

PAGING VS. SCROLLING: NAVIGATION STYLES FOR SELF-TRIAGE OF EPIDEMIC DISEASES

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ABSTRACT

The use of mobile devices is intriguing a study about paging presentation for an application of self-triage of epidemic diseases. It is important in order to develop a mobile application without sacrificing user experiences on the application. Thus, an experiment is conducted in order to identify navigation style that mostly prefer for self-triage mobile application. All participants completed similar tasks using the prototype that has been developed. They are required to complete four consecutive sessions where each of the sessions used different types of questions with two navigation styles, paging and scrolling. There are three types of questions used in this prototype, which were identified from the analysis of self-triage guidelines of epidemic diseases for signs and symptoms. The result of this study concluded that majority of the participants preferred paging instead of scrolling. Besides, the results also shows more than half of the total participants preferred paging instead of scrolling for questions Type I, II and combination of Type I, II and III questions while majority of them preferred scrolling style for question Type III. However, the finding on task completion time shows that participants spent more time on paging for questions Type I and II while scrolling for questions Type III and combination. In conclusion, for self-triage mobile application, both paging and scrolling could be applied depending on the types of questions which have been identified from the existing guidelines for epidemic diseases. The limitation of this study is the number of participants was quite small, where involved only 30 peoples. Besides, sampling method used is not a proper sampling method for experiment, which is convenient sampling. Other than that, the developed prototype only implements the basic user interface design features. Lastly, the results obtained from this study could not reflect the whole population.

Keywords: *Navigation Styles, Self-Triage, Experimental Study, Epidemic Diseases, Mobile Application.*

1. INTRODUCTION

One of the critical issue faced was overcrowding of patients in medical departments especially in emergency department (ED) in crowded area and during peak hour [1,2,3,4,5]. Study by Jayaprakash et al. [2] and Moskop et al. [3,4] identified one of the factor that contribute to ED overcrowding is an increased in patients number with negatively diagnosed of any epidemic diseases. Study conducted by Schmidt [6] in 2012 concluded that current IT technologies could help the healthcare services to spread preventive measures as early precautions to the public. Self-triage is one of the health-related approaches, which could be developed and implemented into mobile devices, which acts as an alternative method for assessing individual illness for non-critical situation. To date, the implementation of self-triage in mobile application is minimal which cause the patients unable to assess themselves during epidemic

outbreak. Hence, we are proposing self-triage application for mobile phone based on existing guidelines of the epidemic diseases.

From the psychology aspect, different users have different skills, styles and preferences. As such, it is very important to design UI for these users in such a way that it will make them more effective in their activities. It is well known that users performance is greatly influenced by the way the UI is designed [7,8]. To ensure the user interface design provides optimum performance, a validation is required. Design without validation is an empty design and difficulty in validation makes the design refused to be accepted. Several researchers have demonstrated that UI design is important. Researchers [8] have stressed on the importance of providing the UI for extending user's experience. They focused on the improvement of an experience gained by users from virtual reality. Another side of study by [9,10] study on exploring aspects of personalized access to



and presentation of websites. Furthermore, Lin and Gregor [11] identified a set of characteristics for encouraging learning experiences for the general public and suggested a number of conceptual guidelines for developing learning applications for enjoyment based on the user's view. However, the current researches test on the virtual environment, gallery and augmented reality, but to provide empirical evidence on mobile application study not on their focus or their intention.

Literature indicated that there are some differences between users in terms of interaction with mobile application. White and Iivonen [12] and Fuji [13] highlighted that users easily recognize information which matches their needs and fits it with their capability of information processing. In a context of navigation styles, different users might prefer different navigation styles depends on the types of applications in order to have a good experience while navigating. It is difficult to find published studies related to navigation styles for mobile application.

The existing studies on the navigation styles between paging and scrolling from different researchers obtained different results. There were certain studies that concluded that scrolling is more appropriate to be applied when presenting search results and text reading [14,15]. Meanwhile, other studies stated that paging is much way better to use when reading text, which required memorisation such as instruction manuals and textbooks [16,17]. In fact, there are few studies, which were unable to decide the best navigation style to be used in their study or found that paging and scrolling had no impact [18,19]. Hence, it is crucial to identify the appropriate navigation styles that are suitable for self-triage mobile application as different users might have different preferences and the possibility of this aspect to affect user experience when using self-triage mobile application is high.

