TITLE

PROPOSAL OF PROSPECTIVE SINGLE BLINDED RANDOMIZED CONTROL TRIAL ON THE EFFECTIVENESS OF USING LARGE LANGUAGE MODEL ARTIFICIAL INTELLIGENCE (AI) CHATBOT TO IMPROVE BOSTON BOWEL PREPARATION SCORES (BPPS) FOR COLONOSCOPY PREPARATION

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Literature review

Paragraph	Content
1	**Colonoscopy and importance of bowel preparation**
2-3	**Challenges in patient preparation**
4-5	**Application of AI chatbot in healthcare**
6-9	**Effectiveness of AI chatbot in patient preparation**
10-11	**Clinical outcome**
12	**Challenges and limitations**
13-14	**Comparison with traditional methods**
15	**Future directions and research gaps**
16	**Conclusions**

Colonoscopy is a vital diagnostic tool for colorectal cancer and adenomas, significantly reducing morbidity and mortality through early detection (1). However, its effectiveness relies heavily on high-quality bowel preparation, which impacts adenoma detection rates (ADR) and procedural success. Inadequate preparation decreases colonoscopy efficiency due to the necessity for repeat procedures, generating increased expenses (2). Furthermore, it engenders delays in diagnosing malignant or precancerous lesions, curtails the adenoma detection rate (ADR), and increases procedural times and possibly patient risk. However, the prevalence of suboptimal colonoscopies across endoscopy units evinces considerable variability in studies, spanning from 6.8% to 33%. (3) A multitude of factors have been linked to inadequate bowel preparation, prompting endeavors to mitigate suboptimal bowel cleansing through interventional studies aimed at high-risk patients with poor bowel cleansing

Patient compliance with these pre-procedural instructions is crucial for achieving high-quality results and reducing the likelihood of complications or the need for repeat procedures. Despite the clear importance of bowel preparation, ensuring patient adherence to pre-procedural instructions remains a significant challenge. Several barriers to effective bowel preparation exist, including non-compliance, lack of understanding of instructions, and anxiety regarding the procedure. Sociodemographic factors, such as age, education level have been identified as predictors of inadequate preparation (4).

Confronted with this challenge, the incorporation of Artificial Intelligence (AI) technology presents an innovative approach to bowel preparation scoring. Particularly noteworthy are the significant achievements of Convolutional Neural Networks (CNN) in medical image analysis, exemplified by the AI system ENDOANGEL, which has brought a higher level of accuracy and consistency to bowel preparation scoring (5). These advancements suggest that deep learning and AI could assist clinicians in improving the accuracy and consistency of bowel preparation scoring. In the past few years, CNNs have advanced in bowel preparation assessment. However, they fall short in clinical usability and human-centered communication. In other words, most deep learning models have this hard boundary in a discriminative way instead of parametrically assigning probabilities to work together with clinicians. Conversely, ChatGPT, a large language processing model, has shown proficiency in processing medical texts and enhancing doctor-patient communication, exemplified by its ability to provide contextually informed suggestions on colonoscopy follow-up timings (6). Furthermore, ChatGPT 4.0 has shown potential in image recognition, enhancing its multimodal analysis capabilities.

Artificial intelligence has become a transformative force in healthcare, with applications ranging from clinical decision support systems to patient management tools. Among these innovations, AI chatbots stand out due to their ability to simulate human conversation, provide tailored information, and engage with patients interactively. Use of AI chatbots can address current health care challenges, such as shortages of healthcare providers, which reduce the availability and accessibility of health care services (7-9). AI chatbots use artificial intelligence (AI), including machine learning (a statistical means of training models with data so that they can make predictions based on a variety of features) and natural language processing (NLP; the ability to recognize and analyze verbal and written language) to interact with humans via speech, text, or other inputs and outputs on mobile, web-based, or audio-based platforms (10,11). Many of these agents are designed to use NLP so that users can speak or write to the agent as they would to a human. The agent can then analyze the input and respond appropriately in a conversational manner.

