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Validation of a quantitative instrument measuring critical success factors and acceptance of Casemix system implementation in the total hospital information system in Malaysia

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ABSTRACT

Objectives This study aims to address the significant knowledge gap in the literature on the implementation of Casemix system in total hospital information systems (THIS). The research focuses on validating a quantitative instrument to assess medical doctors' acceptance of the Casemix system in Ministry of Health (MOH) Malaysia facilities using THIS.

Designs A sequential explanatory mixed-methods study was conducted, starting with a cross-sectional quantitative phase using a self-administered online questionnaire that adapted previous instruments to the current setting based on Human, Organisation, Technology-Fit and Technology Acceptance Model frameworks, followed by a qualitative phase using in-depth interviews. However, this article explicitly emphasises the quantitative phase.

Setting The study was conducted in five MOH hospitals with THIS technology from five zones.

Participants Prior to the quantitative field study, rigorous procedures including content, criterion and face validation, translation, pilot testing and exploratory factor analysis (EFA) were undertaken, resulting in a refined questionnaire consisting of 41 items. Confirmatory factor analysis (CFA) was then performed on data collected from 343 respondents selected via stratified random sampling to validate the measurement model.

Results The study found satisfactory Kaiser-Meyer-Olkin model levels, significant Bartlett's test of sphericity, satisfactory factor loadings (>0.6) and high internal reliability for each item. One item was eliminated during EFA, and organisational characteristics construct was refined into two components. The study confirms unidimensionality, construct validity, convergent validity, discriminant validity and composite reliability through CFA. After the instrument's validity, reliability and normality have been established, the questionnaire is validated and deemed operational.

Conclusion By elucidating critical success factor and acceptance of Casemix, this research informs strategies for enhancing its implementation within the THIS environment. Moving forward, the validated instrument will serve as a valuable tool in future research endeavours aimed at evaluating the adoption of the Casemix system within THIS, addressing a notable gap in current literature.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The rigorous validation process of the questionnaire, including initial validation, translation, pre-testing and exploratory factor analysis using pilot test data, followed by confirmatory factor analysis using field data, enhances the reliability and validity of the instrument used for data collection.

⇒ The use of statistical techniques such as the Kaiser-Meyer-Olkin (KMO) measure, Bartlett's test of sphericity, factor loadings, Cronbach's alpha and various validity tests (unidimensionality, construct validity, convergent validity, discriminant validity) ensures the robustness of the analysis.

⇒ While the large sample size enhances generalisability to some extent, the study was conducted in only five selected hospitals in Malaysia; thus, the findings may not be representative of all hospitals in the country or other healthcare systems.

⇒ This study does not include other professional roles, such as paramedics, medical record officers, information technology officers and finance officers because the knowledge and involvement of these roles in the Casemix system are not comparable to that of medical doctors.

⇒ The findings of the study may be specific to the healthcare context in Malaysia and may not be directly applicable to other countries or healthcare systems with different sociocultural, organisational or technological characteristics.

INTRODUCTION

The global healthcare landscape is witnessing profound evolution driven by an array of challenges, including the rise of non-communicable diseases, the resurgence of communicable diseases, demographic shifts and escalating healthcare costs.[1] Governments and healthcare authorities worldwide

are under mounting pressure to navigate these complexities while optimising operational efficiency and ensuring equitable access to quality healthcare services.[1] Within this context, Malaysia has emerged as a proactive player, spearheading innovative strategies to streamline healthcare delivery and bolster system performance. The Ministry of Health (MOH) Malaysia's proactive stance is exemplified by its robust efforts to standardise and enhance the quality of healthcare services through the implementation of clinical standards and pathways based on international best practices.[2] Notably, initiatives such as the hospital information system (HIS) and the Casemix system have been instrumental in revolutionising healthcare management practices and fostering a culture of continuous improvement.[3–6]

Background of Hospital Information System (HIS)

The HIS stands as a cornerstone of technological innovation in healthcare management, offering a comprehensive platform for efficient data collection, storage and processing.[7] HIS responsibilities include managing shared information, enhancing medical record quality, overseeing healthcare quality and error reduction, promoting institutional transparency, analysing healthcare economics and reducing examination and treatment durations.[8–13] In Malaysia, the adoption of HIS, categorised into total hospital information system (THIS), intermediate hospital information system (IHIS) and basic hospital information system, has paved the way for seamless integration of patient data, administrative tasks, and financial transactions and appointment management into a single system within a hospital.[14–19] The pioneering implementation of a fully integrated paperless system as a THIS facility at Hospital Selayang underscores Malaysia's commitment to embracing cutting-edge technology to enhance healthcare delivery.[20–22] Today, 19 out of 149 Malaysian hospitals have IT facilities.[23 24] Despite challenges during implementation, the overall advantage of using a comprehensive system is priceless.[22 25–29]

