

# NUDGING HEALTHIER PRODUCT CHOICE: FORMULATION OF ADOLESCENTS FOOD- CHOICE MOTIVES INTERVENTION IN SERANG DISTRICT, INDONESIA

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**Abstract:** Studies found that in low-middle-income countries, many people changed their lifestyle into a modern and industrialized lifestyle. Eating habits inevitably induced by personal food choice which has an independent effect on health. Establishment of eating habits and preferences mostly occurred in young age. Eating habits during adolescence period may sustain until adulthood with consequences for long-term health problem. This project aims to develop community-based intervention programme to tackle this adolescent food choice problem, and examine the effectiveness of a selected method in a sub-urban area in Serang district, Banten, Indonesia. A research on factors that drive food choice motives on adolescents was conducted through a focus group discussion, analysed by thematic analysis. Intervention program recommendation was then formulated by intervention mapping method. To examine the effectiveness of nudging application in minimarket, an experiment with customer acceptance and shopping motives survey was executed and analysed by SPSS. The results of the research show that behaviour of target groups is determined mostly by low self-regulation, family and peer influence, and limited food preparation time. Some intervention recommendations were developed to address these determinants, e.g. family-based intervention, peer-led intervention, and school collaboration. Culturally-sensitive learning environments could also be examined to ensure the effectiveness of nutrition education in that area. Nudging as one of assumed appropriate method to tackle an impulsive behaviour seemed to be not effective in increasing healthy product sales ( $p=0,741$ ;  $p=0,316$ ;  $p=0,342$ ;  $p=0,247$ ) but the customers showed a positive attitude towards its future application.

**Keywords:** food choice, adolescent, nudging, eating behaviour, intervention

## Introduction

Some studies found that in low-middle-income countries, many people changed their lifestyle into a modern and industrialized lifestyle. This change is running much faster than in European and other industrialized countries. The lifestyle change including reduced physical activity and eating habits (Maulida, 2016). Eating habits inevitably induced by personal food choice which has an independent effect on health, e.g. could lead to induce some chronic diseases such as diabetes, cardiovascular, cancer, and obesity (Deshpande, 2009). Urban adolescents are more prone to this eating habits change. There was reduction in fruit and vegetable consumption by 41 and 25% respectively,

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concomitant with increase in consumption of soft drink and reduction in milk and fruit juice consumption among children when they were in transition to adolescents (Lytle, 2000). Establishment of eating habits and preferences mostly occurred in young age. Eating habits during adolescence period may sustain until adulthood (Maulida, 2016) with consequences for long-term health. It is also supported by the maturation from adolescence to adulthood where people will start to learn to make all of their own eating decisions (Deshpande, 2009). Adolescents who are adopting inappropriate eating habits can suffer from overweight and obesity which are more likely to suffer from diabetes as adults. In addition, 25-50% of obese adolescents will remain obese when entering adulthood (Maulida, 2016). Overweight and obesity has become a burden in low-middle-income countries besides underweight. It was supported by a cross-sectional study that shown increase in overweight and obesity prevalence while underweight prevalence stays constant (Julia, 2000).

Prior qualitative research revealed some factors that influence food choice in adolescents such as intra-individual influences (food preferences and awareness of healthy eating), intra-familial influences (role of the home food environment), and extra-familial influences (eating away from home). Taste, texture, and appearance were crucial consideration when making food decisions than healthy eating awareness. Home environment influences started to be reduced during adolescent, replaced with nutritional autonomy and lifestyle factors. When eating outside home, adolescent tends to consume less healthy food with peers out of school time because less healthy food is more salient, cheaper and easier to find (Fitzgerald, 2010). Descriptive peer social norms also found as a factor of food intake changing in adolescents (Stok, 2016).

In Indonesia, there are some health risk factors (related to eating habit) according to Indonesia Global School-Based Student Health Survey 2015 among male and female adolescent (Puslitbang Kemenkes RI, 2016), stated in table 1.

*Table 1. Eating habit-related health risk factors of male and female adolescent in Indonesia, 2015*

Health risk factors in male adolescents (Junior, Senior High Students)	Health risk factor in female adolescents (Junior, Senior High Students)
2nd rank: In 30 days, vegetable or fruit (v/f) consumption was < 5 portions a day (76,18%)	1st rank: In 30 days, v/f consumption was < 5 portions a day (77,35%)
3rd rank: In 30 days, soft drink consumption was $\geq 1$ time a day (67,46%)	3rd rank: In 30 days, soft drink consumption was $\geq 1$ time a day (57,44%)
4th rank: In 7 days, fast food consumption was $\geq 1$ time a day (52,58%)	4th rank: In 7 days, fast food consumption was $\geq 1$ time a day (56,17%)

The 2014 Individual Food Consumption Survey analysed the proportion and average consumption at age groups, both in urban and rural areas. Among the age group, adolescents assessed as the first rank age group who consumed less fruit and vegetables (Hermina, 2016).

A study in Jakarta, capital city of Indonesia found food convenience and price and healthy eating motive as the most salient factors on food-choice motives of adolescents, in correlation with gender and socio-economic background. In lower socio-economic group, price could hamper adolescent to eat healthier. Adolescent in upper socio-economic group viewed health as less important than the privilege of unhealthy meal and beverages that assumed as luxury items. Gender has an association

with healthy eating motive especially in male where health became more important when choosing food (Maulida, 2016).

A study done in Serang on adolescents' food motive found that flavour as main factor for choosing fast food. Gender also played a role as female has three times higher chance to eat fast food than male (Marhamah, 2013). However, there is still limited study on eating habit, food choice and nutritional condition of adolescents in Serang, Indonesia. This research will uncover this topic as well as develop suitable behaviour change methods which can tackle existing related problem. Therefore, the purpose of this research is 1) to develop a recommendation program for a community-based nutrition intervention in a sub-urban district in Indonesia; 2) to investigate the effectiveness of a nudge involving a simple food repositioning manipulation; where healthy foods are placed near the cashier, entrance and in front of the eye-line; in a “Mitra Muslim mart”, Serang district, and 3) to provide a preliminary insight and knowledge on how nudging can influence people decision and its applicability in health promotion, especially in sub-urban area in Indonesia.