AI chatbots have been developed for many different aspects of the health sector to support health care professionals and the public. Specific uses include screening for health conditions, triage, counseling, at-home health management support, and training for healthcare professionals (12). With phone, mobile, and online platforms being widely accessible, conversational agents can support populations with limited access to health care or poor health literacy (13,14). They also have the potential to be affordably scaled up to reach large proportions of a population (15). Due to this accessibility, conversational agents are also a promising tool for the advancement of patient-centered care and can support users' involvement in the management of their own health (14,16). Personalize features have the potential to further improve usability and satisfaction, although more research is needed to evaluate their effectiveness in achieving their stated health outcomes and reducing costs and to ensure that there are no negative consequences for decision making or privacy. These systems use NLP to understand and respond to patients' questions in a

conversational manner, thereby overcoming one of the most significant barriers to effective communication: the complexity of medical information. In the context of colonoscopy preparation, AI chatbots can be designed to provide specific instructions on dietary restrictions, bowel cleansing, and medications, ensuring that the patient receives accurate, easy-to-understand guidance.

Based on research, The Effectiveness of Artificial Intelligence Conversational Agents in Health Care: Systematic Review, conducted by Madison Milne-Ivs in 2020 (17), 31 studies have evaluated the use of AI chatbots for educational purposes in healthcare. The study designs varied widely, with 29% (9/31) using cross-sectional designs, 26% (8/31) using RCTs, 23% (7/31) using qualitative methods, 19% (6/31) using cohort studies, and 1 using a cluster crossover design.

There were a wide variety of areas of health care targeted by the conversational agents of the included studies **(17)**. The largest proportion of them (12/31, 39%) addressed mental health issues [13,32-42], with 19% (6/31) providing some form of clinical decision or triage support [8,12,40,42-44] and treatment support (including encouraging users to get screened) , 10% (3/31) being used to support training of health care students and the screening or diagnosis of users [14,38,51], 7% (2/31) targeting physical health and layperson medical education; 1 agent was designed to help monitor users' speech.

Overall, about three-quarters of the studies (22/30, 73%) reported positive or mixed results for most of the outcomes. Perceived ease of use or usefulness (27/30, 90%), the process service delivery or performance (26/30, 87%), appropriateness (24/30, 80%), and satisfaction (26/31, 84%) were the outcomes that had the most support from the studies. Just over three-quarters (23/30, 77%) of the studies also reported positive or mixed evidence of effectiveness. However, very few studies discussed the cost-effectiveness (5/30, 17%, coded as positive or mixed) or safety, privacy, and security (14/30, 47%, coded as positive or mixed) outcomes for the agents being evaluated. About a quarter of studies (8/30, 27%) had neither positive nor mixed reported evidence for more than half of the SF/HIT (synthesis framework for the assessment of health information technology) outcomes (17).

A systematic review highlighted that conversational agents generally improve patient engagement and health outcomes, with 75% of studies reporting positive results in usability and effectiveness. Specifically, they enhance adherence to pre-procedure protocols through interactive guidance. In addition to providing information, AI chatbots can help alleviate patient anxiety, which is another common barrier to successful colonoscopy preparation. Anxiety around the procedure, the bowel prep process, and potential discomfort can discourage patients from completing their preparation effectively. AI chatbots, by offering empathetic responses and providing reassurance, can help ease these concerns and improve patient compliance.

