitative research. The managers' questionnaire and workers' oral examination and interview was used to collect quantitative data while the document, observation and in-depth interview was used to collect qualitative data. The data was proved by data and investigator triangulation. Then data was analyzed by typology and taxonomy, and constant comparison.

The intervention in this research includes:

1 Group discussion with positive approaches and present oral health status of workers in each workplace

2 Exchange experience session

3 Dental health education (on request)

The factories which were not corporate to the intervention, as the control group, workers would be received oral examination and feedback of oral health status and consulting for oral problems as well as intervention group. While factories that corporate exchange experience session and group discussion with positive approaches are intervention I group and factories that corporates only exchange experience session are intervention II group.

This research methodology was progressed in 6 parts: recruitment factory, manager questionnaire survey, workers' oral examination and interview, group discussion with positive approaches, exchange experience among factory managers and the evaluation.

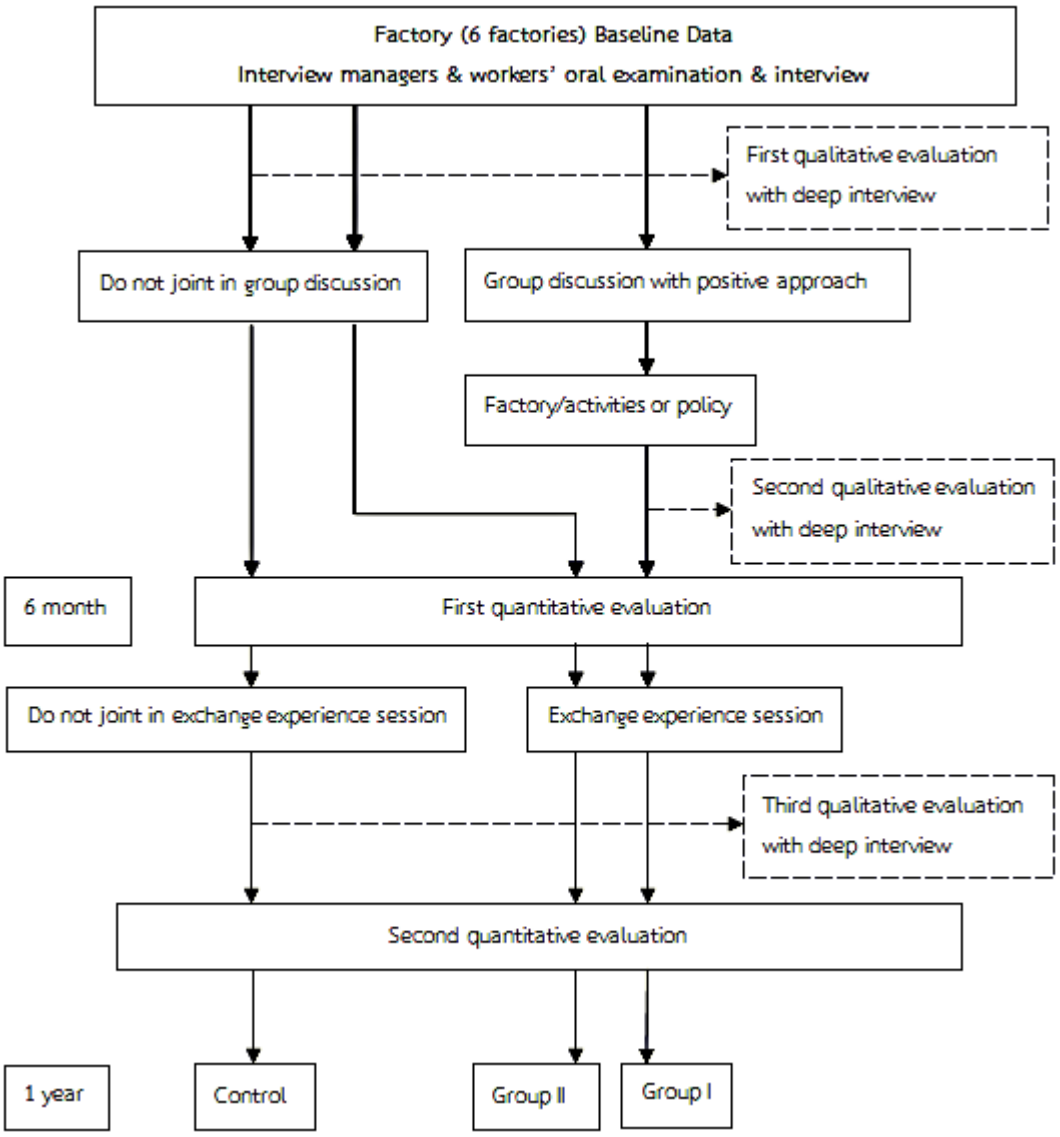


Figure 4 Flow chart shows processes of the research

3.1 Recruitment factory

This study was conducted in the Kaengkhoi district of Saraburi, which is an industrial province located at the center part of Thailand. There are 221 small factories in Kaengkhoi district.[8] All of the 7 factories reach the inclusion criteria that have 50-200 workers. Only 6 factories participated in this study. The joint factories that have two companies in one area of factory, whose workers could change theirs job in both factories, were excluded due to total workers having more than 200 workers. Each factory was sampling workers by convenience sampling. Number of each factory workers was analyzed by formula below. (Table 2)

Table 2 Number and sample size of workers

Size of factory	Number of workers	Number of require workers	Number of sample workers
small	100	26	35
small	87	25	30
small	120	27	34
medium	86	25	28
medium	170	29	35
medium	140	28	29
Sum	703	160	191

$$n=\frac{NZ^2pq}{NE^2+Z^2pq}$$

N=number of population

E=0.1 (error 10%)

p=0.9

q=1-p

Z=1.96 (level of significance 0.05)

Regarding the study's objective of evaluating one year intervention program, sample size was calculated taking into account a previous study's findings on periodontal health improvement after a WOHP program.[72] Fishwick et al reported that bleeding on probing of an intervention group reduced from 56% to 25% but increased from 46% to 48% for a control group.[72] The number of workers in each intervention group was calculated by formula below.

$$n_1 = \left[\frac{z_{1-\frac{\alpha}{2}} \sqrt{\bar{p}\bar{q}\left(1+\frac{1}{r}\right)} + z_{1-\beta} \sqrt{p_1 q_1 + \frac{p_2 q_2}{r}}}{\Delta} \right]^2$$

$R=n_2/n_1$, $q_1 =1-p_1$, $q_2 =1-p_2$

$p=\frac{p_1+p_2 r}{1+r}$, $\bar{q}=1-\bar{p}$

The workers in each group should be 68 persons then the total workers should be 204 person.

3.2 Managers' questionnaire survey

This step started with a structural questionnaire of head workers in 6 factories. One dentist interviewed managers of participated factories by on information regarding factory's oral health policies and environments, that is the presence or absence of extra health insurance for workers (in additional to basic package insurance which is compulsory for all factories), snack shop in factory, wash basin in restrooms, after lunchtime toothbrushing activity supported by factory, provision of free toothbrush and prohibition of eating while working. Information obtained from managers were double-checked by direct observations and asking workers. Factory managers were interviewed about their factory's characteristics. Managers were interviewed 4 times during 1 year period.

The primary data was used to find out factors which each factory has and to find out who is the key person that should be contacted in the implementation

period. Then the factory was invited to participate in all processes of the research. The voluntary factories were included in the next step.

The questionnaire was sent to three experts to check content and validity. Further pilot questionnaire was done to check suitable languages before interview. Nevertheless, the walk around survey of the factory environment was collected.

3.3 Worker's dental examination and interview

The workers of each factory that participated in research were examined for oral health status. Oral examinations conducted by one dentist under natural daylight were to assess dental caries and oral hygiene status using criteria of World Health Organization [10] and Oral Hygiene Index Simplified (OHI-S) index respectively [11]. Intra-examiner reliability was tested during a pilot study showing almost perfect agreement with Kappa statistics of 0.85.[10] In addition to oral examination, interviewed questionnaire was used to collect data on individual background (age, gender and educational level) and oral health behaviors (frequency of toothbrushing per day, frequent consumptions (yes/no) of processed snacks/fruits/sweet drinks/soft drinks, frequency of taking snack breaks per day including processed snacks and fruits, frequency of having sweet drinks or soft drinks per day).

Interviews were conducted by 4 interviewers who were dental nurses and well-trained for correct understanding in the questionnaire. Data collected from participating workers were oral health knowledge, behaviors and oral hygiene status. Data were collected 3 times (baseline, 6 months and 1 year periods) for Control and Intervention I group, and 2 times (baseline and 1 year period) for Intervention II group. Interviewed questionnaire contained twelve items of oral health knowledge and thirteen items on oral health behaviors. Knowledge that was measured related to following 12 aspects: 1) frequency of toothbrushing (at least twice per day) 2) duration of toothbrushing (at least two minutes) 3) type of toothpaste (fluoride

containing) 4) benefit of using mouth rinse (anti-cariogenic and anti-microbial effect not recommend for daily use for all people) 5) benefit of using fluoride mouth rinse (anti-cariogenic effect, recommended for high risk group) 6) frequency of meal (three meals per day) 7) eating vegetable with meals (recommended for every meals) 8) type of snacks recommended (fruit) 9) eating fruit habit (not recommend grazing/ continually consume all day) 10) recommended drinks (plain water or drink does not contain non-milk extrinsic sugar [94]) 11) self-examination (recommended for detecting oral abnormality). Oral health behavioral items were parallel to knowledge items with an additional item on whether or not, you have received oral examination by dentist (during one year period or since the project started). Total knowledge and behavior scores were calculated by summing up all correct answers, thus ranging from 0-11 and 0-12 respectively.

The data would be analyzed at the end of research to evaluate relationship with the result of implement; changing policy and environmental management to support oral health in each factory.

3.4 Group discussion with positive approaches

After baseline data collection, only manager and head workers of factories that participated intervention were invited to group discussion. Group discussions were arranged once for each factory, aiming to gain community participation and strengthen their action in taking control of their oral health.[12] Topics of group discussions were the ways to improve oral health in factory with participant of 6-10 persons each time. The discussions were proceeded under friendly and supportive atmosphere, that is, every participant had positive attitudes and trust towards their peers, felt safe and realized that they had equal rights to express their opinions. Finally, the groups reach agreements on creating oral health-related policy, environments or activities.

The session was followed this:

1 Introduction with objective of the study

2 Show your pride on factories policy and environmental management and explain process to reach it.

3 Explain your workers health status and the way to get it

4 Create your expectation of oral health status of workers and show effect to productivity

5 Design the ways to improve oral health status

6 The committee voted commitments to change.

7 Choose the leader of each procedure, set time to start and define the process

The key messages belong to this:

1 Changing canteen, shop and brushing station

2 Improve workers' oral health status

3 Changing workers' behavior

The positive approach was sincerely contact focusing on their achievements and existing strength. This approach did not find their problem yet force them to solve it. There was a feeling of trust, cohesiveness and supportiveness among researcher and participants. Participants were feeling safe while expressing their opinions.

3.5 Exchange experience among factory managers

At sixth month, Human Resource Team of intervention factories would be invited to exchange experience session. The progress in the past six month process was discussed with positive attitude. The success of the plan or procedure was

represented. The key of success might be used as a guide for others to develop the process. Finally, found out role model of factory to guide other factories.

If they requested some assistance, workshops such as education and skill development might be added depending on the result of the meeting. The researcher would support under limitation of active participation.

3.6 The evaluation

The evaluation of this research was divided in two parts, quantitative and qualitative. The result of intervention was collected in a 5 part of this following:

1 Individual factor

1.1 Age

1.2 Gender

1.3 Education

2 Factory factors

2.1 Size

2.2 Location

2.3 Additional health insurance

2.4 Snack shop

2.5 Wash basin in toilet

2.6 Brushing activity and free toothbrush with no eating

2.7 Manager attitude

3 Outcomes

3.1 Oral health knowledge

3.2 Oral health behaviors

3.3 Oral health statuses

3.4 Oral health related quality of life

4 Productivity of factory belongs to performance, less absenteeism and turnover and working condition.

5 Policy, activity and project

The policy, activity and project after group discussion and exchange experience session were collected to compare with the group which is not corporate intervention on the same aspect.