2. SELF-TRIAGE AND GUIDELINES

Self-triage is an approach which allows the patients to assess themselves whenever they are feeling unwell which could also be used in different situations and locations. To date, there were very few studies about self-triage process in medical and healthcare research area. In spite of this, several studies have been conducted in clinic where they tested the self-triage approach specifically for treatment of specific disease. For instance, Hitchings and Barter [20] had conducted a study about the self-triage effect on waiting times at sexual health clinic where they focusing on the

benefit of self-triage system on reducing the patients' waiting time, improving the patient's pathways as well as reduce unnecessary visit by the patients to the clinic. Besides that, there are many guidelines that make available to the public as references especially during epidemic outbreaks such as hand-mouth-foot disease, dengue, H1N1 and currently, Ebola which affected in western countries especially United States. To date, there are no published study that we are aware of that discuss about implementing self-triage procedures into mobile application even though several of them are currently available in apps store that allow the user to diagnose themselves. For instance Quick Triage Protocols Mobile App by JXTAI and Mobile Triage App by TOMPSA. Hence, this study needs to identify the aspects that related with this study in order to achieve objective of this study. Thus, one of the aims of this study is to identify the existing self-triage guidelines for designing an application for mobile phone. And also discover the self-triage types of questions analysis which frequently asked questions in assessing the severity level of the patients while making the decision whether they need to seek for medical treatment in hospital or clinic or self-treatment at home.

There are several existing studies that implement self-triage concept for different situation and environment. Studies by Kellermann, Isakov, Parker, Handrigan and Foldy [21] and Price et al. [22] were emphasised on self-triage method for influenza-like illnesses. Study by Kellermann et al. [21] which was conducted during 2009 H1N1 influenza pandemic proposed a clinical guidelines based on the Strategy for Off-Site Rapid Triage (SORT) guidelines which is also deployed on interactive website is an applicable self-triage process that allow the public to evaluate themselves whether they were infected with H1N1 influenza. They also refined and modified the SORT guidelines to fit with H1N1 influenza virus signs and symptoms that change over time. On the contrary, research done by Price et al. [22] was focusing on the usability and safety of SORT guidelines for children with influenza-like illnesses which used by parents in order to determine whether their children required immediate medical care in ED or vice versa. SORT guideline is a set of clinical guidelines, which designed to help nurses without triage knowledge to assess the patients with influenza-like illness and make decision about the severity of the patients during epidemic outbreak [21]. Hence, SORT guidelines could be used as a reference and converted into mobile application.

Studies by various researchers [21,22,23] proved that self-triage method could be used as alternative way of triaging people which allows the patients to triage themselves. By using and modifying existing self-triage guidelines, other self-triage guidelines could be produced for other diseases. Self-triage could be implemented for other non-critical illness such as diarrhoea, headache, sprain, pains and etc. Besides, self-triage implementation also could allow the patients to do triage at home. The self-triage will suggest whether the patients need to get proper medical treatment from physician or self-treatment at home by taking suggested medicine based on the symptoms and illness. However, self-triage act as alternative for patients to self-assess themselves in order to avoid unnecessary visit to the emergency department without replacing regular triage process done by triage officer where, patients should seek for professional medical practitioner for the treatment especially to those that have history or suffer from chronic illness.

Based on the analysis of self-triage guidelines for epidemic diseases, only three types of questions have been identified which were relevant for this study where asking for patients' symptoms as well as their condition. There are multiple choices with only an answer is allowed (yes and no); multiple choices with multiple answers are allowed and single textbox (short text or numerical answer). The questions basically ask the patients whether they have any of the diseases symptoms which could be used to identify the illness of the patients. This question is required the patients to answer either yes or no which lead to the first question types, yes and no question.