## **Theoretical frameworks**

### ***Intervention Mapping (IM)***

Intervention mapping (IM) is a planning approach for theory- and evidence-based health promotion interventions development (Bartholomew, 2016). There are six steps of intervention mapping process, which are: 1) Logic model of the problem: Develop a logic model of the problem based on a needs assessment; 2) Program outcomes and objectives/Logic model of change: State program outcomes, target group, behavioural outcome, performance objective and specifying change objectives; 3) Program design: Selecting and developing theory-based intervention methods including the program plan, scope, sequence, change methods, and practical application; 4) Program production: Designing and organising of the program, including program materials and messages; 5) Program implementation plan: Specifying adoption, implementation, and maintenance plans; 6) Evaluation plan. In this paper, step 1 to 4 of intervention mapping will be discussed. To analyse and determine people food choice motives, two theories below are utilised.

### ***Theories of Automatic, Impulsive and Habitual Behaviour***

The Reflective-Impulsive model (RIM) is a dual-systems models that enable and combine reflective and impulsive system to work together with result in behaviour. It can be used for health promotion program to intervene behaviour which involved a conflict between reflective (knowledge) and impulsive (feeling). The intervention must be arranged to depress the impulses. In other words, this model proposes behaviour change intervention to address simultaneously the reflective reactions of people as well as the impulsive reactions. Interventions should create an environment that is convenient for effective self-regulation, improving cues, self-efficacy, coping skills, and control motivation. Otherwise, the reflective system cannot depress the impulsive system effectively (Bartholomew, 2016).

Habits are also part of automatic responses to specific environmental cue with the function to obtain certain goals. It is formed by sequences of acts that have been learned and repeated for a long period. Its main characteristics are efficient and could happen without much awareness. Interventions could

be made for breaking the habit by inhibiting the cued response. The best result could be earned if the intervention exists when people are in transition to a new environment where the previous habits are disrupted, and people's overt reactions are most likely to change (Bartholomew, 2016).

### ***Health Belief Model***

Decision making to engage in a health behaviour is triggered by some cues, either internal or external cues. Health belief model categorize those cues into four psychological constructs which are: 1) Perceived susceptibility: Risk perception of contracting particular illness; 2) Perceived severity: Evaluation of the seriousness of illness; 3) Perceived benefits: Belief on the success of an action to reduce a disease; 4) Perceived barriers: Belief on potential consequences of a certain health action. There are also some factors that induce health behaviour which comes from non-health reasons, including non-health related benefits and barriers, social influences perceptions, behavioural control (Bartholomew, 2016).

### **Material and Methods**

A mixed-method research was utilised in this study. Data collection methods consist of literature review; focus-group discussion; experimental research and questionnaire for testing effectivity of nudging.

The needs assessment was conducted with the combination of of literature review, health-record review and focus group discussion. The data were taken from the district office and/or primary health care operated in Serang district. To complement and analyse the determinants and decide suitable change behaviour method of the food choice problem, the focus-group discussion was conducted to the intended adolescents from Senior High School 1 Serang (SMAN 1 Serang). The questions on the discussion were made based on utilised theories. Participants and their parents were given consent forms that should be signed and collected before discussion session started. Convenient sampling; where the participant who are readily and easily available may join the study, was used (Taherdoost, 2016). Convenient sampling; where the participant who are readily and easily available may join the study, was used (Taherdoost, 2016). Each group was consisted of maximum 8 persons. The total number of respondents were 32 students, consists of 16 females (8 from 10<sup>th</sup> grade students and 8 from 11<sup>th</sup> grade students) and 16 males (8 from 10<sup>th</sup> grade students and 8 from 11<sup>th</sup> grade students), aged 14-16 years old. The third year student was not included due to national examination preparation. The groups were divided based on gender due to the possibility of gender influence based on result of prior researches. The focus group size chosen to ease the group dynamics control and to make participant more comfortable in sharing insights and thoughts. It was stated the ideal size for noncommercial topics is five to eight participants (Krueger, 2014). The number of group was four groups and it matched with literature stated that 90% of themes were discoverable with three to six groups (Guest, 2017). The answers collected after four focus group discussions also already achieved its saturation. The result was analysed by thematic analysis (Nowell et al., 2017).

To study the effectivity of nudging, the experiment was conducted in "Mitra Muslim mart" within three weeks. The nudging was in form of product repositioning where the healthier products such as fiber-source, vitamin-mineral source product, are moved in to strategic spots which are at the cash register and in front of the entrance. The first week was the control phase, without any healthier

product repositioning. The next two weeks was the treatment phase with the repositioning of food product and provision of disclosure label. This disclosure label is added to remove ethical concerns of nudging method by informing people about the choice manipulation done in this experiment, and to examine whether the disclosure would affect effectiveness of nudging. The main dependant variable is the number of healthier food product sold during the experiment. The customer opinions data was taken by the short questionnaire to several random buyers. The questionnaire was presented online through a google form link on a gadget (tablet) provided by researcher. This method was chosen to reduce paper use and to ease data processing. The participants were taken randomly based on convenience sampling from the minimarket buyers within the two weeks treatment phase. Customer who agrees to participate will be given a shopping voucher in the minimarket. The product sales differences were analysed by one-way anova.

## Results and Discussion

### Step 1 to 4 Intervention Mapping – Intervention programme recommendation

The result of each step of intervention mapping will be presented briefly in this section.

*Step 1 Logic model of the problem:* Step 1 of IM are to develop the logic model of the problem using needs assessment. Key findings of this step are the eating behaviour and its determinants of the risk group and environmental actors. The summary of step 1 result is shown in figure 1.