Background of Casemix system

The Casemix system is a global system that categorises patient information and treatments based on their types and associated costs, aiming to identify patients with similar resource needs and treatment expenses.[30 31] It is widely used globally such as in the USA, Western Europe, Australia, Eastern Europe and Asia, playing a crucial role in hospital financing.[32 33] Originating from Australia, it optimises resource utilisation, improves cost transparency and enhances healthcare service efficiency.[34 35] However, its adoption in developing nations like Malaysia faces challenges due to technological constraints and resource limitations.[23 36 37] The Malaysian diagnosis-related group (MalaysianDRG) Casemix system categorises patients based on healthcare costs, improving efficiency and resource allocation.[38–40] This system enhances provider payment measurement, healthcare service quality, equity and efficiency, and assists policymakers in allocating cash for hospitals.[24 41] The information from the MalaysianDRG is integrated into the executive information system, providing access to system outputs such as DRG, severity of illness, average cost per disease and Casemix Index.[38–40]

Integration of Casemix within HIS

The integration of Casemix within HIS frameworks represents a paradigm shift in healthcare management, offering a unified platform for data-driven decision-making, performance monitoring and quality improvement initiatives.[42] In the USA, there is a need to evaluate existing HIS against advanced hardware and software.[42] As hospitals face public opposition due to rising medical expenses, governments are under pressure to manage healthcare costs more effectively.[42] Casemix-based reimbursement policies aim to compensate medical expenses based on Casemix rather than the number of services provided.[42] By consolidating clinical, administrative and financial data within a single system, Casemix-based systems are multifaceted and require organisational restructuring and educational initiatives for successful implementation.[33] Strategies such as providing feedback to clinicians and integrating decentralised databases into HIS are crucial for ensuring data credibility and accuracy.[33] Transitioning from traditional medical record management to health information management requires careful planning and adjustments due to the lack of automation in the current HIS.[33]

Theoretical and conceptual framework

Multiple frameworks are commonly used to evaluate technology systems' acceptance and success attributes. There are noteworthy frameworks, such as the technology acceptance model (TAM), the DeLone and McLean Information Systems Success Model (ISSM), the HOT-Fit Evaluation Framework and the Unified Theory of Acceptance and Use of Technology (UTAUT). The TAM is a widely used framework for assessing the acceptability and success of technology systems, particularly in HIS.[43–47] It suggests that user perceptions of ease of use, usefulness and intention to use significantly impact system usage.[43–47] The DeLone and McLean ISSM evaluates the effectiveness of information systems by examining relationships between system quality, information quality, user happiness, individual impact, organisational impact and overall system success.[48 49] The HOT-Fit Evaluation Framework, evolved from the ISSM, evaluates the congruence of persons, organisations and technology within an information system, considering technological variables, organisational factors and human factors.[12 50] The UTAUT enhances the TAM by incorporating additional elements such as social impact, enabling situations, and behavioural intentions.[43 51 52]

By integrating these frameworks within the context of Casemix implementation within THIS, the investigators aim to assess critical success factors and address barriers to adoption and acceptance, facilitating seamless