Besides, the guidelines also did ask about other symptoms that might be present, the chronic diseases that patients suffer, patients' lifestyles and patients feeling. These questions is required the patients to choose one or more answer option if given which lead to the second types of questions, multiple choices question. Other than that, the guidelines also asked about patients' age, height, weight, days and short answer. These questions is required the patients to type in the answer in the given space which lead to the third type of question, short answer. Hence, only these three types of questions will be used throughout the study to achieve the objective.

3. EXPERIMENT DESIGN

This experiment involves two elements of design dimensions as well as the user factors in order to

identify user preference. The design dimension focuses on different types of questions and navigation styles (Figure-1). There are three types of questions; multiple choices with only one answer is allow, multiple choice with one or more answers and short answers, and two types of navigational styles; paging and scrolling.

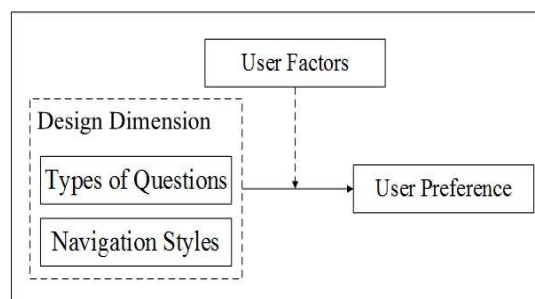


Figure-1. Research Model

This experiment involves two elements of design dimensions as well as the user factors in order to identify user preference. The design dimension focuses on different types of questions and navigation styles. There are three types of questions; multiple choices with only one answer is allow, multiple choice with one or more answers and short answers, and two types of navigational styles; paging and scrolling.

For the purpose of this study, three types of questions are finalized as frequently asked questions during self-triage (Appendix A). Two types of questions are from closed-ended category and one type of question is from open-ended category. Questions from closed-ended category are multiple choices with only one answer is allowed using yes and no as two main answers options and multiple choices with multiple answers. Meanwhile, question from open-ended category is short answers. There is also a combination of several questions from type I, type II and type III.

Navigation styles for this study consist of paging and scrolling. Paging is a method of separating the contents into different layout or pages. Scrolling is an action of showing the contents up to down within a single page. Paging allows the participants to answer the questions in the prototype separately since each page only contains one question. On the other hand, scrolling allows the participants to answer all questions within a single page from top to bottom. Figure-2 shows the navigation structures of the prototype which is divided into four main parts; supporting type I, type II, type III and combination of type I, II and III questions.

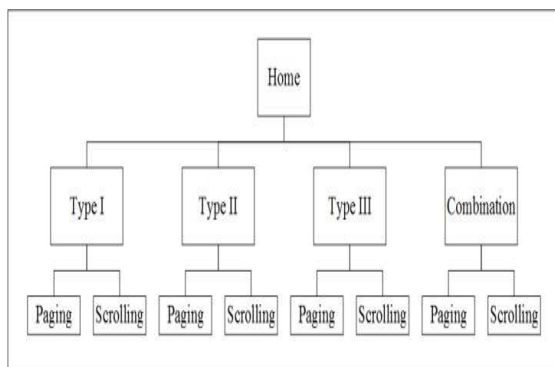


Figure-2. Navigation Structure of the Prototype

All parts are accessible from the home screen (Figure-3), and all parts and contents can return to home screen directly. All four parts will have same navigation type selection screen as shown in Figure-4.

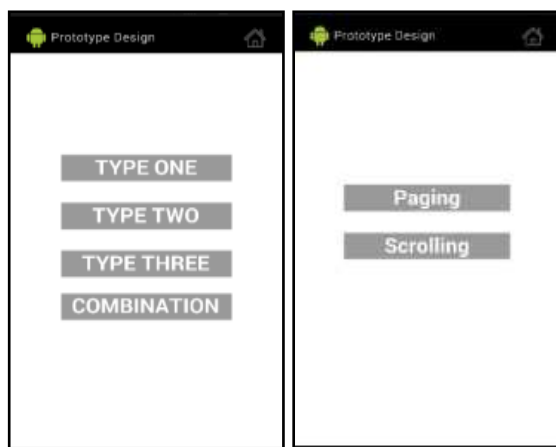


Figure-3. Home Screen Figure-4. Navigation Type Selection Screen

Each selection screen has two options, either Paging or Scrolling. The users will see the contents in paging navigation styles were shown in separate pages (Figure-5). On the other hand, the users will see the contents in scrolling navigational style were shown in the same page which needs to be scroll up and down (Figure-6).