The ultimate goal of using AI chatbots for patient preparation is to improve clinical outcomes. In the case of colonoscopy (18), clinical outcomes can be measured by the quality of bowel preparation, which directly affects the diagnostic efficacy of the procedure, as measured by the Boston Bowel Preparation Scale (BBPS) score (total score range, 0-9, where 0 indicates extremely unsatisfactory bowel preparation and 9 indicates complete bowel preparation), evaluated by the endoscopist during the procedure, who scored from 0 to 3 for the 3 broad regions of the colon: right, transverse, and left (the cecum and ascending colon, the hepatic and splenic flexures, and the descending colon, sigmoid colon, and rectum). If the mucosa could not be visualized because of remaining stool or food residue, this segment would receive a score of 0; a score of 3 means that the whole mucosa of the colon segment can be seen clearly without residual staining, small fragments of stool, or opaque liquid. The endoscopist blinded to the group of patients. High-quality bowel preparation reduces the likelihood of repeat colonoscopies, increases the chances of detecting abnormalities, and reduces the risk of complications.

Secondary outcomes included the rate of adequate preparation (a score 2 for all regions), the polyp detection rate, the biopsy-verified adenoma detection rate, and the cecal intubation rate. A questionnaire can be used to evaluate patient compliance with bowel preparation (rate of complying with diet restriction and laxative use). A self-rated score from 0 to 10 points was used in the questionnaire to assess pre procedure anxiety (measured by self-rated sleep quality before the procedure [where 0 indicates very poor sleep quality and 10 indicates sleep quality that is the same as usual]), overall satisfaction with bowel preparation (where 0 indicates a very poor experience with a very painful process and many adverse effects and 10 indicates the examination has no adverse effects), and willingness to undergo another colonoscopy if indicated (where 0 indicates great reluctance to undergo the examination again and 10 indicates willingness to undergo the examination again if necessary)

While AI chatbots show great promise, there are several challenges and limitations to their use in healthcare. One of the key challenges is the technological barrier, particularly in the complexity of natural language understanding (17). However, research by Marni H. Wilkoff on Can Artificial Intelligence Create an Accurate Colonoscopy Bowel Preparation Prompt, in 2024 suggested, providing ChatGPT with contextualized medical information can help further expand on areas that are considered vague. In addition to utilizing ChatGPT to incorporate contextual knowledge, an experienced gastroenterologist should review and provide additional expertise as well. Chatbots must be able to process and respond to a wide variety of patient queries, which can be difficult when patients ask nuanced or unanticipated questions. Additionally, the chatbot's performance is heavily dependent on the quality of the underlying algorithms and data. Poor design or insufficient data can lead to errors or unhelpful responses, undermining the effectiveness of the tool. Other chatbots-specific negative feedback was that the virtual doctor did not have the ability to go deep enough or provide access to other materials, that too much information was provided or the interaction was too long, the use of nonverbal expressions by the avatar, and a lack of clarity regarding the aim of the chatbot. Some students who used the virtual patients also reported that it

was difficult to empathize and that the agent did not sufficiently encompass real situational complexity. Based on research conducted by Marni H. Wilkoff on Can Artificial Intelligence Create an Accurate Colonoscopy Bowel Preparation Prompt? In 2024, to ensure the prompt is appropriate for various education levels, it is important to modify it, allowing all patients to understand the instructions. Having instructions that are too advanced for an individual can lead to poor bowel preparation compliance and success. Creating multiple versions of bowel preparation instructions has the potential to create more work for physicians, but with the help of ChatGPT, one can query the large language model to customize the response to a specific education level.

Another limitation is patient acceptance. Some patients may be hesitant to trust AI-based systems, especially when it comes to medical advice or procedural instructions. This is particularly true for older adults or individuals with lower levels of health literacy or technological proficiency. Ensuring that AI chatbots are designed to be user-friendly and accessible is crucial to overcoming this barrier. As for patients with technology illiteracy, it is important to prepare the patient with hands-on guidance and offering them reassurance, to build their confidence in using the AI chatbot effectively. Starting off by providing basic education and demonstration, making sure patients have easy access to the AI chatbots by bookmarking or installing apps, walking them through the steps and clarifying any concerns they have.