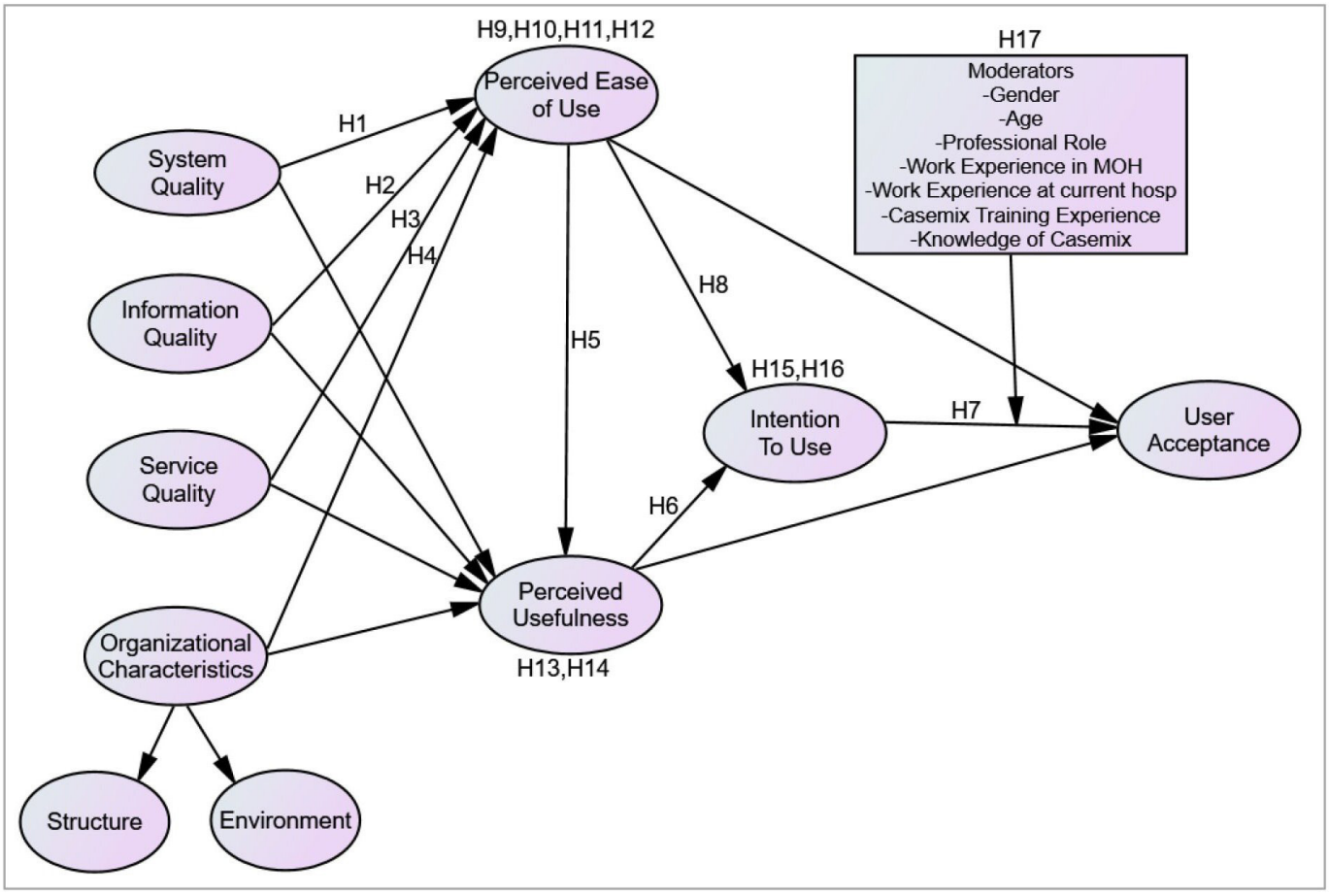

Figure 1 Conceptual framework.

integration and maximising the potential of healthcare modernisation efforts. Hence, the investigators opted to integrate HOT-Fit and TAM frameworks as this study's conceptual framework to achieve the research's specific objectives, scope and contextual considerations (see figure 1). HOT-Fit offers a comprehensive framework for examining the alignment between human, organisational and technological factors, while TAM provides a focused lens on individual-level technology acceptance dynamics.[12 44–47] Based on the current study's conceptual framework, the HOT-Fit framework focuses on technological constructs like system, information and service quality, while the TAM framework covers human dimensions like perceived ease of use, usefulness, intention to use and acceptance. The integration of these frameworks is crucial for achieving the study's specific and general objectives. Thus, these two frameworks are suitable and deemed appropriate for this study. On the other hand, UTAUT does not appear suitable for the current investigation due to the broad scope and complexity of existing TAM with additional external variables and ISSM was also not selected due to its simplicity.[43 51 52]

This current study aims to evaluate the critical success factors (CSFs) and doctors' acceptance of Casemix implementation within the THIS environment to understand the issues MOH Malaysia facilities experience better, fill a research gap on Casemix implementation and help shape plans for modernising healthcare. A comprehensive tool, such as a questionnaire, was created to meet the study objectives. This paper aims to examine a multidimensional instrument that was created to meet the study objectives. Consequently, the exploratory factor analysis (EFA) is instrumental in uncovering underlying factors within observed variables to ensure precision and robustness, while confirmatory factor analysis (CFA) was needed to verify the measurement model's linkages and confirm that the theoretical model was valid, reliable and suitable for data collection, thereby yielding valuable insights.[53–56] Given its merits, the current study used CFA to evaluate the measurement model's validity. After validation processes, structural equation modelling (SEM) was employed to analyse how exogenous, mediating and endogenous constructs interrelate and determine parameters into a structural model to analyse direct, mediating and moderating effects on the study's goals and hypotheses. While the technology evaluation frameworks offer crucial insights, it is essential to note that Casemix is designed to organise patient data and treatment costs rather than analyse the acceptability and success of technology systems. Moreover, meeting the study objectives for evaluating Casemix adoption in THIS can be done without a separate instrument for each system. It

can assist healthcare organisations and policymakers in understanding CSFs facilitating the implementation and acceptance of the Casemix system, and guiding the development of targeted strategies for seamless implementation, enhancing patient care, work efficiency and resource allocation. Therefore, a reliable and valid quantitative instrument is required to achieve these goals.

METHODOLOGY

Study design and ethical approval

Study design

This study employed a sequential explanatory mixed-methods design. Nevertheless, the researchers in the present article solely highlight the exploration and development of items, as well as the reliability and validation of the quantitative study. The data collection for the quantitative pilot study was from 1–14 February 2023, the quantitative phase was from 1 April to 31 June 2023, the qualitative pilot study was on 15 September 2023 and the qualitative field study was from 17 October 2023 to 4 January 2024. This paper highlights on the development of instruments for quantitative phase procedures and findings of the validation of quantitative study only. The quantitative phase used a cross-sectional study design to gather data throughout a specified duration.[53 57 58]

Ethical approval

This study has obtained ethical approval from:

1. The Medical Research Ethics Committee of the Faculty of Medicine, Universiti Kebangsaan Malaysia (JEP-2022–777), see (online supplemental file 1), and
2. The Medical Research Ethics Committee of the Ministry of Health Malaysia (NMRR ID-22–02621-DKX), see (online supplemental file 2).