3.6.1 Quantitative part

The quantitative part had two evaluations. The first evaluation of this research was done for baseline data and the other evaluated at the sixth month before exchange experience session and at sixth month after that the second evaluation.

3.6.1.1 Analysis of baseline data

Data were analyzed using SPSS version 22 (IBM Corp., Armonk, NY, USA). DMFT and DT were calculated for dental caries and OHI-S scores for oral hygiene status. Oral hygiene status was categorized into good (OHI-S score = 0-1.2), fair (OHI-S score = 1.3-3.0) and poor (OHI-S score = 3.1-6.0). Means DMFT and DT scores and percentage of workers with good oral hygiene were clinical outcomes of interest and therefore, were associated with independent variables. The first step of analytical analyses was to explore the difference between factories in relation to workers' individual background, factory's environmental factors and workers' clinical outcomes. Chi-square and Kruskal-Wallis tests were applied for comparing proportions and scores respectively. The second step was to assess associations of clinical outcomes with individual socio-demographic background and oral health behaviors. This is because such individual characteristics were potential confounders of the associations between factory's environments and clinical outcomes. Pearson

correlation and t-test statistics were used to investigate associations of age with dental caries (DMFT and DT scores) and having good oral hygiene respectively. Mann-Whitney-U and Chi-square tests were used to investigate associations of individual socio-demographic background and oral health behaviors with dental caries (DMFT and DT scores) and having good oral hygiene. Finally, associations between factory's environmental factors and clinical outcomes were assessed using negative binomial (Incident rate ratio (IRR) and 95% CI were reported) for dental caries, and binary logistic regression models (Odd ratio (OR) and 95% CI were reported) for oral hygiene. Analyses on dental caries included only workers who had been working in their factories for at least 3 years. Individual socio-demographic background and oral health behaviors that were conceptually related to clinical outcomes and obtained p-values of less than 0.2 from previous analyses were entered into adjusted regression models.

3.6.1.2 Analysis of one year intervention data

Overtime changes in knowledge and behaviors of the three groups were analyzed, by comparing 6 month and 1 year periods with baseline using Wilcoxon sign ranks. In addition, comparisons of changed knowledge and behavior scores between Control and Intervention I as well as Control and Intervention II groups were performed using Mann-Whitney U test. For oral hygiene status, overtime changes were analyzed by comparing percentage of workers with good oral hygiene between 6 month, 1 year periods and baseline using McNemar test. Percentages of workers who improved to having good oral hygiene after 6 month and one year periods were also compared between Control and Intervention groups using Chi-square test. Statistical significance was defined when $p \leq 0.05$.

3.6.2 Qualitative part

The qualitative part has three evaluations. The first evaluation will be done one month after baseline data collection. The deep interview will be done with all human resource team in each factory on the aspect of what factor influenced them participate the intervention and why they participate. The second will be done at sixth month before prepare exchange experience session with human resource team in factories that participate in group discussion with positive approach (intervention B group). The aspects are what projects or activities you did, why you do those or you do not, what the key success are or why they do not success. The last evaluation will be done at twelfth month in human resource team that participate exchange experience session (intervention A and B group). The aspects are why you participate the exchange experience session, what the result of the session of your team, what projects or activities you will do more or you want to stop them, and why you do that. The context, interview data and other information will be analyzed.

Chapter IV

Result

This was a one year longitudinal oral health promotion project in workplace, conducted in 2013 in Kaengkhoi district, Saraburi province, Thailand. Saraburi is an industrial province located at the center part of Thailand. There are 269 factories in Kaengkhoi district, categorized into 22 large, 26 medium and 221 small factories. Size of factory was defined according to the Thai Ministry of Industry based on capital amount and labor intensity. This study was conducted in medium and small-size factories due to the facts that setting up oral health promotion program, as study's lone-term objective, would be more practical compared to large-size factories. Only seven factories reached the inclusion criteria and therefore, were invited. Six factories accepted invitation and were randomly divided into Control and Intervention groups with the equal number of 3 factories in each group. Nevertheless, one factory in the Intervention group delayed their participation for 6 months, thus, was later defined as Intervention II group. Control group did not participate our oral health promotion project. Intervention I group joined the project since beginning, thus duration of project participation was 1 year. Intervention II group joined the project 6 months later, thus, duration of participation was six months. All workers in participating factories were recruited as study sample. Thereafter, workers in selected factories were invited to participate in study on a volunteering basis. Total number of sample was 191 workers dividing into Control (92 workers), Intervention I (69 workers) and Intervention II groups (30 workers).

The result divided into 3 parts, 1) factory characteristic associated oral health status, 2) workplace oral health promotion with positive approach affected oral

health knowledge, behaviors and oral health status, and 3) health promotion outcome and attitude of manager towards workplace oral health promotion.

4.1 Factory characteristic associated oral health status

This part as baseline data explained characteristics of each factory. The study which found some association between factory characteristics and oral health status would divide to 4 aspects.

4.1.1 Factories' characteristics

From all seven small to medium factories invited, six factories participated in the study. All the six factories were different in terms of their products as shown in Table 3. Three factories were considered small size factories, while the other three were medium size. (Table 4) Numbers of total workers in each six factory was between 86 and 170, while numbers of those participating in study were between 28 and 35 workers (20.6-35.0% of total workers) which were higher than calculated minimum sample size. Majority of workers (60-89%) were male for 5 factories while the other factory (Factory B) had male workers for 26.7% (Table 3). Mean ages and education years of workers among the six factories statistically significantly differed ($p < 0.001$) with mean ages ranging from 33.5 to 44.5 and education years from 7.2 to 13.1. (Table 3)

4.1.2 Factories' environmental factors and clinical outcomes

Two factories were located in rural area, while the others were in urban area (Table 4). Two factories (C and E) provided health insurance, additionally to a basic package, to all their workers. Factories A, D and F had snack shops while the other three did not. Almost all factories, except Factory B, had wash basins in toilets so that workers could use the basins during brushing their teeth. In terms of

toothbrushing activity after lunchtime, provision of free toothbrush and prohibition of eating while working, only Factory C had all these three oral health supportive factors while other factories did not have any of them. Managers of 4 factories had positive attitude except Factory D and F.

Regarding clinical oral health outcomes, mean DMFT scores of workers among the six factories did not statistically differ (p = 0.432) although some differences were observed, for example, mean DMFT score was lowest (4.5) for Factory C and highest (7.0) for Factory B. (Table 5) However, statistically significant difference (p = 0.048, p = 0.001) was found for mean DT and FT scores. Mean numbers of untreated decay teeth among the six factories ranged from 0.6 (Factory F) to 1.5 (Factory D). Mean number of filled teeth range from 0.5 (Factory D) to 2.4 (Factory E). The other, MT score, was not statistically different. (p = 0.056) For oral hygiene status, percentages of workers with good oral hygiene were statistically significantly different (p < 0.001). As high as 94% of workers in Factory E were categorized as having good oral hygiene, while about 50% of those working in factory B had good oral hygiene (Table 5).

4.1.3 Individual characteristics

Individual factors and behavioral characteristics of sample were present in Table 6. Ages of sample ranged from 19 to 62 years with a mean (±sd) of 38.5 (±10.2) years. Most (67.0%) of the sample were male, most (62.8%) finished secondary school or higher. For oral health behaviors, the majority (86.9%) brushed their teeth twice or more a day. Most of the sample (82.2%) frequently consumed fruits. Percentage of sample who frequently consumed processed snacks was slightly lower than those who did not, 45.5% and 54.5% respectively. Similar patterns were also observed for consumptions of sweet drinks (47.1% and 52.9% respectively) and soft drinks (47.6% and 52.4%). In terms of taking snack breaks, 63.4% did not or had only once per day while 36.6% had snack breaks twice or more a day. Nearly half (49.7%)

did not drink or drank sweet/soft drink once per day, while the other half (50.3%) drank twice or more a day.

In terms of oral health status, 80.6% of sample had dental caries experience. DMFT scores ranged from 0 to 22 with a mean (±sd) of 5.4 (±5.3). Among the DMFT components, mean numbers of missing teeth (MT) was highest (3.0±3.8). Mean numbers of decay teeth (DT) and filled teeth (FT) were 1.1±2.0 and 1.3±2.5 respectively. Simplified Oral Hygiene Index (OHI-S) scores ranged from 0 to 3.3 with a mean (±sd) of 0.9 (±0.8). Categorized into levels, 70.7% had good oral hygiene while 28.3% had fair and 1% had poor oral hygiene. (Table 5)

Associations of individual characteristic and oral health status were shown in Table 6. Age was statistically significantly associated with all clinical outcomes. Older tended to have higher DMFT ($r=+0.378$, $p < 0.001$) and DT ($r=+0.229$, $p = 0.001$) scores and poorer oral hygiene ($p = 0.003$). Male workers were more likely to have lower DMFT scores than female workers ($p = 0.014$), however significant difference between gender was not found for DT scores and oral hygiene status. All clinical outcomes were statistically significantly related to educational level, that is, workers who studied at secondary school level or higher tended to have lower DMFT scores ($p = 0.044$), lower DT scores ($p < 0.001$), and good oral hygiene ($p < 0.001$) compare to their counterparts.

For oral health behaviors, statistically significant difference were observed for only toothbrushing frequency in relation to oral hygiene status ($p = 0.035$). Workers who brushed their teeth twice or more a day were more likely to have good oral hygiene (73.5%) compared to those brushing once a day (52.0%). Others oral health behaviors were not significantly associated with clinical outcomes, however, some behavioral variables obtained p-value of less than 0.2, namely, brushing frequency ($p = 0.145$), and frequent consumption of fruits ($p = 0.134$) associated with DMFT scores; and frequent consumption of processed snacks with oral hygiene ($p = 0.156$).

Therefore, these variables would be included in further multivariate analyses. (Table 6)

4.1.4 Factories' environmental factors associated with oral health outcomes

Since there are differences between the six participating factories in terms of some oral health outcomes of workers, that is, mean DT, scores and percentages of workers with good oral hygiene, while differences between factories' characteristics and environmental factors were also detected as presented in Table 3 and 5, we further explored whether such the differences in oral health outcomes were associated with factory's characteristics. Table 8, 9 and 10 show crude and adjusted negative binomial and binary logistic regression models for associations of DT scores and having good oral hygiene respectively, with factory's characteristics. Previous analyses on workers' characteristics associated with oral health outcomes also found that age, gender and education years of workers among the six factories significantly differed (Table 3). Analyses on individual characteristics associated with clinical outcomes (Table 6) revealed that individual factors generally significantly associated with clinical outcomes. Therefore, individual factors were entered into adjusted models. In addition, oral behaviors that conceptually related to certain oral health outcomes and obtained p-value of less than 0.2 on univariate analyses were also included in adjusted model. (Table 6)

For dental caries analyses, using DT scores as outcome variable, crude model revealed a potential difference between factories with and without wash basins in toilets. Mean DT score of workers in factories where wash basins were available was 1.8, while that of factories without wash basins was 1.1. Although such difference did not yield statistical significance (IRR = 0.6(0.3-1.2), p-value = 0.056), p-value of less than 0.2 warranted further multivariate analysis. When age, gender and educational

level were entered into adjusted model I and also size of factory was added in adjusted model II, the difference became statistically significant ($p<0.05$). DT scores of workers in factories with available wash basins in toilets were 60% (IRR= 0.4 (0.2-0.9)) less than those in factories without wash basins. (Table 7)

For oral hygiene analyses, crude models showed that workers in medium size factories, those in factory with additional health insurance and those in factories where wash basins were available in toilets were significantly more likely to have good oral hygiene compared to their counterparts. In adjusted models where age, gender, educational level and frequency of toothbrushing were controlled, size, a provision of additional health insurance and availability of wash basins in toilets remained statistically significantly associated with oral hygiene. Workers in medium size factories, those working in factory that provided additional health insurance were about three times more likely to have good oral hygiene compared to workers working in small size factories and where additional health insurance was not provided (OR = 3.1 (1.4-6.9), OR= 2.7 (1.2-6.2) respectively). Moreover, workers in factories where wash basins were available were as high as 7 times (OR= 7.0 (2.2-22.8)) more likely to have good oral hygiene compare to those in factories without wash basins in toilets. Therefore adjusted model II where size of factory was added workers in factory with additional health insurance and those in factory with wash basin in toilet remained statistically significant (OR=3.2 (1.4-7.7) and OR=4.8 (1.4-16.2) respectively). Furthermore workers in factory with toothbrushing activity, free toothbrush and no eating showed three times more likely to have good oral hygiene compared to their counterpart (OR=3.1 (1.1-8.8)). (Table 8)

4.2 Workplace oral health promotion with positive approach affected oral health knowledge, behaviors and oral health status

At 1 year period, about one third of workers dropped out (35.6%). Workers of Control group remained 48.2% of all sample. Workers of Intervention I group were 36.1% while those of Intervention II group were 15.7%.