Traditional methods of patient preparation for colonoscopy often rely on printed materials, pamphlets, or phone calls from healthcare professionals. While effective to some extent, these methods lack interactivity and personalization. To address this, a designated laptop in the clinic can be used during the consent process, allowing patients to interact with an AI chatbot for colonoscopy preparation. This setup ensures immediate assistance if patients face difficulties, with prompts and guidance provided by staff. This hybrid approach combines the 24/7 availability of AI chatbots with direct support, enhancing patient understanding and adherence to preparation guidelines, ultimately improving outcomes like detection rates during colonoscopy..

Although the initial studies on AI chatbots in healthcare are promising, there is still a need for further research to fully understand their potential in pre-procedural patient education. Future studies should focus on improving the natural language processing capabilities of chatbots to ensure they can handle more complex patient interactions. Additionally, research is needed to evaluate the long-term impact of AI chatbot use on patient outcomes, such as the quality of colonoscopy preparation and procedural success. There is also a need to explore patient attitudes towards AI chatbots and identify strategies to increase acceptance and trust in these systems. Further, integration with electronic health records (EHRs) could enable AI chatbots to provide even more personalized and contextually aware guidance, improving their effectiveness and reducing the risk of errors.

AI chatbots represent a promising tool for enhancing patient preparation for colonoscopy. They offer several advantages, including personalized education, real-time support, and improved patient adherence to preparation guidelines. Early studies suggest that AI chatbots can lead to better clinical outcomes, such as improved bowel preparation. However, challenges such as technological limitations, patient trust, and acceptance need to be addressed. As AI technology continues to evolve, further research will be critical in refining chatbot systems and exploring their full potential in improving patient preparation for medical procedures like colonoscopy.

Problem Statement

Traditional pre-colonoscopy counseling requires significant time from healthcare workers to explain procedures, limiting efficiency and patient turnover. Inadequate bowel preparation exacerbates this issue, leading to repeat procedures and increased costs. However, no study has yet evaluated the effectiveness of AI in improving the Boston Bowel Preparation Scale (BBPS) for colonoscopy preparation. By addressing this gap, AI chatbots could provide personalized guidance, reduce healthcare worker burden, improve preparation quality, and enhance patient experience.

General objectives

To determine the effectiveness of artificial intelligence (AI) chat bot in improving bowel preparation among colonoscopy patients in Hospital Tuanku Mukhriz (HCTM), compared to conventional instructions

Specific Objectives

1. To determine the effectiveness of AI chat bot in relieving anxiety among colonoscopy patients in HCTM, compared to conventional instructions.
2. To determine the effectiveness of AI chat bot in improving satisfaction among colonoscopy patients in HCTM, compared to conventional instructions.

Hypothesis

Artificial intelligence (AI) chat bot can improve bowel preparation, anxiety level and patient's satisfaction among colonoscopy patients in Hospital Tuanku Mukhriz (HCTM), compared to conventional instructions

Null hypothesis
Artificial intelligence (AI) chat bot cannot improve bowel preparation, anxiety level and patient's satisfaction among colonoscopy patients in Hospital Tuanku Mukhriz (HCTM), compared to conventional instructions

Study Design

This study is a prospective, block randomized controlled trial designed to evaluate the effectiveness of an AI-powered chatbot (ChatGPT) in improving colonoscopy preparation. Participants will be randomly assigned into two groups: an intervention group utilizing the chatbot and a control group receiving standard written or verbal instructions. The study will compare outcomes between these groups to assess the chatbot's impact on bowel preparation quality, patient satisfaction, and anxiety reduction.

Study Population

The study will recruit adult patients aged 18 to 75 years who are scheduled for elective colonoscopy at Hospital Canselor Tuanku Muhriz (HCTM). Inclusion criteria include patients with internet access and proficiency in using smartphones or web-based platforms. Participants must be able to comprehend one of the following languages: English and Bahasa Melayu and must have a valid medical indication for undergoing a colonoscopy. Participants must also have an educational background of at least SPM level.