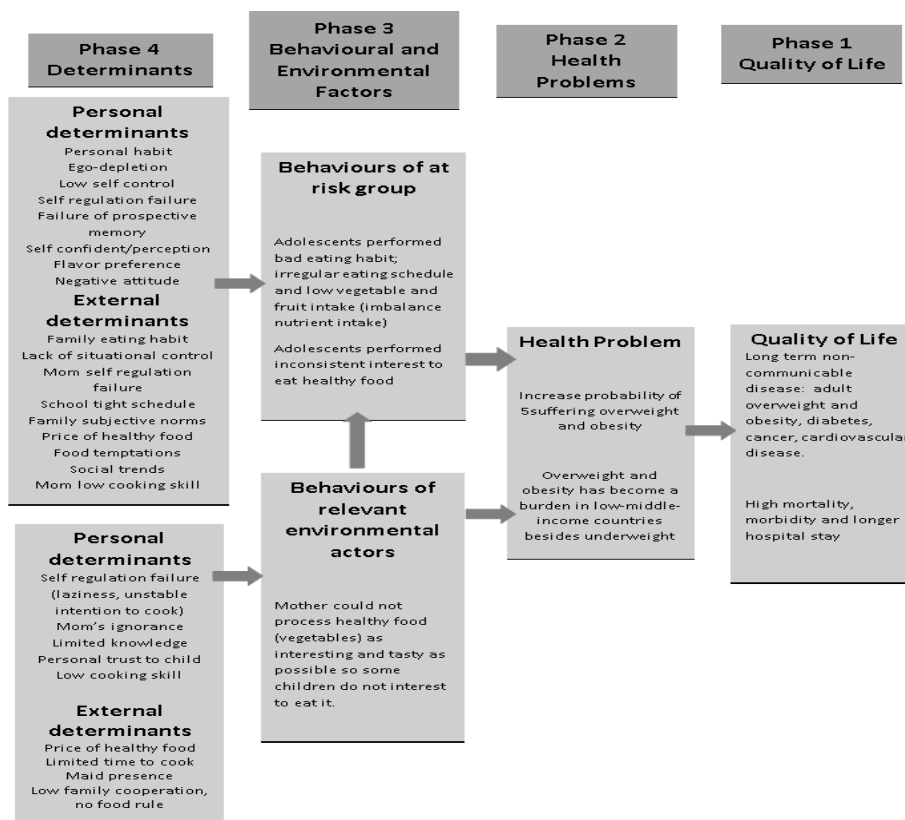


Figure 1: Logic model of the food-choice motive problem in adolescents in Serang

These determinants were grouped in to the framework theories, which are the automatic, impulsive, and habitual behavior and health belief model. In the automatic, impulsive and habitual behavior, the

behaviors were driven by impulsive precursors which are the automatic affective reactions and automatic approach-avoidance reactions. These reactions can be derived in to situational or dispositional boundary conditions which can results in a self-control outcome (Hofmann, 2008). In this research, dispositional boundary conditions influenced by:

Low trait self control. Some of respondents are lazy to eat food provided by their parents at home. It caused by they are already felt comfortable at their room and lazy to move to dining room although their parents tell them to do so. There is also unstable intention to prepare food before going to school or before eating time. For most male participants, they tend to obey the appetite lust, e.g : “Everytime I feel hungry and want to eat, I will just eat any food that I can find.” Although some families already set a food rule, for example not eating spicy food, respondents pretend to eat it without parent permission.

High sensitivity to rewards. Rewards here as a pleasure to eat satisfied food which still dominated with unhealthy food. Most respondents admitted that there are still many temptations to eat healthy food. When unhealthy food is more accessible and easier to find, adolescents will prefer unhealthy food because its perceived flavor.

While the situational conditions influenced by:

High Ego-depletion. All respondents have quite tight school schedule. The school starts at 7 to 16pm in the afternoon. Most respondents have additional after school courses until 18pm and reach home at 19-20pm. This makes most respondents feel exhausted to execute healthy eating habit when getting home. They either continued to sleep, ate instant noodle, or buy traditional snacks sold around home.

High cognitive load. Literature stated that unhealthy food choice as a result of impulsive response is triggered by high cognitive load (Baalen, 2018). High cognitive load of school and extracurricular activity schedule decreases respondent interest and intention to prepare or choose proper and healthy food.

Low working memory capacity. High cognitive load for school and study works induces adolescent to have low working memory capacity in preparing food. It hinder respondents ability to use obtained knowledge and skills to non-school works, in this case: prepare or take the food to school (Kilic, 2010).

The determinants included in the automatic, impulsive and habitual behavior theory is more focus to food choice motive that drives bad eating habit. The complex and tight academic schedule along with unsupportive environment at home seemed to be most important factors.

On the other side, there also other factors come from health belief model that drives respondent food choice motives on healthy eating habit. Some of them already adapted more balanced eating habit due to intention to be more healthy and to prevent disease prevalence such as gastric ulcer. This is appropriate with characteristic of heath belief model that aimed to change health behavior through preventing disease or decrease health risk. The factors included in health belief model are listed below:

Perceived benefits. There are some benefits perceived by respondents who already tried to perform healthy eating behaviour. They tend to apply regular eating schedule with balance nutrient intake, when other friend still eat only twice a day or in irregular schedule and not give adequate attention to fruit and vegetable. Respondent believe that applying this healthy eating habit could make them healthier. There is also perceived benefit regarding development of illness, which is gastric ulcer. Respondents who performed healthy eating habit aimed to prevent gastric ulcer prevalence. Other perceived benefit arises in female respondent was healthy eating habit can help them to increase body weight. While in male student, an overweight repositndent stated that healthy eating habit helped him to get slimmer body.

Perceived susceptibility. Due to gastric ulcer symptoms, some respondents tend to apply healthy eating habit to avoid symptoms relapse and other unwellness of stomach and chest. Health consequences for skipping breakfast also one of condition that avoided by some respondents especially them who suffering from gastric ulcer.

Perceived severity. A history of some severe or chronic illnesses suffered by respondents themselves or family members drives respondents to adopt healthy eating habit. There are severe ulcer, diabetes, gout irregular defecation and urination, sprue.

Perceived barriers. There are some barriers that being perceived by respondents for applying healthy eating habit. Most barriers are the expensive price of healthy food and difficulty to process healthy food.