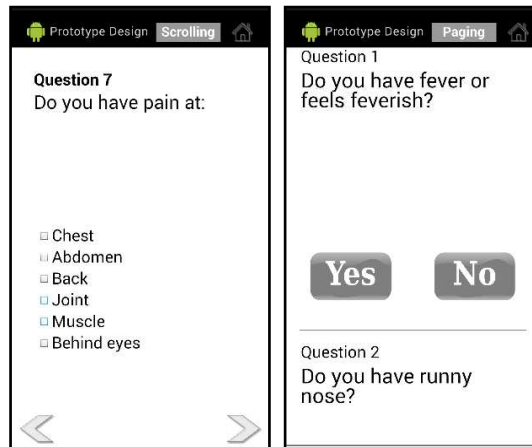


Figure-5. Paging Screen Figure-6 Scrolling Screen

The participants for this study are from convenient sampling where they could be reached at their convenient. Targeted total participants are 30 people who consist of friends, family, and whoever convenient. The age ranges are within 18 to 45 with different background education level; there are university graduates, high school graduates and non-educated. There are several participants who are working, students, and unemployed.

Since this experiment is about self-triage process, certain scenario need to be created because the participants might not have any epidemic illness during experiment process. Seven scenarios are created based on symptoms of epidemic diseases and randomly selected and given to a participant. Each participant will be assigned to one scenario only. The experiment takes place at any place that convenient to the participants and observant such as shopping malls, coffee shops, food junctions, and elsewhere. The participants will use the given smart phone to complete the task.

This experiment will have one briefing session and four experiments sessions. Between each session, all participants will be given a short break as a preparation for next session. For each session, the participants will be given a scenario about symptoms of epidemic diseases and are also allowed to change between paging and scrolling for each type of questions and. At the end of the last session, several questions will be asked to the participants and are free to give any feedback if they have any. Below is the summary of each session. All participants were allowed to ask any related questions and give opinions during experiment. Later, the participants were asked



series of questions after all sessions had finished where asking for participants' preference on navigation styles between paging and scrolling as well as their justification of the preference they chose.

4.0 RESULTS AND DISCUSSIONS

The data accumulated from questions asked were analyses to determine the preferred navigation styles between paging and scrolling by the participants. However, the first two parts will discuss on several factors that were found during the experiment before proceed with the result of this particular study.

4.1 User Preferences Analysis

User preferences analysis allowed us to identify users' preferences as well as their justifications. Three related questions were asked to the participants about their opinions and preferences between paging and scrolling for self-triage mobile application. Analysis of the results of this study also included several user factors based on the observations during the experiment were carried out.

Results show that more than half of the total participants preferred paging instead of scrolling. However, the result did not proved that more people preferred to paging as the statement made only by one participants stated clearly that paging is more suitable for this type of application such as self-triage mobile application that based on question answering. In other words paging might not suitable for certain application. For instance Facebook and YouTube where scrolling is more preferable. This finding was similar with the previous study conducted by Peytchev, Couper, McCabe and Crawford [18] which study about the most appropriate web design for survey between paging and scrolling style. Nevertheless, more in depth study need to be done for specific type of application in order to identify the user preferences between paging and scrolling.

Based on the observation obtained from the on screen recording data, we noticed that several participants who preferred paging did faced some problems at the beginning of the test. However, this is a common problem for the first time users and they slowly started to get used to it easily once they understand the functions. Besides, participants' age also has effect on their preference. From the analysis, all participants in age group of 36 to 45 years old chose paging as their main preference.

This result is probably due to they have already familiar with paging style as compared to scrolling. In contrast, participants between age group of 18 to 25 and 26 to 35 years old, almost 40% of the participants preferred scrolling as younger adults already used to mobile application that uses scrolling style. As a result, age of the participants did influence their preferences in determining the appropriate style for self-triage mobile application.