For baseline data of remained workers, there were not statistically significant differences between dropped out group and participated until 1 year for DMFT, DT, MT and FT scores and having good oral hygiene. Workers of Intervention I and II group were not different from Control group for DMFT, DT, MT, FT scores except those of Intervention II group differed from Control group for DT scores and Intervention I group differed from Control group for FT scores. Furthermore both Intervention group were statistically significantly different for having good oral hygiene. (Table 9) Nevertheless oral health related quality of life of workers were not statistically significantly different between Control and Intervention group for all aspect. (Table 10) Most aspect of oral health knowledge and behaviors scores was not different between Control and Intervention group. However, toothbrushing frequency and duration of toothbrushing knowledge differed between Control and Intervention I, and toothbrushing frequency, frequency of meal and type of snack recommended knowledge differed between Control and Intervention II. (Table 11) For oral health behaviors, type of toothpaste and examination by dentist differed between Control and Intervention I and toothbrushing frequency, self-examination and examination by dentist differed between Control and Intervention II. (Table 12)

Through using positive community participation approach, participating factories initiated various oral health promotion activities. Oral health promotion outcomes that had occurred in Intervention I group consist of posters and morning talks for oral health education. Morning talk was not only to giving oral health message to workers but also to persuade all workers to brush their teeth after

lunchtime. Head workers also accepted they would remind their workers to brush their teeth after lunch. In addition, restriction on snacks and sweetened drinks consumption was applied. Apart from plain water, taking snacks and sweetened drinks was allowed only at after 10.00 am. during morning and after 3.00 pm. during afternoon. For the Intervention II group, outcomes were less extensive than the first group. Only posters on dental health education were displayed in the factory areas. The WOHP with positive approach showed changing on knowledge, behavior and oral health status.

4.2.1 Knowledge

After 6 months, some knowledge improvement was observed in the Control and Intervention I groups (Table 16). For the Control group, knowledge scores at 6 months period were significantly higher than baseline for two items (duration of toothbrushing, $p = 0.050$ and self-examination, $p = 0.018$). Nevertheless, the Intervention I group obtained significantly higher scores, compared to baseline, for 4 knowledge items, that is, frequency of toothbrushing ($p = 0.035$), duration of toothbrushing ($p < 0.001$), type of toothpaste ($p = 0.034$) and self-examination ($p = 0.034$). At one year period, both the Control and Intervention I groups remained showing improvement in some knowledge items. Intervention I groups improved their knowledge on recommended drink ($p = 0.034$). For the Intervention II group, significantly increase in knowledge was found for 2 items, that is, eating vegetable with meals ($p = 0.034$) and self-examination ($p = 0.034$). (Table 13)

Analyses on changed scores of each group were shown in Table 14. At 6 months and 1 year periods, almost all knowledge items of the three groups increased (shown as plus symbol in Table). Through comparing changed scores between Intervention I and Control groups for 6 months and 1 year periods, as well as between Intervention II and Control group for 1 year period, statistically significant

differences were found for only Intervention I group compared to baseline at 1 year period. Intervention I group obtained significantly higher improvement than Control groups for one knowledge items that is, duration of tooth brushing (changed scores of +0.4 for Intervention I and +0.1for Control, $p \leq 0.05$). On the other hand workers of Intervention I group significantly declined on benefit of using mouth rinse ($p \leq 0.05$). (Table 14)

4.2.2 Behaviors

After 6 months, Control and Intervention I groups improved some behaviors (Table 15). For the Control group, three of four items of behaviors scores, that is, frequency of tooth brushing, use of fluoride mouth rinse and self-examination were significantly higher than baseline ($p = 0.014$, $p = 0.034$, $p = 0.025$ respectively) while examination by dentist was significantly lower than baseline ($p < 0.001$). Furthermore, the Intervention I group obtained significantly higher scores, compared to baseline, for 4 behaviors items, that is frequency of tooth brushing, type of toothpaste, eating fruits habit and recommended drinks ($p = 0.014$, $p = 0.008$, $p = 0.014$ and $p < 0.001$ respectively).

At one year period, Control group showed improvement for self-examination ($p = 0.018$) and decreased examination by dentist ($p < 0.001$). For, the Intervention I group, behavioral improvement remained for 3 items, that is type of toothpaste, eating fruits habit and recommended drinks ($p = 0.001$, $p = 0.029$ and $p = 0.001$). For the Intervention II group, significant improvement was found for 2 behavioral items, that is, frequency of tooth brushing and self-examination ($p = 0.046$ and $p = 0.011$ respectively). (Table 15)

Changed behavioral scores of the three groups were shown in Table 16. At 6 months period, comparing changed scores between Intervention I and Control groups, Intervention I group obtained significantly better improvement for 3

behaviors items that is type of toothpaste, $p \leq 0.05$, recommended drink, $p \leq 0.01$ and examination by dentist ($p \leq 0.05$)

At one year periods, comparing changed scores between Intervention I and Control groups, Intervention I group remained showing better behaviors for some items (type of toothpaste, $p \leq 0.05$ and examination by dentist, $p \leq 0.01$). In addition, change scores of daily use of mouthrinse also significantly differed between Intervention I and Control groups ($p \leq 0.05$). For Intervention II compared to Control groups, statistically significant differences were found for two behavioral items. Intervention II group obtained significantly better behaviors than Control groups for frequency of toothbrushing ($p \leq 0.05$) and examination by dentist ($p \leq 0.05$). (Table 16)

4.2.3 Oral health status and oral health related Quality of life

Analyses on mean DMFT show difference in all groups. Control group increased DT, MT and FT significantly at 6 months and 1 year except DT at 1 year. For Intervention I group workers increased DT ($p = 0.046$) and MT ($p = 0.026$) significantly at 1 year and also Intervention II group workers increased MT ($p = 0.016$) significantly at 1 year. (Table 17) As well as change DMFT of both Intervention group did not significantly compare with control at 1 year. However, at 6 months, Intervention I group increased less change of DMFT. Although change of DT and MT did not significantly, Intervention I group change in FT less than Control group significantly at 6 months and 1 year ($p = 0.031$ and $p = 0.026$ respectively). (Table 18)

Analyses on percentage of workers with good oral hygiene and percentage of workers changing to good oral hygiene for each of three groups were shown in Table 17 and 18. At 6 months, there was no difference, compared to baseline, for the Control and Intervention I groups. However, at 1 year period, percentages of workers having good oral hygiene of the three groups increased. Statistically significant

differences were found for the Control ($p < 0.001$) and Intervention I ($p < 0.003$) groups. Through comparing percentages of workers changing to good oral hygiene, there was not any statistically significant difference found.

For oral health related Quality of life, the three daily performances are chewing, working and talking. Only Intervention I group showed improving on chewing at 6 months ($p = 0.030$). (Table 19)

Table 3 Factory characteristics among the six participating factories.

	Factory and their workers' characteristics						
Factory	**Production**	**Total worker (N)**	**Required sample size**	**Study sample N (%)**	**Males (%)**	**Workers' mean age**	**Mean education (years)**
A	Machinery construction products	100	26	35 (35.0)	77.1	39.9±10.7	8.3±3.5
B	Crackers products	87	25	30 (34.5)	26.7	34.7±9.8	7.2±1.7
C	Lead products	120	27	34 (28.3)	82.4	37.4±8.8	10.2±3.9
D	General construction products	86	25	28 (32.6)	89.3	42.3±10.5	9.3±2.9
E	Lime products	170	29	35 (20.6)	60.0	33.5±7.5	13.1±3.6
F	Furfural and furfuryl Alcohol products	140	28	29 (20.7)	65.5	44.5±10.0	12.1±3.9
Total		703	160	191 (27.2)			10.1±3.9
p-value					<0.01[a]	<0.01[b]	<0.01[b]

[a] Chi-square Test for gender among 6 factories

[b] Kruskal-Wallis Test for age and education year among 6 factories

Table 4 Environmental factors among the six participating factories

Factory	Environmental factors						
	Size	**Location**	**Additional health insurance**	**Snack shop**	**Wash basin in toilet**	**Brushing activity + free toothbrush + no eating**	**Manager attitude positive**
A	small	urban	no	yes	yes	no	yes
B	small	rural	no	no	no	no	yes
C	small	urban	yes	no	yes	yes	yes
D	medium	urban	no	yes	yes	no	no
E	medium	rural	yes	no	yes	no	yes
F	medium	urban	no	yes	yes	no	no

Table 5 clinical outcomes among the six participating factories

	Clinical outcomes				
Factory	Mean DMFT[a] (±sd)	Mean DT[b] (±sd)	Mean MT[c] (±sd)	Mean FT[d] (±sd)	Good oral hygiene (%)
A	5.1±5.7	1.4 ± 1.8	3.1±4.8	0.6±1.4	54.3
B	7.0±5.6	1.4± 2.0	4.2±3.9	1.4±2.0	50.0
C	4.5±5.2	1.0± 1.7	2.2±3.0	1.4±3.0	73.5
D	5.6±4.9	1.5± 2.7	3.6±3.3	0.5±1.3	85.7
E	5.1±4.8	0.7± 2.1	2.0±2.4	2.4±3.2	94.3
F	5.6±5.6	0.6± 1.2	3.3±4.4	1.7±2.8	65.5
Total	5.4±5.3	1.1±2.0	3.0±3.8	1.3±2.5	70.7
p-value	0.432[e]	0.048[e]	0.056	0.001[e]	<0.01[f]

[a] DMFT= number of decayed missing and filled teeth

[b] DT= number of decayed teeth

[c] MT= number of missing teeth

[d] FT= number of filled teeth

[e] Kruskal-Wallis Test for age, education year, DMFT and DT among 6 factories

[f] Chi-square Test for good oral hygiene among 6 factories

Table 6 Individual characteristics: socio-demographic and behavioral factors associated with DMFT and DT scores and having good oral hygiene.

Workers' characteristics	% of sample (N=191)	DMFT[a] score		DT[b] score		Good oral hygiene	
		Mean±sd	p-value[c]	Mean±sd	p-value[c]	%	p-value[d]
Socio-demographic factors							
Age		*r*=+0.378	<0.001[e]	*r*=+0.229	0.001[e]		0.003[f]
Gender							
-Female	33.0	6.7±5.6	0.014	0.8±1.7	0.180	79.4	0.090
-Male	67.0	4.8±5.1		1.2±2.1		66.4	
Education							
-Primary school	37.2	6.6±5.9	0.044	1.7±2.5	<0.001	52.1	<0.001
-Secondary school or higher	62.8	4.8±4.8		0.7±1.4		81.7	
Behavioral factors							
Frequency of toothbrushing							
-Once a day	13.1	7.3±6.5	0.145	1.8±3.4	0.417	52.0	0.035
-Twice or more	86.9	5.2±5.1		1.0±1.6		73.5	
Frequently consumed processed snacks							
-No	54.5	5.6±5.5	0.732	0.9±1.4	0.777	66.3	0.156
-Yes	45.5	5.2±5.1		1.3±2.4		75.9	
Frequently consumed fruits							
-No	17.8	4.2±5.0	0.134	0.9±1.3	0.680	61.8	0.218
-Yes	82.2	5.7±5.3		1.1±2.1		72.6	

Table 6 (Cont.)