Exclusion criteria include patients with dementia, impaired memory, or other neurological conditions such as Alzheimer's disease or severe stroke. Additionally, patients with a clinical diagnosis of anxiety or those experiencing gastrointestinal conditions such as diarrhea will also be excluded from the study.

Sample Size
Sample size of the study is calculated based on each study outcome to be studied (i.e., bowel preparation, anxiety, satisfaction, and medication adherence).

Study Outcomes	Sample Size Calculations
Bowel Preparation (BBPS)	Given that BBPS for colonoscopy patients who received AI instruction $= 6.74 \pm 1.25$ points [Zhu], BBPS for colonoscopy patients who received conventional instruction $= 5.97 \pm 1.81$ points [Zhu], significance level $= 0.05$, power of study $= 80\%$, the

	sample size required = 82. This is calculated using Pocock's formula for two means. $$= \frac{2\,(1.25)^2\,(1.96 + 0.84)^2}{0.77^2}$$ = 41 per group = 82 for both groups
Anxiety (DASS-21)	No previous evidence found; hence, sample size cannot be calculated based on satisfaction.
Satisfaction (PSQ-18)	No previous evidence found; hence, sample size cannot be calculated based on satisfaction.

Based on the above calculations, we will choose the largest sample size, which is 82 patients. To account for missing data and loss of follow-up, the sample size is inflated by 10%, hence, a final sample size of 92 (i.e., 82/0.9) patients is required.

Materials

The primary tool for this study is an AI chatbot (ChatGPT) customized with content specific to colonoscopy preparation from reputable medical sources. The chatbot provides detailed instructions on personalized dietary modifications, laxative use, step-by-step preparation guidelines and also motivational messages tailored to the existing bowel preparation protocol used in the clinic. A personalized script is provided to each participant in the intervention group, containing details such as their name, age, comorbidities, medications, and the date of their scheduled colonoscopy. The script concludes with essential instructions on what to do and know before the procedure. Available in two languages—English and Malay—the script ensures accessibility for diverse patient groups. Patients can input the script into the chatbot and ask questions for better understanding and to alleviate anxiety. Additionally, participants are required to complete a research consent form before participating in the study.

The standard protocol for the study includes a colonoscopy consent form and the use of Fortrans, a polyethylene glycol-based laxative. The dosage involves one sachet diluted in one liter of water, to be consumed at specific intervals: 6:00 PM and 8:00 PM the day before the colonoscopy, and again at 6:00 AM on the day of the procedure.

The control group in this study serves as a benchmark for the intervention group. Patients in this group receive verbal instructions from healthcare workers at the clinic. These instructions include dietary modifications, laxative preparation and consumption, and general guidelines for colonoscopy preparation. Unlike the intervention group, the control group relies solely on traditional face-to-face communication without the integration of AI-driven tools.

To assess the outcomes of the study, three validated assessment tools are utilized. The primary assessment tool is the Boston Bowel Preparation Scale (BBPS), which is used to evaluate the cleanliness of the bowel during the colonoscopy. This score is determined by blinded endoscopists to minimize bias. The secondary assessment tools include the Depression Anxiety and Stress Scale 21 (Anxiety Scale), which measures patients' anxiety levels before and after the preparation process, and the Patient Satisfaction Questionnaire (PSQ), which evaluates the overall satisfaction of participants with the preparation process. Both the DASS 21 and PSQ are scored using a Likert scale to ensure standardization and comparability

Methodology

The study is conducted in a colorectal clinic, specifically on Tuesdays. Participants are recruited and divided into two groups: the intervention group and the control group. Each group follows a distinct preparation protocol, allowing for a comparative analysis of outcomes.

In the intervention group, participants interact with the AI chatbot via a laptop. The process begins with participants receiving a personalized script that includes their demographic and medical details, such as name, age, comorbidities, current medications, and their scheduled colonoscopy date. The script concludes with a summary of what the participants should do and know before their colonoscopy, tailored to ensure clarity and relevance. This script is available in two languages—English and Malay—allowing participants to select their preferred language.