Study instrument

This study used a self-administered questionnaire to collect data on the CSF and acceptance of Casemix in THIS environment. The instrument was developed in Malay and English for a better understanding of the respondents due to the geographical areas of the study where Malay is the national language of Malaysia. The questionnaire comprised 60 items divided into three sections, each with a limited number of constructs. Section 1a consists of 8 questions that collected demographic information such as age, gender, educational background and work experience in the MOH Malaysia and current hospital. Section 1b assessed the comprehension/knowledge level of the Casemix system using 10 items. Meanwhile, Section 2 represented the perceived Critical Success Factors of Casemix implementation in the THIS context, consisting of 37 items within six constructs: system quality (SY)—4 items, information quality (IQ)—5 items, service quality (SQ)—5 items, organisational factors (O)—9 items, perceived ease of use (PEOU)—5 items, perceived usefulness (PU)—4 items and intention to use (ITU)—5 items. Section 3 encompasses the outcome of the study which is the user acceptance (UA) construct, which contains 5 items.

The study incorporates and modifies existing scholarly works rooted in the Human Organisation Technology (HOT-Fit) and TAM frameworks for sections 2 and 3. The two sections, each evaluated using a 10-point interval Likert scale. The 10-point interval scale offers respondents a greater range of response possibilities that align with their precise evaluation of a question.[55 56 59 60] A score of 1 represents ‘strongly disagree’, while a score of 10 represents ‘strongly agree’. The constructs and components of the instrument were derived from previous research.[12 43 44 48 50 61–64] These items represented eight constructs: SY, IQ, SQ, ORG, PEOU, PU, ITU and User Acceptance.

The constructs described in sections 2 and 3 underwent initial validation, reliability testing and EFA, using pilot data. CFA was also performed using field data. Details regarding the development validation and reliability procedures of the instrument are provided in subsequent sections. Hence, to facilitate transparency and reproducibility, a blank copy of the measurement instrument developed and validated in this study has been included as a supplementary file (see online supplemental file 3: Blank Copy of Quantitative Instrument).

Independent variables

A few constructs have been examined in this study as mentioned in Subsection 1.6, the conceptual framework comprising technology, organisation and human dimensions.

Technological factors

Constructs such as system quality (SY), information quality (IQ) and service quality (SY) constitute the technological factors. Addressing system quality issues is imperative for fostering user acceptance and realising system benefits.[43] Reliable and accurate systems with dependable functionality enhance user acceptance, while a user-friendly interface and seamless performance enhance user experience. Integration with existing systems promotes acceptability and interoperability.[43 44] Conversely, information quality, encompassing data security and privacy, is crucial in safeguarding patient data, bolstering user confidence and fostering system adoption.[65] Service quality encompasses the support and assistance provided during and after system implementation, with practical training, responsive helpdesk support, and ongoing maintenance contributing to user satisfaction and system success.[51 66 67] Hence, these three constructs encompassing technological dimensions were adapted from the HOT-Fit framework.[12 50]

Organizational characteristics

Organisational dimensions, such as an organisational structure and environment, can limit or facilitate the acceptance or implementation of technical advancements.[68] The elements of organisational dimension were

the most generally surveyed attributes in IT adoption in organisations.[69] Previous research has identified relative benefit, centralisation, formalisation, top management support and perceived cost as essential organisational elements influencing any organisation's decision to embrace current information systems technologies. Management barriers are defined as a lack of efficient planning, a lack of trained people, and limits linked to training courses, according to Abdulrahman and Subramanian.[70] The management, technological, ethical-legal and financial barriers were all integrated into the organisational factor category in this study. Previous research has found that technology adoption rates are related to preparedness and impediments to readiness.[71] Along with several other studies, senior leaders play a critical role in using information systems at the organisational level.[72] Direct involvement of senior executives in IS operations demonstrates the importance of IS and ensures their support and involvement in the overall performance of IS efforts in the organisation.[73] Organisational environment and structure can influence user acceptance of information technology, underscoring the importance of organisational improvement initiatives to enhance user acceptance.[74–77] Hence, this primary construct encompassing organisational dimensions was adapted from the HOT-Fit framework.[12 50]