Workers' characteristics	% of sample (N=191)	DMFT[a] score		DT[b] score		Good oral hygiene	
		Mean ±sd	p-value[c]	Mean ±sd	p-value[c]	%	p-value[d]
Frequency of snack breaks							
-No or once	63.4	5.4±5.3	0.727	1.1±1.9	0.783	67.8	0.322
-Twice or more	36.6	5.5±5.4		1.1±2.1		75.7	
Frequently consumed sweet drink							
-No	52.9	5.4±5.4	0.502	1.2±2.0	0.265	72.3	0.636
-Yes	47.1	5.5±5.2		1.0±1.9		68.9	
Frequently consumed soft drink							
-No	52.4	5.4±5.4	0.717	1.0±1.8	0.371	73.0	0.525
-Yes	47.6	5.5±5.2		1.2±2.1		68.1	
Frequency of drinking sweet/soft drinks							
-No or once a day	49.7	5.9±5.3	0.274	1.0±1.9	0.907	73.7	0.427
-Twice or more	50.3	5.0±5.3		1.1±2.1		67.7	

[a] DMFT= number of decayed missing and filled teeth

[b] DT= number of decayed teeth

[c] Mann-Whitney Test

[d] Chi-square Test

[e] Pearson correlation, *r*= Pearson correlation coefficient

[f] T-tes**t**

Table 7 Negative binomial regression models for associations of factory characteristics with dental caries, adjusted for individual characteristics.

Factory characteristic	Dental caries analysis[c]				
	% of sample (N=139)	DT[a] mean ±sd	Unadjusted IRR[b](95%CI)	Adjusted I IRR[b](95%CI)	Adjusted II[d] IRR[b](95%CI)
Size					
-Small	52.5	1.3±1.9	1		
-Medium	47.5	1.0±2.3	0.8(0.5-1.2)	-	
Location					
-Urban	76.3	1.1±1.9	1		
-Rural	23.7	1.3±2.6	1.2(0.7-2.0)	-	-
Additional health insurance					
-No	65.5	1.3±2.1	1		
-Yes	34.5	1.0±2.1	0.7(0.5-1.2)	-	-
Snack shop					
-No	46.0	1.2±2.2	1		
-Yes	54.0	1.2±2.0	1.0(0.6-1.6)	-	-
Wash basin in toilet			LL=-207.2	LL=-191.5	
-No	11.5	1.8±2.6	1	1	1
-Yes	88.5	1.1±2.0	0.6(0.3-1.2)[f]	0.4(0.2-0.9)[e]	0.4(0.2-0.9)[e]
Brushing activity + free toothbrush + no eating					
-No	77.7	1.2±2.2	1		
-Yes	22.3	1.0±1.8	0.8(0.5-1.4)	-	-
Manager attitude					
-Not positive	35.3	1.1±2.2	1		
-Positive	64.7	1.2±2.0	1.2(0.7-1.9)	-	-

[a] DT= number of decayed teeth

[b] IRR= incidence rate ratio

[c] Negative binomial regression, including workers with working time more than 2 years adjusting for age, gender and education

[d] Negative binomial regression, including workers with working time more than 2 years adjusting for age, gender, education and size of factory

[e] p value<0.05

[f] p value<0.2

Table 8 Binary logistic regression models for associations of factory characteristics with oral hygiene, adjusted for individual characteristics and behavior.

Factory characteristic	Good oral hygiene analysis[a]				
	% of sample (N=191)	% good oral hygiene	Unadjusted OR(95%CI)	Adjusted I OR(95%CI)	Adjusted II[b] OR(95%CI)
Size				-2LL=194.2	
-Small	51.8	59.6	1	1	
-Medium	48.2	82.6	3.2(1.6-6.3)[c]	3.1(1.4-6.9)[c]	-
Location					
-Urban	66.0	69.0	1		
-Rural	34.0	73.8	1.3(0.6-2.5)	-	-
Additional health insurance				-2LL=197.1	-2LL=186.5
-No	63.9	63.1	1	1	1
-Yes	36.1	84.1	3.1(1.5-6.5)[c]	2.7(1.2-6.2)[c]	3.2(1.4-7.7)[c]
Snack shop					
-No	51.8	73.7	1		
-Yes	48.2	67.4	0.7(0.4-1.4)	-	-
Wash basin in toilet				-2LL=191.4	-2LL=187.1
-No	15.7	50.0	1	1	1
-Yes	84.3	74.5	2.9(1.3-6.5)[c]	7.0(2.2-22.8)[c]	4.8(1.4-16.2)[c]
Brushing activity + free toothbrush + no eating					-2LL=189.4
-No	82.2	70.1	1		1
-Yes	17.8	73.5	1.2(0.5-2.7)	-	3.1(1.1-8.8)[c]
Manager attitude					
-Not positive	29.8	75.4	1		
-Positive	70.2	68.7	0.7(0.4-1.4)	-	-

[a] Binary logistic regression, adjusting for age, gender, education and frequency of toothbrushing

[b] Binary logistic regression, adjusting for age, gender, education and frequency of toothbrushing and size of factory

[c] p value<0.05

Table 9 Participation and group of sample associated with DMFT, DT, MT and FT scores and having good oral hygiene at baseline.

Sample	% of sample	DMFT[a] score		DT[b] score		MT[c] score		FT[d] score		Good oral hygiene	
		Mean ±sd	p-value[e]	Mean ±sd	p-value[e]	Mean ±sd	p-value[e]	Mean ±sd	p-value[e]	%	p-value[f]
Participation (N=191)											
-*drop out*	35.6	4.5±4.6	0.134	0.9±1.5	0.518	2.8±3.8	0.274	0.8±1.5	0.120	66.2	0.323
-*participate at 1year*	64.4	6.0±5.6		1.2±2.2		3.2±3.7		1.6±2.9		73.2	
Group (N=123)											
-*control*	48.2	6.1±5.4		1.0±2.3		3.1±3.4		2.0±3.2		82.6	
-*intervention 1*	36.1	5.0±5.8	0.128	1.2±1.9	0.466	2.7±4.0	0.106	1.1±2.6	0.043	63.8	0.010
-intervention 2	15.7	7.8±5.6	0.212	1.8±2.3	0.045	4.4±3.9	0.180	1.6±2.1	0.682	50.0	0.001

[a] DMFT= number of decayed missing and filled teeth

[b] DT= number of decayed teeth

[c] MT= number of missing teeth

[d] FT= number of filled teeth

[e] Mann-Whitney Test between intervention 1, 2 and control group and between participation

[f] Chi-square Test between intervention 1, 2 and control group and between participation

Table 10 Comparing Oral health related Quality of life among control and intervention at baseline.

oral health related Quality of life	Control % (n) (n=56)	Intervention I % (n) (n=47)	Intervention II % (n) (n=20)	p-value
Percentage of workers with chewing problem	39.3(22)	40.4(19) *p*=1.000	65.0(13) *p*=0.068	0.115
Percentage of workers with work problem	5.4(3)	10.6(5) *p*=0.464	15.0(3) *p*=0.183	0.377
Percentage of workers with talking problem	32.1(18)	14.9(7) *p*=0.064	35.0(7) *p*=1.000	0.084

Table 11 Comparing knowledge scores at baseline of the Intervention I and Intervention II with Control groups

Knowledge	Control (mean ±SD) (n=56)	Intervention I[a] (mean±SD) (n=47)	Intervention II[a] (mean±SD) (n=20)	p-value[b]
Frequency of tooth brushing	0.9±0.3	0.7±0.5 *p=0.015*	0.7±0.5 *p=0.044*	0.036
Duration of tooth brushing	0.6±0.5	0.3±0.5 *p=0.020*	0.5±0.5 *p=0.353*	0.065
Type of toothpaste	0.5±0.5	0.4±0.5 *p=0.517*	0.5±0.5 *p=0.682*	0.645
Benefit of using mouth rinse	0±0.1	0.1±0.3 *p=0.115*	0.1±0.2 *p=0.444*	0.291
Benefit of using fluoride mouth rinse	0.2±0.4	0.2±0.4 *p=0.684*	0.1±0.3 *p=0.510*	0.651
Frequency of meal	0.9±0.3	0.9±0.3 *p=0.990*	0.7±0.5 *p=0.044*	0.074
Eating vegetable with meals	0.6±0.5	0.8±0.4 *p=0.125*	0.5±0.5 *p=0.176*	0.041
Type of snacks recommended	0.6±0.5	0.7±0.5 *p=0.316*	0.2±0.4 *p=0.002*	0.001
Eating fruits habit	0.3±0.4	0.2±0.4 *p=0.207*	0.1±0.2 *p=0.055*	0.109
Recommended drink	0.9±0.3	0.8±0.4 *p=0.229*	0.5±0.5 *p<0.001*	<0.001
Self-examination	0.6±0.5	0.6±0.5 *p=0.604*	0.4±0.5 *p=0.083*	0.220

[a] Mann-Whitney Test

[b] Kruskal-Wallis Test

Table 12 Comparing behaviors scores at baseline of the Intervention I and Intervention II with Control groups

Behaviors	Control (mean ±SD) (n=56)	Intervention I[a] (mean±SD) (n=47)	Intervention II[a] (mean±SD) (n=20)	p-value[b]
Frequency of tooth brushing	0.9±0.3	0.9±0.3 *p=0.748*	0.7±0.5 *p=0.044*	0.102
Duration of tooth brushing	0.7±0.5	0.8±0.4 *p=0.244*	0.8±0.4 *p=0.464*	0.468
Type of toothpaste	0.9±0.3	0.7±0.5 *p=0.017*	0.8±0.4 *p=0.416*	0.056
Using mouth rinse	0.3±0.5	0.3±0.5 *p=0.691*	0.2±0.4 *p=0.377*	0.520
Using fluoride mouth rinse	0.3±0.5	0.3±0.5 *p=0.665*	0.2±0.4 *p=0.458*	0.591
Frequency of meal	0.9±0.4	0.8±0.4 *p=0.704*	0.9±0.4 *p=0.938*	0.928
Eating vegetable with meals	1.0±0	1.0±0.2 *p=0.121*	1.0±0 *p=1.000*	0.196
Type of snacks	0.9±0.3	0.8±0.4 *p=0.695*	0.9±0.4 *p=0.622*	0.650
Eating fruits habit	0.5±0.5	0.4±0.5 *p=0.475*	0.6±0.5 *p=0.806*	0.674
Recommended drink	0.7±0.5	0.6±0.5 *p=0.121*	0.9±0.3 *p=0.094*	0.275
Self-examination	0.7±0.5	0.6±0.5 *p=0.647*	0.4±0.5 *p=0.043*	0.121
Examination by dentist	0.4±0.5	0.1±0.3 *p=0.003*	0.1±0.2 *p=0.009*	0.001

[a] Mann-Whitney Test

[b] Kruskal-Wallis Test

Table 13 Overtime changes in knowledge scores of Control and Intervention I, II groups comparing 6 months and 1 year periods within each group with baseline

Knowledge	Control (mean±SD) (n=56)			Intervention I (mean±SD) (n=47)			Intervention II (mean±SD) (n=20)		
	Baseline	6 months	1 year	Baseline	6 months	1 year	Baseline	6 months	1 year
Frequency of tooth brushing	0.9±0.3	0.9±0.3	0.9±0.3	0.7±0.5	0.9±0.4	0.9±0.4	0.7±0.5	0.8±0.4	0.8±0.4
		p=0.480	*p=0.705*		*p=0.035*	*p=0.052*			*p=0.414*
Duration of tooth brushing	0.6±0.5	0.7±0.4	0.7±0.5	0.3±0.5	0.7±0.5	0.7±0.5	0.5±0.5	0.3±0.5	0.3±0.5
		p=0.050	*p=0.162*		*p<0.001*	*p<0.001*			*p=0.257*
Type of toothpaste	0.5±0.5	0.5±0.5	0.6±0.5	0.4±0.5	0.5±0.5	0.6±0.5	0.5±0.5	0.6±0.5	0.6±0.5
		p=0.617	*p=0.018*		*p=0.034*	*p=0.013*			*p=0.414*
Benefit of using mouth rinse	0±0.1	0±0.2	0.1±0.3	0.1±0.3	0.1±0.3	0.1±0.2	0.1±0.2	0.1±0.2	0.1±0.2
		p=0.317	*p=0.025*		*p=0.317*	*p=0.564*			*p=1.000*
Benefit of using fluoride mouth rinse	0.2±0.4	0.3±0.4	0.2±0.4	0.2±0.4	0.2±0.4	0.3±0.4	0.1±0.3	0.2±0.4	0.2±0.4
		p=0.058	*p=0.480*		*p=0.655*	*p=0.257*			*p=0.564*
Frequency of meal	0.9±0.3	1.0.±0.2	1.0±0.2	0.9±0.3	1.0±0.2	0.9±0.2	0.7±0.5	0.9±0.4	0.9±0.4
		p=0.257	*p=0.257*		*p=0.180*	*p=0.414*			*p=0.180*

Table 13 (Cont.)