Participants are instructed to input the script into the chatbot at the start of the session. From there, the chatbot provides comprehensive guidance on dietary restrictions, laxative usage, and step-by-step instructions for the preparation process. Moreover, participants are encouraged to freely interact with the chatbot by asking questions to clarify doubts or address concerns. This interactive feature not only enhances understanding but also helps relieve anxiety by creating a supportive and reassuring experience. The chatbot's motivational messaging further empowers participants to adhere to the preparation protocol. For those requiring additional support, clinic staff are available to assist during the interaction. Each session with the chatbot is designed to last between 15 to 30 minutes, ensuring efficiency and minimizing disruption to clinic operations.

The control group, in contrast, receives preparation instructions through traditional verbal communication from healthcare professionals. These instructions cover the same key areas as the

chatbot, including dietary modifications, laxative preparation and administration, and general preparation guidelines. However, the control group does not have access to the additional features of real-time interaction, personalized support, or motivational messaging provided by the chatbot.

Data collection in this study focuses on both primary and secondary outcomes. The primary outcome, bowel cleanliness, is assessed using the Boston Bowel Preparation Scale (BBPS). Blinded endoscopists evaluate the cleanliness of the bowel during the colonoscopy, ensuring an unbiased assessment of the preparation process. Secondary outcomes include the reduction in patient anxiety levels and overall satisfaction with the preparation process. Anxiety levels are measured using the Depression Anxiety and Stress Scale 21 (Anxiety Scale), with pre- and post-intervention scores compared to determine the impact of the intervention. Patient satisfaction is evaluated using the Patient Satisfaction Questionnaire (PSQ), which assesses various aspects of the preparation process. Both secondary outcomes are scored using a Likert scale, providing a standardized metric for analysis. Anxiety and satisfaction are assessed on the day of the procedure rather than at the time of intervention (appointment scheduling) because anxiety levels may not be significant early on but tend to peak closer to the procedure. Assessing these outcomes at the final stage ensures a more accurate evaluation of the intervention's lasting impact on stress management and overall patient experience.

Research Flow Chart
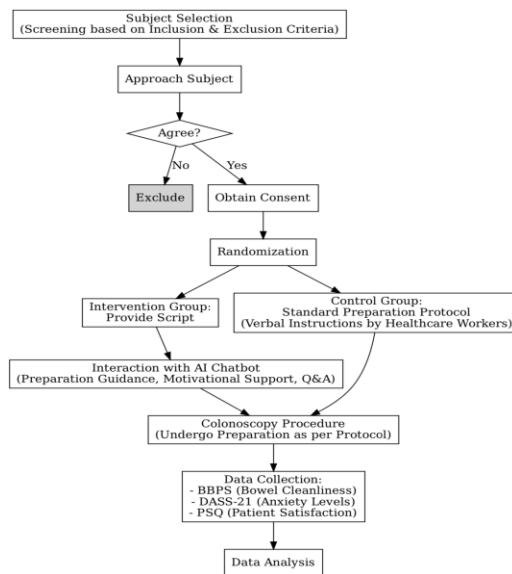
Statistical plan and analysis

For this research, data analysis will involve both descriptive and inferential statistical methods to evaluate adherence, anxiety reduction, and the quality of colonoscopy preparation. The first step will be to conduct a descriptive analysis of participant characteristics, chatbot interaction metrics, and adherence rates. Categorical data, such as gender, ethnicities, types of diagnosis, etc, will be summarized using frequencies and percentages, while continuous variables, including anxiety scores and Boston Bowel Preparation Scale (BBPS), Depression Anxiety and Stress Scale 21 (Anxiety Scale), Satisfaction PSQ-18, will be reported as means and standard deviations or medians with interquartile ranges, depending on the normality of the data. To assess the normality of the data, Kolmogorov-Smirnov test will be used.