From the results also show that the different types of questions might require different navigation styles. There are several questions which are suitable with paging style while others would be nice if using scrolling design. Although, majority of the participants preferred scrolling for type III, from overall analysis, it is obvious that most of the participants still preferred paging for other types of questions. However, the result obtained cannot be used to represent the final decision of user preferences since the number of total participants involved in this particular study was too small to represent the whole community. Therefore, further study need to be done in order to identify which navigation styles between paging and scrolling are more suitable for different types of questions. A few numbers of participants did suggest to combine both scrolling and paging together.

There are several factors that might influence the participants' decisions to combine both paging and scrolling together for certain types of questions especially when we combine all types of questions into one. From the analysis of the questions that we asked and the on screen recording data, we identified that all participants in age group of 26 to 35 and 36 to 45 years old, and at least 40% participants from the age group of 18 to 25 years old agree that it is better to combine both paging and scrolling together. This finding shows that different age group did affect the preference. Younger adults prefer to separate the navigation styles while older adults prefer to combine the navigation styles together. This finding might be due to the younger adults is more familiar with scrolling action used in the application in their mobile phone such as social media application, messenger application and web browser. Meanwhile, older adults are used to both navigation styles as they live in both previous technology and current technology. Hence, further study could be done to identify the influence of user factors with navigation styles preference and decisions.

4.2 Task Completion Time

The average time taken for participants to complete their task for questions type I were 34.20

seconds for paging and 28.30 seconds for scrolling (Figure-7). The participants took the least time for completing the task for questions type I as compared to others. This might be due to the questions type I was very simple, it is either yes or no. This findings were pretty similar with study by Yan and Tourangeau [24] which found the time taken for completing the type I questions took the shortest time. The participants were given a scenario of their conditions when doing the task. If the condition or symptoms are not in the scenario, they just need to answer no and answer yes if otherwise. Besides that, the time taken for participants to complete scrolling style for question type I was much faster than paging with the total difference of 5.90 seconds.

The participants took the longest time to complete the tasks for question type III because short answer type of questions might be difficult for certain participants. Short answer based questions fall into an open-ended question which most of the people usually tends to skip this type of question as it required people to think and write. For example, an open-ended question in Student Evaluation Form that asked for students' opinion on what could be improve about the subjects or modules that they have already taken on the current semester where students tends to leave it empty. This finding also similar with Yan and Tourangeau [24], they found that the questions that requires peoples to think or express themselves will took longer time to complete compare to type I and type II questions. However, comparing between paging and scrolling, the time taken for participants to complete question type III were almost equal to each other which on average, participants spent 89.13 seconds on paging and 90.90 seconds on scrolling with difference of 1.77 seconds.

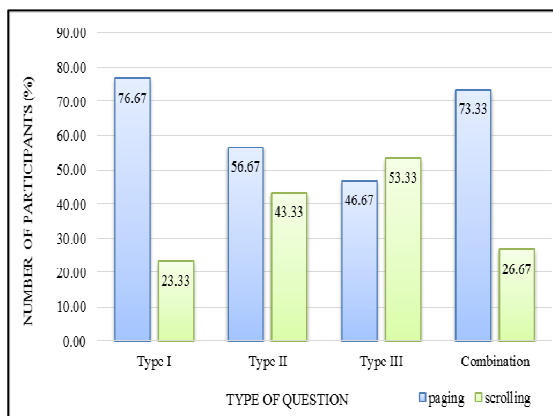


Figure-7. Percentage of participants' preference for Types of Questions between Paging and Scrolling

While, the average time takes by participants to complete their task for questions type II were 45.03 seconds for paging and 39.87 seconds for scrolling with difference of 5.16 seconds. This question is a multiple choice question which required participants to choose one or more answer from the provided answers. The participants might not need to spend a lot of time on those questions. As mentioned before, each participant was given a scenario for the task. If the questions asked in type II are not related to their scenario, they could choose to answer option "Not Applicable" or choose the suitable answers from the list if the question and scenario are related.