Knowledge	Control (mean±SD) (n=56)			Intervention I (mean±SD) (n=47)			Intervention II (mean±SD) (n=20)	
	Baseline	6 months	1 year	Baseline	6 months	1 year	Baseline	1 year
Eating vegetable with meals	0.6±0.5	0.7±0.5	0.7±0.5	0.8±0.4	0.8±0.4	0.7±0.5	0.5±0.5	0.8±0.4
		p=0.248	*p=0.593*		*p=0.739*	*p=0.405*		*p=0.034*
Type of snacks recommended	0.6±0.5	0.7±0.4	0.6±0.5	0.7±0.5	0.6±0.5	0.6±0.5	0.2±0.4	0.3±0.5
		p=0.090	*p=0.819*		*p=0.439*	*p=0.317*		*p=0.157*
Eating fruits habit	0.3±0.4	0.3±0.5	0.3±0.4	0.2±0.4	0.1±0.3	0.2±0.4	0.1±0.2	0.2±0.4
		p=0.317	*p=1.000*		*p=0.739*	*p=1.000*		*p=0.157*
Recommended drink	0.9±0.3	1.0±0.2	1.0±0.1	0.8±0.4	0.8±0.4	0.9±0.2	0.5±0.5	0.6±0.5
		p=0.102	*p=0.059*		*p=1.000*	*p=0.034*		*p=0.180*
Self-examination	0.6±0.5	0.8±0.4	0.8±0.4	0.6±0.5	0.7±0.5	0.7±0.5	0.4±0.5	0.7±0.5
		p=0.018	*p=0.008*		*p=0.034*	*p=0.083*		*p=0.034*

Table 14 Comparing changed knowledge scores at 6 month and 1 year periods of the Intervention I and Intervention II with Control groups

Knowledge	Control (mean±SD)		Intervention I (mean±SD)		Intervention II (mean±SD)
	6 months (n=72)	1 year (n=56)	6 months (n=62)	1 year (n=47)	1 year (n=20)
Frequency of tooth brushing	+0.1±0.4	0±0.4	+0.1±0.5	+0.1±0.5	+0.1±0.6
Duration of tooth brushing	+0.2±0.6	+0.1±0.7	+0.3±0.6	+0.4±0.6[a]	-0.2±0.6
Type of toothpaste	0±0.5	+0.2±0.5	+0.1±0.4	+0.2±0.5	+0.1±0.6
Benefit of using mouth rinse	0±0.1	+0.1±0.3	0±0.2	0±0.3[a]	0±0.3
Benefit of using fluoride mouth rinse	0.1±0.4	0±0.4	0±0.3	0.1±0.4	0.1±0.4
Frequency of meal	0.1±0.4	0±0.4	0±0.3	0±0.3	0.2±0.6
Eating vegetable with meals	+0.1±0.5	0±0.5	0±0.4	-0.1±0.5	+0.3±0.6
Type of snacks recommended	0.1±0.5	0±0.6	0±0.6	-0.1±0.6	0±0.6
Eating fruits habit	0±0.5	0±0.5	0±0.4	0±0.5	+0.1±0.3
Recommended drink	+0.1±0.3	+0.1±0.3	0±0.4	+0.1±0.4	+0.2±0.5
Self-examination	+0.2±0.6	+0.2±0.5	+0.1±0.4	+0.1±0.5	+0.3±0.6

[a] $p \leq 0.05$, compared to changed score of Control group

Table 15 Overtime changes in behavioral scores of Control and Intervention I, II groups comparing 6 months and 1 year periods within each group with baseline

Behaviors	Control (mean±SD) (n=56)			Intervention I (mean±SD) (n=47)			Intervention II (mean±SD) (n=20)		
	Baseline	6 months	1 year	Baseline	6 months	1 year	Baseline	1 year
Frequency of tooth brushing	0.9±0.3	1.0±0	0.9±0.3	0.9±0.3	1.0±0	1.0±0.2	0.7±0.5	0.9±0.3
		p=0.014	*p=0.157*		*p=0.014*	*p=0.102*		*p=0.046*
Duration of tooth brushing	0.7±0.5	0.6±0.5	0.7±0.5	0.8±0.4	0.8±0.4	0.9±0.4	0.8±0.4	0.7±0.5
		p=0.593	*p=0.513*		*p=1.000*	*p=0.102*		*p=0.317*
Type of toothpaste	0.9±0.3	0.9±0.3	1.0±0.2	0.7±0.5	0.9±0.3	0.9±0.2	0.8±0.4	0.9±0.3
		p=0.257	*p=0.059*		*p=0.008*	*p=0.001*		*p=0.157*
Using mouth rinse	0.3±0.5	0.4±0.5	0.4±0.5	0.3±0.5	0.3±0.5	0.2±0.4	0.2±0.4	0.3±0.4
		p=0.166	*p=0.225*		*p=0.705*	*p=0.083*		*p=0.655*
Using fluoride mouth rinse	0.3±0.5	0.4±0.5	0.4±0.5	0.3±0.5	0.4±0.5	0.4±0.5	0.2±0.4	0.3±0.5
		p=0.034	*p=0.058*		*p=0.206*	*p=0.096*		*p=0.414*
Frequency of meal	0.9±0.4	0.8±0.4	0.8±0.4	0.8±0.4	0.8±0.4	0.9±0.3	0.9±0.4	0.9±0.3
		p=0.317	*p=0.180*		*p=0.414*	*p=0.480*		*p=0.317*

Table 15 (Cont.)

Behaviors	Control (mean±SD) (n=56)			Intervention I (mean±SD) (n=47)			Intervention II (mean±SD) (n=20)	
	Baseline	6 months	1 year	Baseline	6 months	1 year	Baseline	1 year
Eating vegetable with meals	1.0±0	1.0±0	1.0±0	1.0±0.2	1.0±0	1.0±0	1.0±0	1.0±0
		p=1.000	*p=1.000*		*p=0.157*	*p=0.157*		*p=1.000*
Type of snacks	0.9±0.3	1.0±0.2	0.9±0.3	0.8±0.4	0.9±0.3	0.9±0.3	0.9±0.4	0.9±0.3
		p=0.157	*p=1.000*		*p=0.157*	*p=0.096*		*p=0.564*
Eating fruits habit	0.5±0.5	0.6±0.5	0.6±0.5	0.4±0.5	0.7±0.5	0.6±0.5	0.6±0.5	0.5±0.5
		p=0.127	*p=0.564*		*p=0.014*	*p=0.029*		*p=0.763*
Recommended drink	0.7±0.5	0.8±0.4	0.8±0.4	0.6±0.5	0.9±0.3	0.9±0.3	0.9±0.3	0.9±0.4
		p=0.248	*p=0.157*		*p<0.001*	*p=0.001*		*p=0.655*
Self-examination	0.7±0.5	0.8±0.4	0.8±0.4	0.6±0.5	0.7±0.5	0.7±0.4	0.4±0.5	0.8±0.4
		p=0.025	*p=0.018*		*p=0.059*	*p=0.058*		*p=0.011*
Examination by dentist	0.4±0.5	0.1±0.2	0.1±0.2	0.1±0.3	0.1±0.3	0±0.2	0.1±0.2	0±0
		p<0.001	*p<0.001*		*p=0.705*	*p=0.180*		*p=0.317*

Table 16 Comparing changed behavioral scores at 6 month and 1 year of the Intervention I and Intervention II with Control groups

Behaviors	Control (mean±SD)		Intervention I (mean±SD)		Intervention II (mean±SD)
	6 months (n=72)	1 year (n=56)	6 months (n=62)	1 year (n=47)	1 year (n=20)
Frequency of tooth brushing	+0.1±0.3	0±0.2	+0.1±0.3	+0.1±0.4	+0.2±0.4[a]
Duration of tooth brushing	0±0.5	+0.1±0.6	0±0.3	+0.1±0.4	-0.1±0.4
Type of toothpaste	+0.1±0.4	+0.1±0.3	+0.2±0.5[a]	+0.3±0.4[a]	+0.1±0.3
Using mouth rinse	+0.1±0.5	+0.1±0.5	0±0.4	-0.1±0.5[a]	+0.1±0.5
Using fluoride mouth rinse	0.1±0.4	0.1±0.4	0.1±0.5	0.1±0.4	0.1±0.6
Frequency of meal	0±0.2	-0.1±0.3	0±0.4	0±0.4	0.1±0.2
Eating vegetable with meals	0±0.1	0±0	0±0.2	0±0.2	0±0
Type of snacks	0.1±0.4	0±0.5	0±0.4	0.1±0.4	0.1±0.4
Eating fruits habit	+0.1±0.6	+0.1±0.7	+0.2±0.6	+0.2±0.6	-0.1±0.8
Recommended drink	+0.1±0.4	+0.1±0.6	+0.3±0.5[b]	+0.3±0.5	-0.1±0.5
Self-examination	+0.2±0.5	+0.2±0.5	+0.1±0.5	+0.1±0.4	+0.4±0.6
Examination by dentist	-0.3±0.5	-0.3±0.5	0±0.4[a]	-0.1±0.3[b]	-0.1±0.2[a]

[a] p≤0.05, compared to change score of control group

[b] p≤0.01, compared to change score of control group

Table 17 Overtime changes in oral health status of Control and Intervention I, II groups comparing 6 months and 1 year periods within each group with baseline

Oral health status	Control % (n) (n=56)			Intervention I % (n) (n=47)			Intervention II % (n) (n=20)		
	Baseline	6 months	1 year	Baseline	6 months	1 year	Baseline	6 months	1 year
DMFT	6.1±5.4	6.6±5.6	6.6±5.6	5.0±5.8	5.2±5.9	5.4±5.9	7.8±5.6		8.5±5.8
		p<0.001	*p*<0.001		*p*=0.014	*p*=0.003			*p*=0.007
DT	1.0±2.3	1.1±2.3	1.0±2.2	1.2±1.9	1.3±2.1	1.3±2.1	1.8±2.3		1.9±2.2
		p=0.021	*p*=0.739		*p*=0.096	*p*=0.046			*p*=0.851
MT	3.1±3.4	3.3±3.6	3.4±3.9	2.7±4.0	2.8±4.0	2.9±4.0	4.4±3.9		5.1±4.3
		p=0.011	*p*=0.004		*p*=0.059	*p*=0.026			*p*=0.016
FT	2.0±3.2	2.2±3.3	2.2±3.3	1.1±2.6	1.1±2.6	1.1±2.6	1.6±2.1		1.6±2.1
		p=0.019	*p*=0.013		*p*=0.655	*p*=0.655			*p*=1.000
Percentage of workers with good oral hygiene[a]	87.5(49)	83.9(47)	92.9(52)	68.1(32)	78.7(37)	72.3(34)	45.0(9)		70.0(14)
		p=0.727	*p*<0.001		*p*=0.125	*p*=0.003			*p*=0.581

[a] S-OHIS, score ≤ 1.2

Table 18 Comparing changed oral health status at 6 month and 1 year of the Intervention I and Intervention II with Control groups.