The Patient Satisfaction Questionnaire, PSQ-18 will be used to evaluate the satisfaction improvement in between the intervention group (i.e., receive AI instructions) and control group (i.e., receive conventional instruction), will be analyzed using independent t-test if data is normally distributed, otherwise Mann-Whitney's test will be used.

The Depression Anxiety and Stress Scale 21 (Anxiety Scale) will be used to evaluate anxiety reduction pre-procedure and post-procedure in both intervention group (i.e., receive AI instructions) and control group (i.e., receive conventional instruction). Paired samples *t-tests* will be conducted to determine whether there is a significant reduction in anxiety scores post-intervention compared to baseline. If the data are not normally distributed, the Wilcoxon signed-rank test will be applied instead. The null hypothesis is that there is no significant change in anxiety levels before and after using the AI chatbot.

The primary outcome, colonoscopy preparation quality, will be measured using the BBPS during the procedure. Comparisons of BBPS scores across adherence levels or engagement groups will be analyzed using independent t-test (if data is normal) or Mann-Whitney's test (if data is not normal). To control for potential confounders, such as age, gender, comorbidities, level of education, will be controlled using multivariate regression..

Finally, all analyses will include confidence intervals to provide precision estimates, and p-values will be reported to assess statistical significance ($p < 0.05$). This comprehensive data analysis plan ensures a robust evaluation of the chatbot intervention's impact on adherence, anxiety reduction, and preparation quality. All statistical analyses will be performed using SPSS version 28.

Budget Proposal

Equipment and Supplies

No.	Item	Quantity	Unit Cost (RM)	Total Cost (RM)	Justification
1.	Chat Gpt Plus	6 month	$25 (RM111.75)/ month	RM 671	ChatGPT Plus ensures reliable access, minimizing disruptions and response variability. It restricts sources to trusted, Malaysia-approved resources for accurate colonoscopy guidance. With enhanced reliability and real-time support, it maintains study integrity, ensures high-quality research, and prioritizes patient safety with medically approved advice from authoritative sources.
2.	Patient Honorarium	96 patient	RM 10/patient	RM 960	The patient honorarium budget values participants' time, encouraging enrollment and adherence. It boosts engagement, reduces dropouts, and enhances data reliability, ensuring the study's successful completion and valid findings
	Total			RM 1631	

*Based on current currency

Source: Geran Fundamental Fakulti Perubatan

Gantt Chart

No.	Task/Month	Oct	Nov	Dec	Jan	Feb	March	Apr	May	June	July	Aug	Sept
1.	First meeting with supervisor and discuss possible title for research	■											
2.	Discuss literature review related with research title		■										
3.	Budget proposal discussion		■										
4.	Submission of proposal			■									
5.	Present proposal at the department				■								
6.	Submit proposal to ethics committee				■								
7.	Present the proposal to the ethics committee if needed.				■								
8.	Data collection					■	■	■	■	■			
9.	Prepare manuscript and Data Analysis										■	■	
10.	Manuscript submission											■	

13

Appendix 1

Proforma Form

Section 1: Patient Demographics	
Name	
Age	
Gender	
MRN	
BMI	
Profession / Occupation	
Digital Literacy Level	Basic/Intermediate/Advanced
Comorbidities	Diabetes Mellitus/Hypertension/Chronic Kidney Disease/Ischemic Heart Disease Others:
Relevant medical history	Previous history of constipation (Rome's Criteria)/ Previous history of diarrhoea Others:
Smoker	Yes/No
Alcohol drinker	Yes/No
Section 2: Bowel Preparation	
Dietary restriction before colonoscopy	Yes/No
Completion of laxative (Fourtrans) as instructed	Yes/No If No state the reasons:
Section 3: Colonoscopy Details	
Indication for colonoscopy	

Dosage of sedation(midazolam&pethidine)	
Completion	Complete/Incomplete If Incomplete state the reason:
Time taken	
Diagnosis	
Bowel preparation method	
Boston Bowel Preparation Scores (BBPS)	
Finding	
Intervention during colonoscopy	(Yes/No) If Yes state the indication:
Histopathology examination (if available).	Benign/Malignant.
Adverse event	Yes/No If Yes state the event:

Section 4: Surveys and Questionnaires

- State Trait Anxiety Inventory Questionnaire
- Patient Satisfaction Questionnaire -18

Appendix 2

Personalized scripts

<u>English</u>

Hi, my name is **[Insert Name]**. I am **[Insert Age]** years old and have the following medical conditions: **[List Comorbidities Ex: Diabetes, Cholesterol, Blood Pressure]**. I am currently on these medications: **[List Medications]**. I am scheduled for a colonoscopy on **[Insert Date]**. Please ensure that all the answers related with the colonoscopy procedure will be from KKM guidelines and a reputable journal.

Can you tell me what I need to do or know before the colonoscopy?

<u>Malay</u>

Hai, nama saya **[Masukkan Nama]**. Saya berumur **[Masukkan Umur]** tahun dan mempunyai keadaan kesihatan seperti berikut: **[Senaraikan Komorbiditi, CTH : Kencing manis, Kolesterol, Darah Tinggi].** Saya sedang mengambil ubat-ubatan ini: **[Senaraikan Ubat]**. Saya dijadualkan untuk kolonoskopi pada **[Masukkan Tarikh].** Sila pastikan bahawa semua jawapan berkaitan prosedur kolonoskopi adalah berdasarkan garis panduan KKM (Kementerian Kesihatan Malaysia) dan jurnal yang bereputasi.

Boleh tak anda terangkan apa yang saya perlu buat atau tahu sebelum kolonoskopi?

Appendix 3
DASS-21 and PSQ-18 Questionnaires

DASS – 21 Anxiety Scale

How you feel over the past week	Did not apply to me at all	Applied to me to some degree, or some of the time	Applied to me to a considerable degree or a good part of time	Applied to me very much or most of the time
I was aware of dryness of my mouth	0	1	2	3
I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
I experienced trembling (e.g. in the hands)	0	1	2	3
I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
I felt I was close to panic	0	1	2	3
I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	0	1	2	3
I felt scared without any good reason	0	1	2	3

How understandable was the language used by the doctor/ AI chatbot?	1	2	3	4	5

Time Spent

How you generally feel	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
How satisfied were you with the amount of time the doctor/chatbot took to answer your queries?	1	2	3	4	5
How would you rate the Doctor/chatbot's overall efficiency in helping you prepare for your colonoscopy?	1	2	3	4	5

Access to care

How you generally feel	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Was the doctor/AI chatbot available when you needed it?	1	2	3	4	5
How would you rate your ability to easily access the doctor or healthcare workers/chatbot?	1	2	3	4	5

Trust and confidence

How you generally feel	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
How much trust did you place in the information provided by the doctor/chatbot?	1	2	3	4	5
How confident were you in following the doctor/chatbot's instructions for bowel preparation?	1	2	3	4	5

18

Patient satisfaction questionnaire – 18

General satisfaction

How you generally feel	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
How satisfied are you with the information for bowel preparation?	1	2	3	4	5
How satisfied are you with your overall experience with doctor explanation/AI chatbot for bowel preparation?	1	2	3	4	5

Technical Quality

How you generally feel	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
How would you rate the doctor's explanation/AI chatbot's ease of use?	1	2	3	4	5
How satisfied are you with the doctor's explanation/ chatbot's ability to provide prompt responses?	1	2	3	4	5

Interpersonal aspect

How you generally feel	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
How well did the doctors' explanation/chatbot understand your questions or concerns?	1	2	3	4	5
How would you rate the doctor's explanation/ chatbot's ability to engage with you in a personalized way?	1	2	3	4	5

Communication (clarity and comprehensibility of the information provided)

How you generally feel	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
How clear were the instructions provided by the doctor/AI chatbot regarding bowel preparation?	1	2	3	4	5

19

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