Human factors

The TAM is a framework that consists of five fundamental elements: PEOU, PU, ITU, actual system use and external Variables.[78–81] PEOU is a subjective evaluation of a technology's ease of use, influenced by usability, training and user assistance.[78–81] PU quantifies the level of usefulness attributed to technology, influenced by factors such as usefulness and compatibility with user needs and responsibilities.[78–81] Intention to Use (ITU), External factors, such as organisational regulations, access and availability, can also influence the interactions within the model.[78–81] External variables, such as individual variances, cultural influences and supportive environments, can either amplify or reduce the impact of perceived ease of use and usefulness on behavioural intention and actual use.[78–81] The TAM has been a crucial paradigm for understanding technology acceptance and has significantly impacted research in information systems and technology adoption. The HOT-Fit Evaluation technique, which focuses on system use and user satisfaction, is suitable for this study.[12 50] These two constructs are interconnected to PEOU and PU, delineated by the TAM framework.[78–81] For successful implementation of an information system, medical doctors perceive it as easy to use (PEOU) through adequate training, user-friendly interfaces and intuitive system design.[78–81] Healthcare providers should also perceive the system as useful (PU) to ensure successful implementation, highlighting its benefits such as improved efficiency, quality of care and cost control.[78–81]

Dependent variable

The only dependent variable in this study is acceptance which is adapted from the TAM.[44 45 82] The study presents a pragmatic taxonomy of eight different implementation outcomes, including acceptability/acceptance, adoption, appropriateness, feasibility, fidelity, implementation cost, penetration and sustainability.[64] Acceptability is a crucial aspect of implementation, referring to the acceptance of a specific intervention, practice, technology or service within a specific care setting.[64] It can be measured from the perspective of various stakeholders, such as administrators, payers, providers and consumers.[64] Ratings of acceptability are assumed to be dynamic and may differ during pre-implementation and throughout various stages of implementation. In similar literature, Proctor *et al* delineated examples of measuring provider and patient acceptability/acceptance including case managers' acceptance of evidence-based procedures in a child welfare system and patients' acceptance of alcohol screening in an emergency department.[64] The terms acceptability and acceptance are interchangeably used to describe implementation outcomes. Therefore, in this study, the researchers would like to explore the acceptance of the Casemix system in the MOH's THIS facilities.

Patients and public involvement

Participants in this study were medical doctors and this study did not involve any patients or the public. Hence, there was no patient or public involvement in this study.

Initial validation processes

The initial validation procedures were conducted to establish the content, criteria and face validity/pre-test of the instrument for the field study.

Content validity

Content validity is significant when developing new measurement tools because it links abstract ideas with tangible and measurable indicators.[83] This involves two main steps: identifying the all-inclusive domain of the relevant content and developing items that correspond to this domain.[83] The Content Validity Index (CVI) is often used to measure this validity.[84–86] Recent studies have demonstrated the content validity of assessment tools using the CVI.[87–90] The best method for calculating the CVI, suggesting that the number of experts reviewing an instrument should range from 2 to 20.[84–86 91 92] Typically, the number of experts varies from 2 to 20 individuals.[93] For the current study, two experts from the Hospital Financing (Casemix Subunit) at MOH Malaysia were selected. This is coherent with the number of experts that are recommended by a few literature in online supplemental file 4A.[84] There are two types of CVI: I-CVI for individual items and S-CVI for overall scales.[84–86 91 92] S-CVI can be calculated by averaging the I-CVI scores (S-CVI/Ave) or by the proportion of items rated as relevant by all experts (S-CVI/UA).[84–86 91 92] Before calculating CVI, relevance ratings are converted to binary scores. The relevance

rating was re-coded as 1 (scale of 3 or 4) or 0 (scale of 1 or 2), as indicated in online supplemental file 4B. Online supplemental file 4C reveals two experts' item-scale relevance evaluations to exhibit CVI Index calculation. In this study, the experts validated the questionnaire contents, achieving perfect scores of 3 or 4 for all items, resulting in S-CVI/Ave and S-SCVI/UA scores of 1.00. In conclusion, a thorough methodological approach to content validation, based on current data and best practices, is essential to confirm the overall validity of an evaluation.

Criterion validity

Criterion validity denotes to the degree of correlation between a measure and other established measures for the same construct.[62 88 89 94 95] An academic statistics expert and an expert in questionnaire development and validation procedures reviewed criterion validity. This can be reviewed in online supplemental file 5. Subsequently, a certified translator translated the instrument from English to Malay back-to-back precisely.

Face validity

A face validity assessment was undertaken to evaluate the questionnaire's consistency of responses, clarity, comprehensibility, ambiguity and overall comments. Before commencing the pilot study and fieldwork, the researchers acknowledged and resolved the concerns that were previously mentioned.[62 90 96] Following the validation process, 11 respondents were purposefully selected for face validity also known as pre-testing to accomplish the prerequisite for face validation. Furthermore, they must meet exclusion criteria like those stipulated for participants in the field study. Subsequently, these respondents were excluded from participation in the quantitative field study. The study population will be described further in Subsection 2.6.2. The objective of this pre-test or face-validation process was to assess the consistency of responses, and clarity, ambiguity and overall design of the questionnaire.[97] This will be done through the evaluation from the online Google Form of the Questionnaire. Before conducting the pilot study and fieldwork, the researchers took into consideration the concerns that had been raised.[97] The face validity result has been uploaded as online supplemental file 6.