For respondents who already have a strong intention to adopt healthier eating habit, the perceived barriers seemed could be handled by them. While for most respondents, those factors still became a big issues. It was not only driven by the environment actors, but from respondent internal barriers like negative attitude to healthy food.

*Step 2 Logic model of change:* In step 2 we decided our program outcomes and objectives including behavioural outcomes, performance objectives, important and changeable determinants, and desired change objectives of the primary target group (PTG) and secondary target group (STG). PTG in this study is adolescents, with subgroup of male and female adolescents. It is found that there are some differences in food perception between gender e.g., based on physical appearance and weight control (Maulida, 2016; Missagia, 2012). The STG came to the mother who is the closest family member who is the most responsible in managing family eating pattern. Study showed that parent has strong influence on children eating habits maintenance such as in health behavior modelling, supportive environment establishment, food preparation, and healthy eating habit reinforcement (Eisenmann, 2008). Furthermore, interventions that focus directly to family environmental level showed significant effectivity in increasing fruit and vegetable consumption among adolescents (Pearson, 2010).

The ultimate health outcome for this intervention is to reduce the incidence of overweight and obesity by 5% in the adult population in suburban area in Indonesia. This number chosen because based on Riset Kesehatan Dasar (basic health survey in Indonesia), the number of obesity still increasing every 5 years by around 4-6%.

The first intermediate health outcome is to increase healthy food consumption, especially fruit, vegetable and other healthy snacks intake by 10% in adolescents aged 14-17 in Serang. The second intermediate health outcome is to reduce incidence of obesity and overweight in adolescents aged 14-17 in Serang by 10% by the end of the intervention period. The percentages for intermediate health outcome made by researcher estimation based on ultimate health outcome percentage.

We have selected the first intermediate health outcome as the most relevant level to focus on in our intervention program, because this outcome is directly influenced by the behaviour of the at-risk group and environmental actors.

Behavioural outcomes and performance objectives and its determinants: The behavioural outcomes of the PTG is “Adolescents build a positive attitude to healthy food and maintain good self control for facing environmental temptations”. The behavioural outcomes for the STG is “Mother is able to process healthy food (vegetables and fruit) as interesting and tasty as possible”. We select the most important and changable performance objectives for each behavioural outcomes. The selected performance objectives can be seen in table 2 and 3 along with its personal and external determinants (PED) and the change objectives.

The important/changeable performance objectives in PTG are chosen to the findings that role models seem to be critical to adolescent confidence in attempting healthier lifestyle (Sylvetsky, 2013). Answer from focus group discussion also revealed that influence of healthy eating modelling in family member level is good. Therefore it will be worthy to apply and see the result of this method. Other considerations for taking these performance objectives come from focus group discussion answers regarding the strong impact of social influence and subjective norms of family and friend, and bad eating habit which not prioritize fruit and healthy snacks. The important/changeable performance objectives in STG are selected based on the findings that parent has strong influence in creating conducive environment to active lifestyle and encouraging and reinforcing eating patterns (Eisenmann, 2008).

PED for both target group’s performance objective are selected based on their importance and changeability. PED for the PTG’s performance objectives consist of internal barriers (impulsive precursors: ego-depletion, self regulation failure), attitude (flavor preference, self perception, negative attitude to healthy food), personal habit, social influence (social trends), and social support (friend influence). The impulsive precursors or internal barriers is an important determinant because it will be activated automatically when temptation exists unless person can control it. Personal eating habit is important because all of current behavior mostly already formed since years ago as a family habit. Habitual behavior is difficult to change unless we can make a supportive or new environment. Opinion from people including friend, family, or public figure around respondents have strong influence in changing their eating habit. Also, social support is quite important for adolescents, since they still count what their closest friend and family support on.

While PED for the STG’s performance objectives are knowledge (limited knowledge to process the food), internal barriers (impulsive precursors: self regulation failure), attitude (mom’s ignorance, outcome expectation in child), and skill (low cooking skill). Knowledge and skill of how to cook an appealing healthy food is important because some parents of respondents still do not know how to



make it. Furthermore the impulsive precursors or internal barriers also has to be main focus because when it wins over the reflective precursor, the behavior plan we already made can be cancelled. For both of target group, attitude is important because it consists of specific construct of beliefs and our positive or negative perception on a behavior. If we want to change people behavior, we have to make sure that a person has positive attitude on that behavior.

Desired change objectives: Figure 2 and 3 shows the change objectives of each performance objectives that will be used to formulate technical task in programme recommendation.

Performance objective	Personal and external determinants				
	Internal barriers	Attitude	Personal habit	Social influence	Social support
1. Search and follow social media account of a modelling person for healthy eating habit	Express to keep being motivated when looking and scrutinize information provided by role models after tired of activity schedule	Express positive attitude towards following and scrutinize information provided by role models	Commit to scrutinize information provided by role models regularly at least twice a week	Able to distinguish (make a list of) healthy and unhealthy eating habit trends/influence and consistently only follow and scrutinize healthy eating habit influence/trends	-
2. Eat healthy food regularly in break time, like simple fruit piece, or low fat or low salt snack	Mark popular or frequent unhealthy food sites and shun from its temptations when they find it  Express effort to find and choose healthier food	Express positive attitude towards eating healthy food regularly in break time  Perceive that their body becomes healthier now and in the future with eating healthy food not unhealthy food	Commit to bring and eat fruit piece/low fat/low salt snack for at least twice a day	-	-
3. Invite and have a small circle friend who also doing the same thing to remind and support each other	Express to keep being motivated to apply healthy eating pattern when interact (online and offline) with the group after tired of activities	Express positive attitude towards being in the circle reminder group  Feeling excited and motivated each time gathering with the group	Commit to gather and sharing what they have done every week with the group	Consistently being together with conducive and supportive environments	Motivate each other in every chance through online and offline media

Figure 2: Change objectives of the PTG per performance objective.