There is a combination of type I, II and III questions task that done by the participants. For combination questions, the average time taken by participants to complete their task were 64.30 seconds for paging and 80.03 seconds for scrolling with time differences of 15.73 seconds. Most of the participants spent longer time to complete the task on scrolling. The possible reasons are the questions asked were too many until causes them to be confused with the questions used in the prototype or the participants have difficulties navigating using scrolling. Meanwhile, the participants that preferred paging took the shortest time to complete is because they could focus on the current question separately as well as better navigation for paging instead of scrolling.

In sum up, overall average of all participants to complete all tasks was 472 seconds or 7 minutes 52 seconds. The longest time took by the participants to complete the task was 690 seconds or 11 minutes 30 seconds and the shortest time was 382 seconds or 6 minutes 22 seconds. The participants that complete the task with longest time was from age group of 36 to 45 years old and the participant between 18 to 25 years old took the shorted time. This findings were similar with Yan and Tourangeau [24] in their study which found that the older adult on average are slower than younger adult which also consistent with the results from another study conducted by Fricker, Galesic, Tourangeau and Yan [25] in 2005. They concluded that less skill in typing and limited computer knowledge in older users might cause the completion time were the longest as compared to younger users' typing skills and computer knowledge.

Table-1 summarizes the findings of this particular study. For questions type I, type II and combination of all questions, majority of the participants preferred paging instead of scrolling.



On the other hand, most of the participants preferred scrolling for questions type III.

Table-1. Summary Of Percentage Of Participants' Preference Between Paging And Scrolling, And Task Completion Time For Types Of Questions

		Type I	Type II	Type III	Combination	Average
Paging	Preference (%)	76.67	56.67	46.67	73.33	63.33
	Time (s)	34.20	45.03	89.13	64.30	58.17
Scrolling	Preference (%)	23.33	43.33	53.33	26.67	36.67
	Time (s)	28.30	39.87	90.90	80.03	59.78

We noticed that on the navigation styles that participants prefer, they tends to spend more time compare to the one that they not prefer except for combination of type I, II and III questions. This finding was unexpected because initially we expected that the participants would spent less time on the navigation styles that they preferred as they already used to the preferred navigation styles. The reason could be the participants were attracted with the preferred navigation styles which cause them to spend more time as they want to explore the preferred navigation styles.

However, for combination of type I, II and III questions, the outcome of user preferences and task completion time were similar with our expectation where the participants who preferred paging completed the task faster instead of scrolling. The reason could be the questions used in the combination type were from the question in Type I, Type II and Type III which is more similar with actual self-triage process where in the actual self-triage process, there are different types of questions were used together. In contrast, questions in Type I, Type II and Type III were focus on each individual type of questions which are Type I uses yes and no questions, Type II uses multiple choice answer questions and Type III uses short answer questions. Thus, it could be concluded that the most preferred navigation styles for self-triage mobile application is paging with an average of 63.33% out of 30 participants.

5. CONCLUSION

Both paging and scrolling are two types of navigations styles that could be used when developing mobile applications depending on the purposes. For self-triage mobile application, both paging and scrolling could be applied depending on

the types of questions which have been identified from the existing guidelines for epidemic diseases. Once an appropriate user interface design for self-triage mobile application has been found, it could be used as a base platform for other developers to develop similar self-triage mobile applications for other diseases either for critical or non-critical situations. In fact, all the methodologies and the findings within this particular study could be used as a closed reference for future researches.

In conclusion, mobile application of self-triage for epidemic diseases will benefits many people during epidemic outbreak especially for those who stay in the rural area where they have limited access to the healthcare providers such as hospitals and clinics. The results obtained from this study could be used as a closed reference to improve the current prototype design for future research works. In fact, proper self-triage mobile application design could be implemented in other to study other related aspects that could contribute to a wide range of feedbacks from the users.

In addition, other researchers as well as developers could use these findings as a reference for future research works. Developers who develop self-triage mobile application, for example, could use the results obtained to design properly the application for epidemic diseases that are accessible by anyone around the world. In fact, the methodologies and results are not restricted only to epidemic related studies but also researches, which test on the navigation styles as well as the questions types that were used in self-triage application.