Quantitative pilot test and EFA

The pilot study was conducted at a Federal Territory hospital in Malaysia, Hospital W. The pilot study population also possess similar characteristics to the participants/samples involved in the subsequent quantitative field study. Additionally, these respondents were excluded from participation in the quantitative field study. This study used a minimum of 100 samples to ensure valid results for the EFA.[97 98] Hence, since the current pilot study is using EFA, the minimal sample size of 100 is therefore supported by a few studies and books experienced in research and validation procedures.[54–56 97 99] Therefore, to account for a projected drop-out rate of 20%, the minimum sample size for this preliminary pilot study was determined to be 125 medical doctors.[100] The research was conducted without participant or public involvement in the design, conduct, reporting or dissemination strategies. The data collection method was also like the field study. It was employed using an online Google Form Questionnaire. Participants were asked to scan a Google Form link or QR code to access information sheets, consent forms and online questionnaires. Each participant was notified that their information would be kept private their anonymity would be retained solely for the study, and they could withdraw at any time.

The pilot study will use EFA to measure data from a collection of hidden concepts. EFA is a method that generates more accurate results when each shared component is represented by many measured variables, either exogenous or endogenous constructs.[54–56 97 98 101–103] The collected data will be used to identify and quantify the dimensionality of items that assess the construct.[53–56 59 60 104] EFA is essential to determine whether items in a construct produce distinct dimensions from those found in previous studies.[53–56 59 60 104] Factors' dimensionality may change as they are transported from other domains to a new research topic, and fluctuations in the population's cultural heritage, socioeconomic status and passage of time might affect dimensionality. The EFA methodology uses principal component analysis (PCA) to decrease the amount of data, but it fails to discern between common and unique changes efficiently.[97 98] PCA is indicated when there is no known theoretical framework or model, and it is used to create the first solutions in EFA. Four requirements of PCA included (1) components with eigenvalues more than one, (2) factor loadings greater than 0.60 for practical relevance, (3) no item cross-loadings greater than 0.50 and (4) each factor has at least three items to be retained.[97 98] The data's eligibility for factor analysis was determined using the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) of >0.6 and Bartlett's test of sphericity.[55 56 105–107] The effectiveness of Bartlett's test for factor analysis hinges on the significant result, with a value near $p<0.001$ ($p<0.05$) indicating acceptability.[53–56 107] The scree plot also determined the best number of constructs to keep.[53–56]

Quantitative field study

Study location

The present study gathered data from five hospitals situated in various Malaysian zones—South, North, West, East and East Malaysia—that are outfitted with the Total Hospital Information System (THIS) and Casemix system. The study used cluster sampling to select study sites in Malaysia, dividing the country into five distinct clusters. Five hospitals that had successfully implemented Casemix for at least 3 years were chosen to represent different regions of Malaysia. Hospital N was selected for the northern region, Hospital E for the eastern region, Hospital S for the southern region and Hospital W for the central/western region. Hospital EM was chosen for East

Malaysia. Cluster sampling is suitable when the research encompasses a vast geographical expanse.

Target population for the study

The target population for this study was medical doctors by profession working in hospitals under MOH in 2023. The study collectively obtained a sampling frame of 3580 medical doctors by profession, encompassing hospital directors, deputy directors (medical division), consultants/specialists, medical officers and house officers from the five selected hospitals. These doctors should fulfil the inclusion and exclusion criteria of this study as follows:

Inclusion criteria

1. Permanent/ contract of service medical doctors who were posted to current participating hospital.
2. Has working experience in the current participating hospital for at least 3 months.
3. Agree to participate in the study.

Exclusion criteria

1. Attachment medical doctors.
2. Refuse to participate in the study.

The study population of face validation/pre-test and pilot test has characteristics similar to those of the study population in the field study. The pre-test and pilot-test samples will also be excluded from samples in the field study. Participants were given surveys to complete at their own pace, without fear or pressure.

Sample size and sampling method

The target population was selected using proportionate stratified random sampling, dividing the total population into homogeneous groups.[16 108–110] Proportionate stratified random sampling is a probability sampling method that includes separating the entire population into similar groups (strata) to conduct the sampling process.

The authors are concerned about the sample size needed for CFA validation of the measurement model. However, current studies do not have a consensus on the appropriate sample size. For small indicators, a minimum sample size of 100–150 respondents is often needed,[111–113] whereas, precise analysis for CFA may require 250–500 respondents.[114 115] Some authors suggested the following suggestions for the sample size requirement: (a) a sample size to parameter ratio of 5 or 10, (b) ten cases per observation/indicator and (c) 100 cases/observations per group for multigroup modelling.[116–118] In conclusion, the researchers opted to employ five times the number of indicators in the questionnaire because the number of indicators for latent variables is large.[116 119] The final questionnaires contain 59 items, requiring a total sample size of 295. However, there is an additional 20% anticipated dropout rate. The sample size was estimated using the formula n=n/1-d (n=total samples, n=minimum required samples and d=drop out rates), yielding a minimum sample size of 369.[100] This is also corroborated by other research, which states that because the conceptual framework in this study consists of eight constructs, each with at least four items, the required sample size is 300, with an additional 20% expected drop-out rate, the calculated sample size was 375.[56 97 100 102] As a result, the researchers opted to distribute questionnaires to the 375 participants using proportionate stratified random sampling depending on their professional roles as suggested.[56 97 102 116]