Performance objective	Personal determinants			
	Knowledge	Attitude	Skills & self-efficacy	Internal barriers
1. Design a conducive (full-motivation) environment to eat healthy food; put healthy eating habit motivation (from quotes, public figure opinion, academics opinion), and healthy food picture on visible place at home	List 1 motivational quotes/opinion from different public figure/academics on eating healthy every week	Express positive attitude and consistency in designing a conducive environment to eat healthy	Demonstrate confidence and skill progress of designing conducive and appealing environment to eat healthy food	Being aware and mark each tempted condition and directly shun from its temptations when they find it
2. Cook appealing healthy food from recipes on a regular schedule	Elaborate and make resume of healthy food recipes twice a week	Express positive attitude towards cooking healthy food recipes regularly	Demonstrate confidence and skill progress of cooking appealing healthy food each week	Being aware and mark each tempted condition and directly shun from its temptations when they find it  Express effort to find and choose healthier food for cooking

Figure 3: Change objectives of the STG per performance objective.

**Step 3 Programme Design.** In this step, a group of theory-based intervention methods are selected to address the determinants and achieve the change objectives. Table 2 and 3 shows the recommended methods for PTG and STG and explains the parameters for use, the related change objectives, how these can be applied and the explanation of the parameters. The selected methods and application yielded from this step will be applied to create a complete sequential intervention programme in step 4.

Table 2. Methods for personal determinants of the PTG with parameters for use, change objectives, and their application.

Personal determinants	Methods (Theory)	Definition	Parameters for use	Change objectives	Application
Internal barriers	Stimulus control (Theories of Automatic, Impulsive and Habitual Behavior; Trans-Theoretical Model: Prochaska et al., 2015; Wood & Neal, 2007)	Encouraging removing cues for unhealthy habits and adding prompts for healthier alternatives	Needs insight in the behavioral chain leading to the automatic response	Express to keep being motivated when looking and scrutinize information provided by role models after tired of activity schedule	-Set an alarm reminder or notification alert at tiring time (e.g. after school, or after finishing tasks) on regular schedule to look on information/ posts by role model. Make a notes of it and apply “One Tips One Week” from tips provided by role models. -Delete or hide notification/posts from tempted information source.
	Cue altering (Theories of Goal Directed Behavior; Theories of Automatic, Impulsive and Habitual Behavior: Verplanken & Aarts, 1999; Wood & Neal, 2007)	Teaching people to change a stimulus that elicits or signals a behavior	Existing positive intention	Mark popular or frequent unhealthy food sites and shun from its temptations when they find it.	-Ask adolescent to mark popular unhealthy food shop/centre around city and encourage them (and their family & friends) to go home or other destination by public transport (online or offline transportation) or picked up by family rather than by private transportation (own motorcycle or car) -Put unhealthy snacks or food in invisible place or place that more difficult to be reached.
	Nudging (Theories of Automatic, Impulsive, and Habitual Behavior: de Ridder, 2014; Thaler & Sunstein, 2008).	Simple changes in presentation of choice alternatives that make the desired choice the easy, automatic, or default choice	Requires autonomy: freedom of choice, a sense of awareness, and the healthy choice being default: easy and attractive.	Express effort to find and choose healthier food	Healthier product repositioning in shop or stores near the school. The healthier product are moved into more strategic places like at the cashier and in front of the gate.

	Public commitment (Theories of Automatic, Impulsive and Habitual Behavior: Ajzen, Czasch, & Flood, 2009)	Stimulating pledging, promising or engaging oneself to perform the healthful behavior, and announcing that decision to others.	Most effective when publicly announced; may include contracting	Express to keep being motivated to apply healthy eating pattern when interact (online and offline) with the group after tired of activities	Announce their commitment on healthy eating behaviors that they want to adapt in next few months in their social media, family, and in front of their fellow companion-in-arms and ask them to remind him/her whenever they see him/her forget or do the unhealthy behavior.
2. Attitude	Environmental reevaluation (Trans-Theoretical Model: Prochaska et al., 2015)	Encouraging realizing the negative impact of the unhealthy behavior and the positive impact of the healthful behavior.	Stimulation of both cognitive and affective appraisal to improve appraisal and empathy skills.	Express positive attitude towards following and scrutinize information provided by role models	-Participants watch testimonial video or read testimonial articles about prior followers who already succeed applying healthier eating behavior. -Pin the video or article in visible/accessible place, e.g. in laptop or smartphone desktop/front screen.
	Repeated exposure (Theories of Learning: Zajonc, 2001)	Making a stimulus repeatedly accessible to the individual's sensory receptors.	Neutrality of original attitude.	Express positive attitude towards eating healthy food regularly in break time	-Participants watch testimonial video or read testimonial articles or listening to persons/group who already succeed applying healthier snacking behavior. -Pin the video or article in visible/accessible place, e.g. in laptop or smartphone desktop/front screen.
	Environmental reevaluation (Trans-Theoretical Model: Prochaska et al., 2015)			Perceive that their body becomes healthier now and in the future with eating healthy food not unhealthy food	-Monitor their health progress and make notes of it periodically to evaluate it.
3. Personal habit	Cue altering (Theories of Goal Directed Behavior; Theories of Automatic, Impulsive and Habitual Behavior: Verplanken & Aarts, 1999; Wood & Neal, 2007)	Teaching people to change a stimulus that elicits or signals a behavior	. Existing positive intention	Commit to scrutinize information provided by role models regularly at least twice a week	Set an alarm reminder or notification alert at tiring time (e.g. after school, or after finishing tasks) on regular schedule to look on information/ posts by role model. Make a notes of it, put the notes on room wall, and apply "One Tips One Week" from tips provided by role models.