Oral health status	Control % (n)		Intervention I % (n)		Intervention II % (n)
	6 months (n=72)	1 year (n=56)	6 months (n=62)	1 year (n=47)	1 year (n=20)
DMFT	0.6±0.8	0.5±0.8	0.2±0.7	0.4±0.9	0.8±1.0
			p=0.004	*p*=0.259	*p*=0.281
DT	0.2±0.6	0±0.4	0.1±0.5	0.2±0.6	0.1±0.9
			p=0.328	*p*=0.097	*p*=0.212
MT	0.2±0.4	0.3±0.7	0.1±0.5	0.3±0.8	0.7±1.1
			p=0.168	*p*=0.515	*p*=0.084
FT	0.2±0.5	0.2±0.5	0±0.3[b]	0±0.3[c]	0±0.5
			p=0.031	*p*=0.026	*p*=0.196
Percentage of workers improving to have good oral hygiene[a]	61.1(44)	44.6(25)	64.5(40)[c]	57.4(27)[d]	70.0(14)[d]
			p=0.723	*p=0.237*	*p=0.069*

[a] S-OHIS, score ≤ 1.2

Table 19 Comparison of oral health related Quality of life overtimes within each group and percentage improvement between control and intervention groups

oral health related Quality of life	Control % (n)			Intervention I % (n)			Intervention II % (n)	
	Baseline (n=92)	6 months (n=72)	1 year (n=56)	Baseline (n=69)	6 months (n=62)	1 year (n=47)	Baseline (n=30)	1 year (n=20)
Percentage of workers with chewing problem	39.3(22)	46.4(26) [a] *p*=0.481	26.8(15) [a] *p*=0.167	40.4(19)	27.7(13) [a] *p*=0.109	19.1(9) [a] *p*=0.052	65.0(13)	45.0(9) [a] *p*=0.289
Percentage of workers improving chewing		11.1(8)	23.2(13		17.7(11) [b] *p*=0.030	34.0(16) [b] *p*=0.394		30.0(6) [b] *p*=0.834
Percentage of workers with work problem	5.4(3)	72.3(34) [a] *p*=1.000	10.7(6) [a] *p*=0.453	10.6(5)	27.7(13) [a] *p*=0.063	4.3(2) [a] *p*=0.453	15.0(3)	15.0(3) [a] *p*=1.000
Percentage of workers improving work		2.8(2)	3.6(2)		8.1(5) [b] *p*=0.171	10.6(5) [b] *p*=0.257		5.0(1) [b] *p*=0.829
Percentage of workers with talking problem	32.1(18)	17.9(10) [a] *p*=0.096	39.3(22) [a] *p*=0.454	14.9(7)	6.4(3) [a] *p*=0.219	19.1(9) [a] *p*=0.727	35.0(7)	20.0(4) [a] *p*=0.453
Percentage of workers improving talking		22.2(16)	10.7(6)		9.7(6) [b] *p*=0.074	6.4(3) [b] *p*=0.385		25.0(5) [b] *p*=0.392

[a] compare to baseline with in each group (N=123) [b] compare to percentage improvement of control group

4.3 Health promotion outcome and attitude of manager toward workplace oral health promotion

This WOHP along with health promotion actions, such as poster, feedback examination, consulting oral health problems and, showed the change on health promotion outcomes that is changing in toothbrushing and consumption knowledge and skill, changing in using dental service, creating oral health care activity by social group, increasing number of workers who brushing teeth at factory, and changing in consuming snacks regulation. It also changed intermediate health outcomes, changing in toothbrushing with fluoride tooth paste 2minute at factory, changing eating snack habit, and peers of toothbrushing group in factory. Furthermore, it improved OHIS and chewing aspect of quality of life at 6 months. (Table 16)

The guideline to reach the aim of WOHP was belonging to managers and head workers attitude under their context.

4.3.1 Factory context

All of the six factories in this study had different contexts such as size of the factory, investment, education level of workers and activity program in the factory. The details are as followed.

There were three of small factories. Factory A was a machinery construction products factory that provide machine for other industry. The investment was 4 million baht. Most workers were male and graduated primary school. There was a local convenience store in factory. There were the basins for toothbrushing but there was no toothbrushing activity for workers. Nevertheless there was no annual health examination.

Factory B was a crackers products factory of 5 million baht investment. Most workers were female and graduated primary school. There was neither basin for

toothbrushing nor toothbrushing activity for workers. However there was the annual health examination.

Factory C, as a lead products factory, was a small factory with the investment of 40 million baht. Most workers were male and most of them graduated higher than primary school. There were the basin for toothbrushing and toothbrushing activity for workers including the annual health examination.

The others, 3 factories, were medium factories. Factory D was general construction products factory that invested 85 million baht. Most workers were male and graduated higher than primary school. There was a local convenience store. The basin was provided for toothbrushing but factory do not provide toothbrushing activity for them. They did not receive the annual health examination.

Factory E, as a lime products factory, was invested 700 million baht. Most of workers were male and graduated higher than primary school. The factory was provided with basin for toothbrushing but do not provide toothbrushing activity for them. The factory also provided the health examination yearly.

Factory F as the furfural and furfuryl alcohol products was invested 900 million baht. Most workers were male and graduated higher than primary school. There was a local convenience store. The basin for tooth brushing was provided but the toothbrushing activity was none. The workers received the annual health examination as benefits from factory.

4.3.2 Attitude of managers toward workplace oral health promotion

4.3.2.1 Viewpoint of managers and head workers to workers' oral health status and behavior

Manager of some factories told that workers would bring food with them for lunch at factory or lunched at home for who stay near the factory. In some factories, workers do not have breakfast but they have a snack instead. A manager of small

factory said that most workers who had loss of nutrition were less knowledgeable. “Some workers do not have breakfast before work and are hungry before lunch time. Then they eat a snack.”

Sweet drinks and soft drinks are popular among workers. “Some drinks like green tea have prizes which make workers want to drink more of them just to get a prize. Furthermore, they always buy snacks and share them with their partners.” Factory C, as a lead products factory had no snack during work regulation. Workers would have to eat at the canteen. Factory A avoided worker to not to eat snacks that took a lot of time to make such as beans. Although in the same factory, Factory B that had several parts of production line, workers in each part had different regulation on eating snacks that in some parts they could eat and others were avoided. The manager’s attitude of a small factory showed “eating is a private matter that could not be commanded.”

For oral health care, a manager from small factory said “some workers misunderstand that frequent toothbrushing will damage the gingival. It can also make someone feel queasy during toothbrushing when they have not brushed their teeth. The result of this situation made their oral health worse.” However, a head worker thought that “less care of oral hygiene and toothbrushing was habitual, the instructions and suggestions on the problem might be useful for a while. But in the end they would recall the past behaviors.” The same was true for another manager of a small factory that said “workers that had primary school education and worked closed to their home did not know how to care for oral health because of working hard and had less time for self-care.”

For oral health status of workers, managers thought that the oral examination and feedback on oral health problems should improve their self-care. “The oral examination may motivate workers to decide to change their behavior on toothbrushing technique. With this knowledge, they should have better oral hygiene

than before when they had less knowledge." Manager suggested that oral status and behaviors is a private matter that each person should take their own responsibility.

4.3.2.2 Viewpoint of managers and head workers on toothbrushing activity

From a walk around survey in the factory, two of three factories provided basin that could support toothbrushing activity. While the interview found only Factory C provided toothbrushing activity before clock out because their works contaminated to lead, of which is a toxic material. Factory also provided toothbrushes and toothpaste in a cleaning set for cleaning the body of every worker before they finish working daily to prevent contamination of lead out of the factory. This regulation made workers brush their teeth daily.

Belong to the interview, as the opinion of managers to toothbrushing activity in factory; they inform that this activity may have several barriers. A manager thought "the procedure is difficult for lunch time because workers have to increase their income. Thus, they have less oral self-care. For example, some workers who have a contract job don't have the time to brush their teeth at lunch time because the more they work the more they get paid." Some factories, only a few workers brush their teeth after lunch.

Type of work also affects organized activity such as a factory that produces part of a machine which installs in another factory. Head workers are told that "To install part of machine in high place which takes all day and may take all night, workers would stay up high and hard to climb down. They eat and urinate without toilet. This is the reason why they cannot even have toothbrushing. Furthermore, the installation in other factory they should share the toilets with those workers which is inconvenient to have toothbrushing." The same as a manager from medium factory said "the workers who went to work at the mine in the mountain, it is inconvenient to have toothbrushing." Moreover, head workers of small factories said that "the

night shift workers have different lifestyles; they may not eat all night at factory because there are no shops. Thus, they do not have toothbrushing at night but they would brush before finishing works in the morning. And the next toothbrushing was done before starting work in the evening so that they might eat after leave home so they could not brush their teeth all night."

In conclusion, the managers thought toothbrushing in the factory should launch with no effect to factories' production. By the way, toothbrushing after lunch is a mandatory activity that must be done. A head worker said "factory would not take action on toothbrushing because it is a private matter that worker could brush their teeth in break time"

4.3.2.3 Viewpoint of managers and head workers on local convenience store

From factory information found that Factory A, D and F had the local convenience stores which provided food, snack and beverages and may have included other consumables. Factories would not prescribe regulation of food and beverage types. It could be observed that factories that have workers' who own a local convenience store could buy snack and food at all times. A manager said that "the seller is a worker's family who lives in the factory for long time. He does not want to mess with them in the snack aspect of their business. However, they also buy toothbrushes and toothpaste including household items." However, workers could buy snacks outside the factory and be able to bring them to eat in the factory.

4.3.2.4 Viewpoint of managers and head workers on decision to participate in oral health promotion program

This viewpoint would explain in 3 parts that is readiness of factory, effect to production and policy

4.3.2.4.1 Readiness of factory

Belong to regulation, factory that had upper than 100 workers should provide staff safety to take care of workers' health. So, the medium factory had more readiness and latency on processing health promotion projects. A manager of a medium factory thought that "processing oral health promotion was feasible if they had a planning- programming- budgeting system." The small factory had limited budget and no staff safety. However, a manager of the small factory said "a manager should look after all the parts in the factory, take care of each other as relative and family member." Therefore, it is possible to process oral health promotion program in every factory size. However, a manager gave an opinion that "an oral health promotion program may not be of interest unless an incentive is involved for cooperating in an activity." The same as a manager of a medium factory said that "to follow up or command to participate the activity was hardly to do."

Job characteristics, which workers work in the building, had an advantage because the process in the factory must have more facilities such as toilet and tap water. While factory, produce part of the machine which had to install, workers must go out to works, toothbrushing activities depend on factory regulation and the workplace.

4.3.2.4.2 Productivity effect

Manager of factory thought that oral health promotion activity should not waste working time and decrease productivity. The activity that used the less time could progress immediately in small factory that manager could make a decision while, the medium factory, would have to pass the consensus of the committee of the factory. The manager of the medium factory said "he would suspend activity if it had an effect in production. To make decision to participate oral health promotion activity would have to wait for factory policy from management board and it should

be evaluated for advantage which most factories had industrial welfare for health and may have health advice and other activities." Workers may not completely participate. They should replace others or volunteer to participate in some interested topic." For small factory, manager thought that "effect to productivity was not much and factory process was adjustable. If the activity used less time it could be a launch program." Especially, it launches at lunch time. A head worker of small factory told that "if doing activity at lunch time that will not affect works, it should receive better cooperate from factory."

4.3.2.4.3 Policy effect

In aspect of health factory policy, five of six factories had no policy that supports health activity directly. However, Thai law had regulation on factory environment which may have effect to health. Such as eyes, ears which could lead to accident during work that may end up with a disability. The other regulation was chemical environment. This study had only one factory that command to clean their body including toothbrushing before finishing work which this regulation affect to better oral health.

To force factory to create oral health care policy was hardly to do, especially, there was no law. A head worker gave an opinion that it should be state of law to include oral examination in annual health examination. However, some health policy of factory had problem that workers did not pay attention and cooperate the activities. A manager said "annual health examination cost 230 baht per person but most of them, 60-70%, did not get examination."

On the other hand, some managers detailed that "if there is a law, they must do" "if there is regulation, workers would follow it." Although there was policy to process for health, to perform was not easy. It should have the details about how and where to do, and should have special team to work it out.