Data collection methods

The data collection method for the quantitative field study is similar to the techniques used in the quantitative pilot study. This data collection method was elaborated in Subsection 2.4.4. However, the link for the participant information sheet (PIS) and informed consent forms was included on the first page of the questionnaire which is https://bit.ly/3F8IF2e. The participant's information sheet and informed consent forms are attached as online supplemental files 7 and 8, respectively. Similarly to the quantitative pilot study, respondents may do so freely without losing their data if they withdraw from the survey midway. Participants were assured that their information would be kept confidential and that their anonymity would be strictly protected during the field study. Participants who wish to participate must first consent and complete all survey questions. They were also instructed to contact the lead investigator with any questions. The participants have up to 2 weeks to complete and submit the online questionnaire. All survey information was linked to a research identification number. For example, study identifications 001 to 375 on the subject data sheets will be used instead of the subject's name. The appropriate senior management and Casemix System Coordinators (CSCs), the department's Casemix Coordinator and Heads of Department will be contacted 3 days before the data gathering session concludes. All measures were taken to safeguard participants' privacy and anonymity.

Data analysis using Confirmatory Factor Analysis (CFA)

Once the EFA technique has been completed, these constructs and emerging components of the revised conceptual framework were used in the field study. Hair *et al* and Awang *et al* described two distinct models in the field study: the measurement model used in the CFA technique and the structural model used to estimate paths using the SEM.[54–56 97 99] This study paradigm has the features of a confirmatory form of research, with a focus on behavioural components. This type of SEM is known as covariance based-SEM (CB-SEM) and exhibits theory testing or theory-driven research that integrates existing theories to replicate an established theory into a new domain, confirming a pre-specified relationship.[54–56 97 99]

The SPSS Analysis of Moment Structures (AMOS) V.24.0 software was used in CFA to evaluate the unidimensionality, validity and reliability of the measurement model.[53 54 56] The instrument's normality is also achieved using CFA.[53 54 56] There are two ways to validate measurement models: pooled and individual CFA.[54–56 120 121] Pooled-confirmatory factor analysis' (Pooled-CFA) higher degree of freedom enables model identification even when some

constructs have fewer than four components.[54–56 120 121] The missing data will be omitted/discarded from the analysis. To ensure unidimensionality, the permissible loading factor for each latent construct is calculated, and items that cannot fit into the measurement model due to low factor loading are excluded.[53 55 56 97 122–125] The cut-off value for acceptable factor loading varies depending on the research goal. However, this study used a threshold value of 0.5 to minimise item deletion.[53 55 56 97 121 122 126] Convergent validity is assessed by calculating the average variance explained (AVE) for each construct.[53 55 56 97 111 122] Meanwhile, composite reliability (CR) assesses how often a construct's underlying variables are used in structural equation modeling.[53 55 56 97 122] A latent construct's CR must be 0.6 to achieve composite reliability.[53 55 56 97 122]

Several fitness indicators were reported among scholars. Some recommendations are to report fit indices as absolute fit (chi-squared goodness-of-fit (X^2) and standardised root mean square residual, or SRMR), parsimony-corrected fit (root mean square error of approximation, or RMSEA), Comparative Fit Index (CFI) and comparative fit (Tucker-Lewis Fit Index (TLI)).[54–56 99 123 124 126–129] They advised using at least one index from the three fitness categories: absolute fit, incremental fit and parsimonious fit.[54–56 123 124 126–129] A model fit was indicated using a set of cut-off values: RMSEA values from 0.05 to 1.00, CFI >0.90 and Chisq/df<5.00, which would imply a reasonable fit.[53–56 126 129–131]

RESULTS

Findings for the pilot test through exploratory factor analysis

Out of the required minimum sample size of 125, a total of 106 participants took part in the quantitative pilot study, resulting in an 84.8% response rate. According to Hair *et al* and Awang *et al*, in order to conduct an EFA, at least 100 samples are needed.[54–56 97] However, considering a potential drop-out rate of 20%, the minimum required sample size for this pilot study is 125. Researchers performed an EFA to find the primary dimensions from a wide set of latent constructs represented by 42 items before conducting the CFA. EFA uses PCA as the extraction method to reduce data and create a hypothesis or model without pre-existing preconceptions about the variables' quantity or nature.[54–56 97 132] The EFA deemed indicators above 0.60 significant, and indicators loading into the same component were combined to match the measurement model.[97] The measurement model (for CFA) and structural model (for path estimation) of SEM will use EFA results.[54–56 97 99] EFA was used to evaluate and appraise the items measuring the construct, while CFA was used to validate the measurement.[12 43 44 50 61] EFA and CFA used pilot and field study data, respectively. EFA is a method used to select factors for retention or removal, using PCA and varimax rotation. It is a popular orthogonal factor rotation approach that clarifies factor analysis.[53 55 56 97 122] The extraction technique reduces the organisational factors (O) from nine to eight items, with one item, 'Organisational competency to provide the resources for the implementation of the Casemix system in THIS setting,' not reaching the factor loading of 0.6, hence it was [55 97] see table 1.