				Commit to bring and eat fruit piece/low fat/low salt snack for at least twice a day	Put fruit/low fat/low salt snack in more visible place together (side-by-side) with reminder notes to bring them to school as a snack.
				Commit to gather and sharing what they have done every week with the group.	-Set alarm or reminder on one day before the meeting day. -Put group picture on desk/room wall and pin whatsapp group on the whatsapp chats screen.
4. Social influence	Information about others' approval (Theory of Planned Behavior; Reasoned Action Approach; Social Comparison Theory: Forsyth 2014; Mollen, Ruiters, & Kok, 2010)	Providing information about what others think about the person's behavior and whether others will approve or disapprove of any proposed behavior change.	Positive expectations are available in the environment	Able to distinguish (make a list of) healthy and unhealthy eating habit trends/influence and consistently only follow and scrutinize healthy eating habit influence/trends	Asking and collecting informations about healthy and unhealthy eating trends that being popular nowadays, then include the healthy eating trends to must-followed list.
				Consistently being together with conducive and supportive environments	Sharing about the opinions of certain unhealthy and healthy eating behavior and own behavior change plan with companion-in-arms group.
5. Social support	Mobilizing social support (Diffusion of Innovations Theory; Theories of Social Networks and Social Support: Holt-Lundstat & Uchino, 2015; Valente, 2015)	Prompting communication about behavior change in order to provide instrumental and emotional social support.	Combines caring, trust, openness, and acceptance with support for behavioral change; positive support is available in the environment.	Motivate each other in every chance through online and offline media	Sharing positive impacts or impressions that has been experienced through healthy behavior change regularly on social media or online group platform and during offline group meeting.

Table 3. Methods for personal determinants of the STG with parameters for use, change objectives, their application and explanation.

Personal Determinants	Methods (Theory)	Definition	Parameters for use	Change objectives	Application
Knowledge	Chunking (Theories of Information Processing: Gobet et al., 2001; Smith, 2008)	Using stimulus patterns that may be made up of parts but that one perceives as a whole.	Labels or acronyms are assigned to material to aid memory	List 1 motivational quotes/opinion from different public figure/academics on eating healthy every week	Write motivational quotes/opinion from different public figure/academics on eating healthy every week in attractive way; using colored ink/pen, highlight important keyword in each quotes/opinion and put it on wall of dining room, family room, near front door, and other sites that frequently passed by family member.
	Advance organizers (Theories of Information Processing: Kools, 2012; Kools, van de Wiel, Ruiters, Cruys, & Kok, 2006)	Presenting an overview of the material that enables a learner to activate relevant schemas so that new material can be associated.	Schematic representations of the content or guides to what is to be learned.	Elaborate and make resume of healthy food recipes twice a week	Make a chart of healthy food recipes twice a week in attractive way (based on own preference), using interesting picture, colors, or symbols, and put it on room/kitchen wall or collect it in to one bundle.
	Using imagery (Theories of Information Processing: Steen, 2007; Wright, 2012)	Using artifacts that have a similar appearance to some subject.	Familiar physical or verbal images as analogies to a less familiar process.		
2. Attitude	Environmental reevaluation (Trans-Theoretical Model: Prochaska et al., 2015)	Encouraging realizing the negative impact of the unhealthy behavior and the positive impact of the healthful behavior.	Stimulation of both cognitive and affective appraisal to improve appraisal and empathy skills	Express positive attitude and consistency in designing a conducive environment to eat healthy	-Participants watch testimonial video or read testimonial articles or listening to persons/group who already succeed in making supportive environment to eat healthy at home. -Pin the video or article in visible/accessible place, e.g. in laptop or smartphone desktop/front screen.

	Shifting perspective (Theories of Stigma and Discrimination: Batson, Chang, Orr, & Rowland, 2002)	Encouraging taking the perspective of the other.	Initiation from the perspective of the learner; needs imaginary competence	Express positive attitude towards cooking healthy food recipes regularly	Mother asks and discusses her children perception on healthy food served by them.
3. Skills and Self-efficacy	Set graded tasks (Social Cognitive Theory; Theories of Self regulation: Kelder et al., 2015)	Setting easy tasks and increase difficulty until target behavior is performed.	The final behavior can be reduced to easier but increasingly difficult subbehaviors.	Demonstrate confidence and skill progress of designing conducive and appealing environment to eat healthy food.	-Dicuss and make a periodic achievement plan start from smallest scope at home to maximum target with children and other family member living at home.  -Announce their commitment on designing conducive and appealing environment to eat healthy food for the next few months in their social media, family, and ask them to remind her whenever they see her forget to execute her planning.  -Put their commitment on family room to remind herself and family.
	Public commitment (Theories of Automatic, Impulsive, and Habitual Behavior; Ajzen et al., 2009).	Stimulating pledging, promising or engaging oneself to perform the healthful behavior, and announcing that decision to others.	Needs to be a public commitment; may include contracting.		
	Set graded tasks (Social Cognitive Theory; Theories of Self regulation: Kelder et al., 2015)	Setting easy tasks and increase difficulty until target behavior is performed.	The final behavior can be reduced to easier but increasingly difficult subbehaviors	Demonstrate confidence and skill progress of cooking appealing healthy food each week	Dicuss and make a periodic achievement plan start from easiest recipe to a quite difficult recipe with children and other family member living at home.

	Self-monitoring behavior (Theories of Self-Regulation: Creer, 2000)	Prompting the person to keep a record of specified behavior(s).	The monitoring must be of the specific behavior (that is, not of a physiological state or health outcome). The data must be interpreted and used. The reward must be reinforcing to the individual.		
4. Internal Barriers	Counterconditioning (Theories of Automatic, Impulsive, and habitual behavior: Wood & Neal, 2007)	Encouraging the learning of healthier behaviors that can substitute for problem behaviors	Availability of substitute behaviors	Being aware and mark each tempted condition and directly shun from its temptations when they find it	When mother feel tempted or lazy to cook healthy food, mother instructed to do other activities like walking to the kitchen while seeing motivational quotes about healthy eating habit that have been put in house wall or drinking water and sit in the dining room.
	Nudging (Theories of Automatic, Impulsive, and Habitual Behavior: de Ridder, 2014; Thaler & Sunstein, 2008).	Simple changes in presentation of choice alternatives that make the desired choice the easy, automatic, or default choice	Requires autonomy: freedom of choice, a sense of awareness, and the healthy choice being default: easy and attractive.	Express effort to find and choose healthier food for cooking	Healthier product repositioning in shop or stores near housing. The healthier product are moved into more strategic places like at the cashier and in front of the gate.