4.3.2.5 Suggestion of managers to guidelines for oral health promotion project

To process successful oral health promotion, manager from medium factory suggested that “the factor that the factory would have a decision to launch activity if the board committee was interested in it and if it did not waste time and spend money on other equipment, for the activity process. The manager should be the pioneer and frequently motivated along with oral health knowledge. Then it will be effective.” While a manager from a small factory thought that board committee who had viewpoint on workers’ health care was an important factor to process health activity.”

Suggestion of oral health promotion activities were “factory had a morning talk before going out to work; the managers should talk or post up knowledge poster for worker.” While medium factory that provided knowledge course for workers could add oral health aspect or set a campaign on oral cleaning in next budget plan. A manager of medium factory told that “factory had course program which could added knowledge by adding oral health care course.” Furthermore, workers should be motivated frequently to have oral health behavior. By the way a head worker in small factory offered that “manager or head worker could remind the staff in charge to take care oral.

To build the motivation for oral health promotion project, factory could get benefit to the activities. A manager of a small factory thought that “they should have a reward on oral health care for factory which will create a better image for the organization”. The manager of a medium factory said that “there was a channel, that motivated workers to promote oral health activity by adding the result of oral examination as a part of assessment of salary, bonus and other benefits. The labor union would have annual commitment to the factory but workers maybe not be

interested and did not accept to put it as a condition to assessment or had a low from the oral examination.

However, many managers and head workers had the same opinion that “we should gradually promote the conscious of oral health care” “persuasion or building of consciousness to have oral health care is not easy so if they did not have pain they should not have self-care and go to the dentist.” Bad oral health had no effect to quality of life workers as they did not show interest in their oral health such as “when their tooth was loose or had a problem they would use the other. They feel no effect to their life.” The important point is some managers and head workers had the view point that “Oral health is a private matter; it may have an effect to the factory when workers would take off to visit a dentist.”

Furthermore, manager of two small factories thought that government should take action on policy “the ministry of labor should add oral health care policy more than prevention the danger in factory.” And a head worker said “health examination law should added oral examination too.”

Chapter V

Discussion

This study found that there were some differences in oral status between the six participating factories. After investigating into factory factors that might explain such the differences, we found that the presence or absence of wash basin in toilets significantly related to dental caries and oral hygiene. In addition, presence/absence of additional health insurance and size of factory significantly related to oral hygiene of workers. Thus, the existence or provision of health supportive environments ought to have some beneficial effects on workers' oral health. The presence of wash basins in toilet might facilitate workers' toothbrushing activity making their brushing time longer and better, which subsequently, led to low dental caries and better oral hygiene. Toothbrushing with fluoride toothpaste certainly has benefit in reducing dental caries.[95] A previous study also found that oral health care program aiming to improve quality of toothbrushing could successfully reduce participants' new dental caries lesions.[69] This study also found a positive significant association between toothbrushing frequency and oral hygiene, that is, workers who brushed their teeth more frequently tended to have good oral hygiene. When toothbrushing frequency was controlled, the presence of wash basin remained significantly associated with having good oral hygiene. This might reflect other aspects of toothbrushing activity such as brushing time or brushing quality as above mentioned that were facilitated by wash basin but not collected by this study. Although there is no previous study on relating issue, a similar study could be discussed. Malikaew et al[96] found that schools with dry floor, no obstructed objects and no concrete ground, prevalence of traumatic dental injuries among students was lower than that of schools with wet

floor, having obstructed objects and having concrete ground. This confirms the role of safety and health supportive environments on oral health.

In addition to the presence of wash basin in toilet, this study found that provision of additional health insurance by factory to their workers significantly related to workers' good oral hygiene. Having a more extensive health insurance might lead to better dental attendance pattern, and subsequently, good oral health practice and oral hygiene. Previous studies also showed that people with dental insurance coverage had better oral health in terms of more number of teeth, requiring less dental treatment and treatment times.[76, 97] Other studies also found that people who received oral screening, oral health education as well as oral hygiene aids had lower dental caries, better oral hygiene practices and better periodontal health.[69, 72, 98] Thus, this study's finding confirms with previous studies that providing access or opportunity to get access to oral health service might be beneficial to people's oral health.

Effects of socio-demographic and socioeconomic status on oral health were confirmed by the present study as we found that age, sex and education level were, in general, significantly associated with dental caries and oral hygiene. These findings agree with the existing knowledge, for example, previous studies showed that low educated workers had more numbers of tooth loss and more likely to have periodontal disease.[97, 99-101] Significant association between size of factory and workers' oral hygiene as found in the present study might reflect the effect of socioeconomic status on oral health.

An important imitation of finding on the association between factory characteristic and oral health status relates to small sample size, which was due to the fact that this study was a part of a longitudinal oral health promotion project and not designed to test the associations of oral health with covariates. Furthermore, bias due to convenient sample could have been reduced if stratification was applied

in sampling method. Therefore, our small sample size could not warrant formal statistical comparisons. Statistically significant associations of DMFT and DT were not found even though some were expected. For example, dental caries noticeably differed between workers who brushed their teeth once (DMFT = 7.3±6.5, DT = 1.8±3.4) and those brushing twice/more a day (DMFT = 5.2±5.1, DT = 1.0±1.6) which was consistent with the existing evidence on the effectiveness of toothbrushing with fluoride toothpaste on caries prevention.[102] However, such the differences did not obtain statistical significance as expected. In addition to findings at individual level, toothbrushing supportive factory's policy should also contribute to better oral health of workers as Morishita et al[69] found that workers who received oral health promotion package including free toothbrush and education pamphlets had lower DMFT score. However, in our study, there was only one factory (factory C) with toothbrushing supportive policy that is, providing free toothbrush and urged their workers to brush their teeth as a regulation of lead products factory. Due to a small sample, the presence of such supportive policy did not statistically significantly relate to the oral health of workers. Similarly, associations of dental caries with individual behaviors on sugary food consumption and with factory factors on the presence of snack shop were not statistically significant in the present study. These findings are consistent with existing evidence on the crucial role of sugary food on dental caries development.[103] A previous study also showed that dental caries was lower in schools with a diet policy where healthier and less sweet food was provided for children.[104, 105] Non-significance of our study's results might be due to our small sample size.

In spite of the study's unavoidable weakness on small sample size, our findings do provide useful information regarding the potential effects of workplace environments on workers' oral health. By arranging or providing oral health supportive environment, beneficial effects on workers' oral health could be

expected. Further studies on larger sample size as well as longitudinal studies are required for better understanding the effects of workplace environments on oral health of workers.

Regarding to the workplace oral health promotion with positive approach affected oral health knowledge, behaviors and oral health status, the one year workplace oral health promotion program could improve oral health knowledge and behaviors of factory workers. Knowledge that was improved covered all important oral health topics, namely, toothbrushing practice, sugar consumption and oral examination. The improvement was found for the Intervention groups in more than half of knowledge items (7 out of 11 items): frequency of toothbrushing, duration of toothbrushing, type of toothpaste, using mouth rinse, eating vegetable, recommended drink, self-examination. For oral health behaviors, improvement of the Intervention groups also related to all important oral health topics. Seven out of 12 behavioral items were improved, that is, frequency of toothbrushing, type of toothpaste, using mouth rinse, eating fruit, recommended drink, self-examination, examination by dentist. Moreover, out of the seven improved items, five items were knowledge and behaviors in the same topics, that is, frequency of toothbrushing, type of toothpaste, using mouth rinse, recommended drink and self-examination. This clearly showed that the improvement in knowledge could contribute to behavioral improvement.[106]

Knowledge and behavioral improvements were more extensive for the Intervention I than Intervention II groups. Intervention I group showed improvements in 6 knowledge items (frequency of toothbrushing, duration of tooth brushing, type of toothpaste, using mouth rinse, recommended drink and self-examination), and in 6 behavioral items (frequency of toothbrushing, type of toothpaste, using mouth rinse, eating fruit, recommended drink and examination by dentist), while Intervention II group showed improvement only for 2 knowledge items (eating vegetable and self-

examination), and 3 behavioral items (frequency of toothbrushing, self-examination and examination by dentist). Possible reasons for the relatively lower effectiveness of Intervention II than Intervention I group related to types of oral health promoting activities that occurred in workplaces. Educational posters, morning talks, stimulations by head leaders and restriction on snack time occurred in Intervention I group, whereas only poster was used in Intervention II group. Although Intervention II group participated for only 6 months while Intervention I group did so for one year, this study found that knowledge and behaviors of Intervention I group already improved at 6 months. Thus, shorter period of 6months might not be a reason for the lower effectiveness.

Previous studies on health promotion program showed that longitudinal programs could successfully improve health related knowledge and behaviors of adults.[56, 67, 73, 75, 107, 108] For example, a 4 months program on Japanese workers could improve their knowledge on vegetable intakes.[56] Knowledge on fluoride benefits as well as behaviors on using fluoride and chocolate consumption was improved by 1 year oral health program in Danish workers in a chocolate factory.[73] A 2 months study in nursery school in Scotland could improve children's toothbrushing knowledge of staff[107], while frequency of toothbrushing among adult workers in Japan increased after receiving annual workplace oral health examination program.[67] Oral service utilization among Finnish workers increased after subsidization program was implemented.[75] Seeking treatment due to oral problems among Australia mothers decreased by a 2 years preventive oral health program.[108] However previous studies on oral health promotions aimed at improving knowledge and behaviors in few common aspects particularly, toothbrushing practice, use of fluoride, snack consumption and dental service utilizations. No previous study on oral health promotion in adults has ever reported knowledge and behavioral improvement in

detailed aspects such as duration of tooth brushing, fruit and drink consumption, self-examination that were included in the present study.

Health educational approach has been a basis of oral health promotion program aiming to improve knowledge and behaviors. Various educational methods were used by previous studies such as leaflet, poster, video, individual direct teaching, training and practice exercises.[67, 73, 75, 107, 108] In contrast to previous studies, the present study did not focus on individual teaching and training methods. Instead, oral health educational message was given mainly through displayed posters. Moreover, the present study innovated some other methods for passing as well as reminding health messages to workers, namely weekly morning talks and stimulating workers by head workers. These methods were comparable to a study in Pakistan on school based oral health education which could increase adolescents' knowledge through peer leaders.[109] Thus, combination of education-based approach together with community participation in terms of peer or head worker supports as used in this study could successfully improve knowledge and subsequent behaviors of workers.

In addition to education-based and community participating methods, policy and environmental change was also taken into consideration of the present study. Intervention I group initiated their policy on sugar consumption. Regulation to reduce sweetened food was set up, that is reduction of snack break times. Thus, workers unavoidably reduced their sugary snack and drink consumptions, which in the long term, would have a positive effect on dental caries reduction.[103, 110-112] Unfortunately, this study was not able to evaluate any change in dental caries status of workers due to time limitation.

The workplace oral health promotion program of this study covered a wide range of strategies including oral health education, community participation, policy and environmental change as well as provision of free oral health examination and

consultation. Moreover, several actions of health professional were used such as stimulation, facilitation, empowerment, and advocacy. Such a various strategies and actions used in this study were comparable to Ottawa Charter on oral health promotion recommended by World Health Organization.[12, 113]

All workers in this study showed 28.6% of workers increased tooth decay since 6 months and increased to 32.5 % in 1 year, it may be assume that about one third of workers in small and medium factory in this area of Thailand should be defined in at least moderate caries risk group.[114] The lower FT of Intervention group showed the less using dental services. Although they had Social Security Insurance which is not directly paid to the health center, they should pay for it. This situation might be the cause of less using dental services. Furthermore, the one year intervention could not decrease tooth decay, it could delay increasing DMFT at 6 months. However, the questionable of high caries in the study should be explored in other factories.

Regarding oral hygiene status of workers, although the Intervention I group improved their oral hygiene at 1 year period compared to baseline, this positive finding was questionable because the same finding was also observed for the Control group. The inconclusive finding on the benefit of our program on oral hygiene improvement might be explained by modes of oral hygiene instruction. The present study applied health education on toothbrushing through posters and morning talks as well as peer supports while previous studies used individual instruction and training on toothbrushing skill.[66, 68-71, 107, 108] This could be considered as a limitation of the present study that the public and social-oriented method could not well improve oral hygiene of workers.