The input to the ANN is the value of exponent of reactive power load-voltage characteristic (n_q) and the output is the desired proportional gain (K_p) and integral gain (K_i) parameters of the SVC. Normalized values of n_q are fed as the input to the ANN the normalized values of outputs are converted into the actual value. The process of

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APPENDIX A**TYPE I - Multiple Choice (only one answer is allowed) – Yes and No**

1. Do you have fever or feels feverish?
2. Do you have runny nose?
3. Do you have cough?
4. Do you have difficulty with breathing?
5. Do you suffer from dehydration (no urination for the past six hours)?
6. Do you suffer from repeated vomiting?
7. Do you experience recovery from the symptoms in morning but the symptoms worsened at night, or vice versa?
8. Do you feel pain in chest or abdomen area?

TYPE II - Multiple Choice (multiple answer is allowed)

1. Do you have one or more of the following symptoms?
 - a. High fever
 - b. Runny nose
 - c. Cough
 - d. Headaches
 - e. Not Applicable
2. In which body area do you have pain?
 - a. Chest
 - b. Abdomen
 - c. Back
 - d. Joint
 - e. Muscle
 - f. Behind eyes
 - g. Not Applicable
3. What are you suffering from?
 - a. Stomachaches
 - b. Vomiting
 - c. Diarrhea
 - d. Nausea
 - e. Not Applicable
4. Do you have mild bleeding from any of the following body areas?
 - a. Cough
 - b. Mucus
 - c. Feces
 - d. Urine
 - e. Nose
 - f. Gums
 - g. Not Applicable
5. Do you have the following feelings?
 - a. Fatigue
 - b. Chill
 - c. Confused
 - d. Sweating abnormally
 - e. Not Applicable

6. Do you have ulcers, rashes or blisters at any of the following body areas?
 - a. Mouth
 - b. Hand
 - c. Foot
 - d. Legs
 - e. Buttocks
 - f. Others
 - g. Not Applicable
7. Do you have any of the following chronic diseases?
 - a. Diabetes
 - b. Asthma
 - c. Hypertension
 - d. Heart Disease
 - e. Leukemia
 - f. Not Applicable
8. Do you practice any of the following lifestyle?
 - a. Smoking
 - b. Drinking alcohol
 - c. Drugs addiction
 - d. Free sex
 - e. Loafing (lack of exercise)
 - f. Not Applicable

TYPE III - Short Answer

1. Age
2. Height/Weight
3. Gender (male/female)
4. What are the symptoms that you have?
5. How long have you suffered from those symptoms (in days)?
6. Are there any other symptoms that you have? E.g. pain/bleeding/rashes/ulcer/blister. If yes, please specify.
7. Have you received any treatment for the symptoms? If yes, how long ago (in days)?
8. Are you on regular medication? If yes, please specify.

Combination of TYPE I, II & III

1. Age
2. Height/Weight
3. Gender (male/female)
4. Do you have fever or feels feverish?
5. Do you have runny nose?
6. Do you have cough?
7. In which body area do you have pain?
 - a. Chest
 - b. Abdomen
 - c. Back
 - d. Joint
 - e. Muscle
 - f. Behind eyes
 - g. Not Applicable

8. Do you have mild bleeding from any of the following body are
9. as?
 - a. Cough
 - b. Mucus
 - c. Feces
 - d. Urine
 - e. Nose
 - f. Gums
 - g. Not Applicable
9. Do you have ulcers, rashes or blisters at any of the following body areas?
 - a. Mouth
 - b. Hand
 - c. Foot
 - d. Legs
 - e. Buttocks
 - f. Others
 - g. Not Applicable
10. How long have you suffered from those symptoms (in days)?
11. Have you received any treatment for the symptoms? If yes, how long ago (in days)?
12. Do you experience recovery from the symptoms in morning but the symptoms worsened at night, or vice versa?
13. Do you have any of the following chronic diseases?
 - a. Diabetes
 - b. Asthma
 - c. Hypertension
 - d. Heart Disease
 - e. Leukemia
 - f. Not Applicable
14. Are you on regular medication? If yes, please specify.
15. Do you practice any of the following lifestyle?
 - a. Smoking
 - b. Drinking alcohol
 - c. Drugs addiction
 - d. Free sex
 - e. Loafing (lack of exercise)
 - f. Not Applicable