*Step 4 Programme Recommendation.* Eisenmann (2008) stated that parent has strong influence on children eating habits maintenance such as in health behavior modelling, supportive environment establishment, food preparation, and healthy eating habit reinforcement. Parents who are supported by brief nutrition information that being followed up regularly, have demonstrated substantial decrease on dietary fat consumption and increase on fruit and vegetable intake (Black, 2017). Therefore family-based intervention could be chosen as main intervention type in this programme. Based on Social Cognitive Theory, children are influenced by expectations, attitudes and behaviours of peer groups. Some studies revealed that in adolescents, peer-led education seemed to be more effective in gaining positive attitude and health behaviour change than adult-led education. It is also shown that adolescents may prefer conveying health education by themselves and prefer obtain information from peers. Peer-led education defines as adolescent delivering an educational program to others who are at similar age with them (Shanklin, 2014).

There is one of selected that is being tested in the evaluation step; nudging method. It was chosen because it is targeting behavioural determinants of both target group; is the easiest to follow and being tested in the allocated research time; and a novel and rare intervention in the targeted area (developing country).

The programme recommendation for food choice motives intervention will be divided into two programmes which are: 1) family-based intervention and peer-led intervention, 2) nudging intervention at minimarket. The programme could be adopted in a family for a maximum 12 weeks (Black, 2017). The summary of the programme can be seen in Figure 4. The number shows sequence of methods that can be applied for each target group during intervention period.



ADOLESCENT'S FOOD CHOICE MOTIVE INTERVENTION PROGRAMME RECOMMENDATION				
Formulated by Intervention Mapping approach. Based on samples in Serang district, Indonesia, 2019.				
Primary target group (adolescents)				
No.	Intervention type	Method	Explanation	Execution time/Frequency
1	Family-based	Stimulus control and cue altering	1. Set an alarm reminder or notification alert at firing time (e.g. after school, or after finishing tasks) on regular schedule to look on information/posts by role model. Make a notes of it, put the notes on room wall, and apply "One Tips One Week" from tips provided by role models. 2. Delete or hide notification/posts from tempted information source	At the beginning of period / Reevaluate every week.
2	Family-based / Peer-led	Information about other's approval	1. Asking and collecting informations about healthy and unhealthy eating trends that being popular nowadays, then include the healthy eating trends to must-follow list.	At the beginning of period
3	Family-based	Cue altering	1. Ask adolescent to mark popular unhealthy food shop/centre around city and encourage them (and their family & friends) to go home or other destination by public transport (online or offline transportation) or picked up by family rather than by private transportation (own motorcycle or car). 2. Put unhealthy snacks or food in unvisible place or place that more difficult to be reached. 3. Put fruit/low fat/low salt snack in more visible place together (side-by-side) with reminder notes to bring them to school as a snack.	At the beginning of period
4		Environmental reevaluation & Repeated exposure	1. Participants watch testimonial video or read testimonial articles about prior followers who already succeed applying healthier eating (and snacking) behavior. 2. Pin the videos or articles in visible/accessible place, e.g. in laptop or smartphone desktop/front screen.	At the beginning and every week
5	Family-based	Public commitment	1. Announce their commitment on healthy eating behaviors that they want to adapt in next few months in their social media, family, and in front of their fellow companion in-arms and ask them to remind him/her whenever they see him/her forget or do the unhealthy behavior.	At the beginning
6		Cue altering	1. Set alarm or reminder on one day before the meeting day with companion-in-arms peer group. 2. Put group picture on desk/room wall and pin whatsapp group on the whatsapp chats screen.	At the beginning
7	Peer-led	Environmental reevaluation	1. Monitor their health progress and make notes of it periodically to evaluate it.	Every week
8		Information about others approval	2. Sharing about the opinions of certain unhealthy and healthy eating behavior and own behavior change plan with companion-in-arms/peer group.	Every two weeks
9	Family-based	Mobilizing social support	1. Sharing positive impacts or impressions that has been experienced through healthy behavior change regularly on social media or online group platform and during offline group meeting.	Every two weeks

Secondary target group/environment actors (Mother)				
No.	Intervention type	Method	Explanation	Execution time/Frequency
1	Family-based	Environmental reevaluation	1. Participants watch testimonial video or read testimonial articles or listening to persons/group who already succeed in making supportive environment to eat healthy at home. 2. Pin the video or article in visible/accessible place, e.g. in laptop or smartphone desktop/front screen.	At the beginning and every week
2		Chunking	1. Write motivational quotes/opinion from different public figures/academics on eating healthy every week in attractive way, using colored ink/pen, highlight important keyword in each quotes/opinions and put it on wall of dining room, family room, near front door, and other sites that frequently passed by family member.	Every week
3		Set graded tasks (designing conducive and supportive home)	1. Discuss and make a periodic achievement plan start from smallest scope at home to maximum target with children and other family member living at home.	At the beginning / Reevaluate every month
4		Public commitment	1. Announce their commitment on designing conducive and appealing environment to eat healthy food for the next few months in their social media, family, and ask them to remind her whenever they see her forget to execute her planning. 2. Put their commitment on family room to remind herself and family	At the beginning
5		Set graded tasks and self monitoring behaviour (food recipes)	1. Discuss and make a periodic achievement plan start from easiest recipe to a quite difficult recipe with children and other family member living at home.	At the beginning / Reevaluate every month
6		Advance organizers and Using imagery	1. Make a chart of healthy food recipes twice a week in attractive way (based on own preference), using interesting picture, colors, or symbols, and put it on room/kitchen wall or collect it in to one bundle.	At the beginning and every two weeks
7		Shifting perspective	1. Mother asks and discusses her children perception on healthy food served by them	Every week
8		Counterconditioning	1. When mother feel tempted or lazy to cook healthy food, mother instructed to do other activities like walking to the kitchen while seeing motivational quotes about healthy eating habit that have been put in house wall or drinking water and sit in the dining room.	Everyday

Both Target Groups				
No.	Intervention type	Method	Explanation	Execution time/Frequency
1	Nudging experiment	Nudging	1. Healthier product repositioning in shop or stores near housing. The healthier product are moved into more strategic places like at the cashier and in front of the gate (disclosure label is added)	During the intervention.