For quality of life aspect, although workers increased tooth decay, it did not affect to their chewing, work and communication to others. Only Intervention I group

could improve their chewing at 6 months. This situation difference from the previous report[115] that showed oral status affected to daily performance especially chewing.

Another limitation of the intervention related to an ethical consideration that is, oral examination was provided for all workers in the three groups, including the Control group. Therefore, improvement in knowledge, behaviors and subsequent oral hygiene status might be due to oral health consultations during individual oral examination. Furthermore, there were some differences in baseline data between Control and Intervention groups. Difference in baseline data was seriously concerned since the study was designed. Due to the fact that oral health difference strongly relates to socioeconomic background[116] , we intended to invite only small to medium sized factories with the expectation to obtain similar baseline data. With the presence of this limitation, the study's analyses focused on improvement scores, rather than punctual outcomes at different points of time. The positive approach which focused on achievements and trusted on existing workers' strength could reach the goal of WOHP.

Regarding to the interview, this WOHP could change some aspect of oral health promotion outcomes belong to Ottawa Charter the same as Watt et al. framework.[9] (Table 20) The managers' opinion showed the possible on the process of WOHP in factories. They thought the workers had improper habit of consuming and oral care because they had low education, less knowledge on oral care and less self-care. This opinion was the same as analysis found in Part II and others previous study.[97, 100, 101] However they thought that oral examination and some suggestion would help workers improved self-care. Although it could change only short period and then recall the same habits, like the finding was found by Haleem et al.[109], the motivation of their partners should remain it.

Health in the past was national duty while, present, it was a private matter.[117] The same as toothbrushing and eating habit in this study, managers and head

workers put it on a private matter that they could not force to change. However, health is a resource of personal and social and, also health promotion, it not only promoted directly to a person but also action towards controlling over the determinants of health.[12] The first step was changing managers and head workers view point on these determinants. The next step of action was atomically continued by them. They could take action on the determinants of health in factory such as provided toothbrusing activity and supported toothbrush, toothpaste and areas for toothbrushing, provided knowledge area, and also regulated rule for eating snacks.

The factory environment as a determinant of health was an important part to launch WOHP. Each factory had different size, budgets, staff especially safety staff who take care health aspect in the factory, and also workers' job characteristics which made them had different lifestyles. The different structure of the workplace made managers and head workers create different activities upon their contexts on supporting convenience to have toothbrushing activity and location of eating. However, local convenience shop in the factory was hard to manage because of the "thoughtful" nature of Thai people. However, at the beginning of the WOHP, managers and head workers should provide souvenirs to incentive workers for easier accessing to launch activity and board committee should be the beginner and facilitator.

For policy aspect, the regulation on preventing chemical contamination to environment of lead factory was useful to improve oral health behavior.[118] It made the factory support more on health and oral health. Furthermore, it should be spread to all factories that managers and head workers thought oral health would be interested in aspects for the board committee and the establishments to launch programs. Nevertheless, the WOHP could change regulation on break time in the factory to help workers reduced the risk of decay.[112]

The limitation of this interview was only one factory cover with preventing chemical contamination regulation and the interview was done for small and medium factories in a province. The other areas may have different context and factory characters so the next study should be made in different area as well as size of factory.

Table 20 WOHP evaluation framework

Health Social Outcomes	**Quality of life and Equity** - Oral health related quality of life on chewing	**Mortality, Morbidity, Disability** - improved in OHIS	
Intermediate Health Outcomes	**Healthy lifestyles** -increased toothbrushing with fluoride tooth paste 2 minutes at factory -change eating snack habit		**Healthy environments** -peers of toothbrushing group
Health Promotion Outcomes	**Health literacy** -Change in toothbrushing and consumption knowledge and skill -Change in using dental service	**Social influence and action** - morning talks - reminding to brush after lunch by head workers	**Healthy public policy and organizational practice** -change in consuming snacks regulation
Health Promotion Actions	**Education** -Poster -Feedback examination and consulting oral health problems	**Facilitation** -Formation of leader of oral health group -Exchange experience session	**Advocacy** -Persuade for healthy food and oral self-care

Chapter VI

Conclusion

In conclusion, caries and oral hygiene of workers among six factories statistically significant differed and were associated with environmental factors, that is, wash basin in toilet, factory size and additional health insurance. Workers in of factories with wash basins in toilets had lower number of decayed tooth (DT) than those with no wash basin. Workers in medium factories, factories with additional health insurance and with wash basin in toilet were significantly more likely to have good oral hygiene status. Such findings imply that oral health of workers might be improved through the improvement of health-related environments in workplaces.

The one year longitudinal oral health promotion project in factories, which applied a combination method of education, community participation as well as policy and environmental changes, could improve oral health knowledge and behaviors of workers. Oral health knowledge, that was improved, related to frequency and duration of toothbrushing, using toothpaste and mouth rinse, food and drink consumption and self-examination. For oral health behaviors, the improvement related to frequency of toothbrushing, using toothpaste and mouth rinse, food and drink consumption, self as well as by dentist oral examination. Further actions would be required to maintain, follow up and re-evaluate changes in oral health status in the long term.

Regarding the managers and head workers' opinions towards the work place oral health promotion (WOHP) project, several issues needed to be considered in order to successfully implement the project. First, attitudes towards oral health care need changing. Instead of viewing oral health care as a personal matter of workers,

managers should recognize in their potential and ability in creating oral-health supportive environment as well as activities in workplaces. Director or factory committee board could discuss on any possibility and procedures in project implementation. Subsequently, WOHP project could be initiated, monitored and continued supported by the committee. Regulations on safety and health of workers should be established in all factories. Detailed health supportive activities could vary depending on each factory context. Since WOHP project of this study was limited to small and medium size factories, further projects including large factory as well as factories with different characteristics and locations would provide more understanding on policy holders' opinions about WOHP project.

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APPENDIX

Manager interview for Evaluation of workplace oral health promotion in Kaengkhoi District, Saraburi province: a positive approach

Name-Surname.....age.....Tel.....

Position.....Job.....Name of factory.....

Mark with / in ( ) and fill in the blank

Part I General data

1) Gender ( ) male ( ) female
2) Educational level
   ( ) junior high school ( ) secondary high school
   ( ) diploma ( ) bachelor
   ( ) master ( ) other.....

Part II Factory characteristics

3) Number of managers.....
4) Number of head workers.....
5) Number of workers.....
6) Number of outsource workers.....
7) Health insurance
   ( ) Social security insurance ( ) Quota private insurance
   ( ) Add oral insurance ( ) private insurance
   ( ) other.....

8) Environment of workplace

Environment	Yes	No	Observation note
1 sweet less food court			
2 candy shop (sweets, sugar chewing gum, snack)			
3 fruit shop			
4 drinks shop (soft drink, sweet drinks, juices, coffee)			
5 water vending machines (soft drink, sweet drinks, juices, coffee)			
6 bread shop (bread, sandwich)			
7 dessert shop (Thai desert)			
8 water and basin for toothbrushing			
9 free candy, snack and coffee corner			
10 free fresh water and fruits corner			

9) Workplace health promotion policy

Policy	Yes	No	Use to have
1 No alcohol factory			
2 No smoking factory			
3 Smoking area			
4 Provide convenience for exercise			
5 Control sugar in food court			
6 No candy shop (sweets, sugar chewing gum, snack)			
7 Annual examination belong to factory regulation			
8 Environment screening belong to factory regulation			
9 Health CSR for worker and people around factory			

Other policy.....

Worker interview for Evaluation of workplace oral health promotion in Kaengkhoi District, Saraburi province: a positive approach

Name-Surname.....age.....Tel.....

Position.....Job.....Name of factory.....

Mark with / in ( ) and fill in the blank

Part I General data

1) Gender ( ) male ( ) female
2) Educational level
   ( ) junior high school ( ) secondary high school
   ( ) diploma ( ) bachelor
   ( ) master ( ) other.....
3) Work type
   ( ) office worker ( ) labor worker

Part II oral health related quality of life

1) Six months ago, is there any oral problems chewing food
   ( ) no (skip to the next) ( ) yes
   ( ) high ( ) moderate ( ) low
   Due to ( ) tooth ache ( ) mobility ( ) food impaction
   ( ) other.....
2) Six months ago, is there any oral problems when working
   ( ) no (skip to the next) ( ) yes
   ( ) high ( ) moderate ( ) low
   Due to ( ) tooth ache ( ) swelling
   ( ) other.....

3) Six months ago, is there any oral problems when talking to others

( ) no (skip to the next) ( ) yes

( ) high ( ) moderate ( ) low

Due to ( ) tooth ache ( ) halitosis

( ) other.....

Part III Dental service (fill in the blank of table)

Type of service	Once a year	Twice a year	More than twice a year	Other please note.....			
				2 year ago	3 year ago	5 year ago	> 5 year ago
1 examination							
2 filling							
3 scaling							
4 extraction							
5 prosthesis							
6 medication							

Part IV Knowledge and behaviors for oral health care (fill in the blank of table)

Aspect	Behaviors	Knowledge
1 toothbrushing • frequency - not everyday - once a day - twice a day - more than twice a day • duration - half a minute - a minute - two minute or more		
2 fluoride toothpaste - yes - no		Benefits of fluoride
3 mouthrinse - yes - no	(not use skip to number 5)	Reasons for use of mouthrinse
4 fluoride mouthrinse - yes - no		Benefits of fluoride
5 self-examination		

Part V Knowledge and behaviors for consumption (fill in the blank of table)

Aspect	Behaviors	Knowledge
1 meal • type - bread - vegetable - yes - no • frequency - once a day - twice a day - more than twice a day - once a week - twice a week		
2 snacks • type - processed snacks - Thai dessert - fresh fruit - fruit with salt • frequency - once a day - twice a day - more than twice a day - once a week - twice a week		

Part V Knowledge and behaviors for consumption (fill in the blank of table) (cont.)

Aspect	Behaviors	Knowledge
3 beverage • type - fresh water - sweet drink - soft drink • frequency - once a day - twice a day - more than twice a day - once a week - twice a week		

Oral Health Assessment Form for Workers

Name-Surname _____ Gender M F Tel _____

Address _____ Med. History _____

Dentition status

	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
1 First																
2 Second																
3 Third																

	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
1 First																
2 Second																
3 Third																

Permanent	Status
0	sound
1	decay
2	secondary decay
3	filled tooth
4	missing due to decay
5	sealant
6	primary decay
P	exposed pulp
R	arrested tooth
7	crown restoration
8	impaction
T	tooth fracture
9	not record

OHIS index

Plaque

1 B B B
# # #
# # #
L B L

2 B B B
# # #
# # #
L B L

3 B B B
# # #
# # #
L B L

0 No debris or stain present

1 Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered.

2 Soft debris covering more than one third, but not more than two thirds, of the exposed tooth surface.

3 Soft debris covering more than two thirds of the exposed tooth surface.

sum1_____ sum2_____ sum3_____

Calculus

1 B B B
# # #
# # #
L B L

2 B B B
# # #
# # #
L B L

3 B B B
# # #
# # #
L B L

0 No calculus present

1 Supragingival calculus covering not more than one third of the exposed tooth surface.

2 Supragingival calculus covering more than one third but not more than two thirds of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both.

3 Supragingival calculus covering more than two third of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth or both.

sum1_____ sum2_____ sum3_____

Hygiene score1_____ Hygiene score2_____ Hygiene score3_____

VITA

Miss Haruthai Sukcharoenkosol was born on February 16th, 1974 in Phrae, Thailand. She graduated

- Doctor of Dental Surgery from Chiangmai University in 1997
- Master of science (Preventive Dentistry) from Chiangmai University in 2002
- Bachelor of Laws from Sukhothai Thammathirat Open University in 2005

She works as a dentist for

- Wiangkaen Hospital in Chiangrai province since 1997 to 1999
- Phayamengrai Hospital in Chiangrai province since 1999 to 2003
- Phrae hospital in Phrae province since 2003 to 2009
- Kaengkhoi Hospital in Saraburi province since 2009 to 2015
- Fang Hospital in Chiangmai province since 2015 until present

She is now studying a doctoral degree in Dental Public Health at the Faculty of Dentistry, Chulalongkorn University.