Figure 4. Intervention programme recommendation

The methods addressing knowledge of mother are essential as an information repository for giving food advice to children. Also, it will increase mother interest to eat healthier food such as fruit and vegetable and becomes a role model for their children (Eisenmann, 2008).

Besides methods and programme formulated from intervention mapping, there are other recommendation methods advised by respondents. This includes school and community-based intervention. These methods have possibility to suit adolescent needs and interest since they come from the adolescent itself. They are small lectures/group discussion on healthy eating, cooking experiment or competition, cooking demonstration, social appraisal for eating healthier food, and healthy food provision at school canteen.

The application of this programme has to consider the characteristic of region. A study showed that different type of city or village (e.g., metropolitan, rural, provincial, mining town) could have different learning strategies, student behavior, and teacher-student relationships. Therefore, it will be a wise decision to perform a preliminary study to reveal culturally sensitive factors of learning environments (Shanklin, 2014).

#### ***Step 5 to 6 Intervention Mapping – Programme implementation plan and evaluation***

Nudging was tested by repositioning healthy snacks to a strategic position; at the cash register and in front of the entrance, for three weeks. A disclosure label consisted health information on the foods was added. Customer acceptance also was being investigated with asking them some questions regarding current and future nudging application.

The main analysis examined the difference of healthy or nudged product sold between the three weeks intervention. The analysis done by using One Way ANOVA. The ANOVA showed that the total number of nudged product sold was not significantly different between control week, treatment week 1, and treatment week 2 with  $F(2,195)=0,300$ ,  $p=0,741$ . The similar result also shown for the analysis per position. In position A (at the cashier), B and C (in front of entrance), number of nudged product sold also was not significantly different with respectively score of  $F(2,12)=1,269$ ,  $p=0,316$ ;  $F(2,78)=1,088$ ,  $p=0,342$ ;  $F(2,111)=1,415$ ,  $p=0,247$ . It can be seen from table 4 below, that at some points the number of product sold increased or decreased by some amounts. For instance in position A (at the cashier), the number of product sold increase by 17 from control week to treatment week 1 but it did not reach statistical significance. Most of data showed “odd” result in form of decrease of product sold number from control week to treatment weeks. It also showed inconsistent product sales from control week to treatment week 1 and treatment week 2. This implied that nudging method in form of product repositioning in this research was not effective to increase healthy product sales. In other words, it slightly influences customer’s food choice.

Table 4. Nudged product sales number and statistic result

Product Sales Number	Week 1	Week 2	Week 3	One-way anova result
All products	76	58	66	F(2,195)=0,300, p=0,741
Position A	9	26	18	F(2,12)=1,269, p=0,316
Position B	16	8	16	F(2,78)=1,088, p=0,342
Position C	53	24	32	F(2,111)=1,415, p=0,247

*Customer Acceptance.* The customer acceptance of nudging was assessed by questionnaire. Customer acceptance questionnaire were spreaded in the second and third week of intervention. Customers were asked whether they want to fill in the questionnaire or not. Questionnaire provided in online and offline form. Customer could fill the online form on tablet provided by data collector or researcher. When data collector was absent, the willing customers could fill the offline questionnaire stored at the cashier. Willing customers would got a compensation in form of shop voucher by Rp 25.000 (1,54 Euro).

More than half of respondents (67,3%) scored 10 for importance of eating healthy food. This implied that they already have a positive awareness towards eating healthy food. When respondents asked whether they aware of any change in minimarket, 92,7% responded negatively. Mostly half of respondents (54,5%) stated that product repositioning influenced their decision making, but the rest admitted it did not give any influence on their decision making. On the one hand, 61,8% respondents admitted that disclosure label influenced their decision making. All respondents responded positively on their acceptance of nudging application in the future. Most of them (74,5%) did not feel disturbed with choice manipulation that brought by nudging method. Product repositioning just slightly influenced their decision making because of some factors such as customer already has initial intention to buy certain things, has already memorized the regular position of the products (they were getting confused when the product was relocated) and perceives that they do not need it (although they admit healthy food is important). The addition of disclosure label did not add significant effect to the repositioning, although it increased product sales in a little amount. It also showed by the result of customer opinion that most customer (61,8%) admitted that the disclosure label is beneficial and can influence their decision making.

Although product sales statistics showed that nudging method was not effective but 74,5% of respondents feeling positive about being helped to make healthier choices and no one feeling discomfort about this. Furthermore, all respondents admitted that these methods would be helpful to make healthy food choices. It is found that if customers have positive attitude to nudging method, e.g. agreed that nudging led them to make better decision compared to normal condition, preferably customers would go along way to encourage its adoption (Cadario, 2018). The application of disclosure label could be adopted because of its perceived benefits. Nevertheless, with 67,3% customers regard healthy eating as highly important (10), it is not surprisingly that intervention was favorably accepted by most customers.

## Conclusion

An intervention program could be implemented in a family setting as family is closest environment to adolescent that proven to has strong influence in forming eating patterns. Peer-led intervention could also be applied since it is more influential to adolescent behaviour change than adult-led intervention.

In the future, collaboration with school also will enhance the success of a food choice motive intervention. Further researches can be done on the effectivity of combination of these intervention settings in sub-urban area in Indonesia. The effectiveness can be supported by biomedical health outcomes besides behavioural outcomes. Culturally-sensitive learning environments could also be examined to ensure the effectiveness of nutrition education in that area.

Nudging as one of assumed appropriate method to tackle an impulsive behavior was not effective to tackle the problem. In other side, the society is assumed will have a positive attitude towards nudging application in the future. Future research could compare the product sales between nudged products and unhealthy products, and investigate what factors that can enhance the effectivity of nudging in sub-urban area in a developing countries like Indonesia.

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The authors declare that they have no conflict of interests.

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