To prepare for the next stage, the researcher reorganises the objects into their respective components and begins data collection in the field study. The EFA results also reveal that the two components of the organisational characteristics (O) construct were later named organisational structure (STR) and organisational environment (ENV).[53 55 56 97 122] The instrument was used for 41 items in the field study and analysed with Cronbach's alpha, ensuring its internal reliability for the field study,[53–56 97 133] see table 2 below.

Consolidating correlated variables was EFA's primary goal. EFA established eight constructs from the pilot study data and according to the researcher's conceptual framework (See figure 1).[53–55] The overall results of KMO and Bartlett's sphericity test for all constructs, see table 3. The KMO value was 0.859, which is larger than 0.6. The result of Bartlett's test of sphericity shows that p value <0.001 yielded statistically significant findings, which is p value <0.05.[53 55 56 97 122] Therefore, it is appropriate to proceed with further study.

The amount of variance accounted for, referred to as total variance explained (TVE),[53–56 97] see table 1 (online supplemental file 9). Each component had an eigenvalue larger than 1 and the TVE was 84.07%, exceeding 60%.[53–56 97] The researcher should contemplate incorporating more items to assess the structures as it indicates that the existing items are inadequate for accurately assessing the constructs if the TVE is less than 60%. However, this does not occur in the present study.

The EFA approach also includes the scree plot. The researcher can ascertain the number of components by observing the distinct slopes in the scree plot.[53–56 97] The scree plot exhibits nine distinct slopes, as shown in figure 1 (online supplemental file 9). Hence, the EFA identifies a total of nine components.

Cronbach's alpha would calculate measuring each item's internal reliability. Internal reliability assesses how well the selected items measure the same construct.[53–56 97 133] All constructs topped 0.7 Cronbach's Alpha. Hence, this instrument is reliable for use in field study.

Findings for the field study through the confirmatory factor analysis

The ultimate measurement tool for field study comprises 41 elements from the EFA procedure. To adequately address the intricacy of the quantitative instrument for the field study, the researchers determined that a minimum of 300 samples was necessary to implement CFA.[97] An additional 20% drop-out rate resulted in a minimum sample size of 375 individuals for the field study. Hence, out of this sample, only 343 participants answered, indicating a response rate of 91.5%.[100] No missing data was reported.

CFA validates factor loading and assessment in this study. The researcher tests a theory or model using CFA.

Table 1 Factor loading of EFA with PCA and varimax rotation

	Rotated component matrix* component								
	1	2	3	4	5	6	7	8	9
PEOU1			0.908						
PEOU2			0.916						
PEOU3			0.889						
PEOU4			0.919						
PEOU5			0.895						
PU1								0.872	
PU2								0.888	
PU3								0.914	
PU4								0.872	
O1				*0.590*					
O2							0.873		
O3							0.746		
O4							0.874		
O5							0.861		
O6				0.827					
O7				0.864					
O8				0.808					
O9				0.882					
SY1					0.826				
SY2					0.821				
SY3					0.836				
SY4					0.853				
IQ1									0.614
IQ2									0.625
IQ3									0.654
IQ4									0.689
IQ5									0.619
SQ1		0.754							
SQ2		0.796							
SQ3		0.788							
SQ4		0.848							
SQ5		0.830							
ITU1	0.825								
ITU2	0.792								
ITU3	0.770								
ITU4	0.925								
ITU5	0.890								
A1						0.676			
A2						0.694			
A3						0.625			
A4						0.878			
A5						0.833			

Extraction method: principal component analysis.
Rotation method: varimax with Kaiser normalisation.
*Rotation converged in eight iterations.

Table 2 The number of items for each construct before and after EFA and Cronbach's alpha

No. of construct	Name of construct	Name of component	Item codes	Number of items before EFA	Number of items dropped	Number of items retained after EFA	Cronbach's alpha (>0.7)
1	System quality		SY1-SY5	4	–	4	0.968
2	Information quality		IQ1-IQ4	5	–	5	0.950
3	Service quality		SQ1-SQ5	5	–	5	0.902
4	Organisational factors		O1-O9	9	1	8	0.933
		Structure	O2-O5				0.958
		Environment	O6-O9				0.919
5	Perceived ease of use		PEOU1-PEOU5	5	–	5	0.969
6	Perceived usefulness		PU1-PU4	4	–	4	0.914
7	Intention to use		ITU1-ITU5	5	–	5	0.949
8	User acceptance		A1-A5	5	–	5	0.952
Total				**42**	**1**	**41**	

Unlike EFA, CFA is a form of structural equation modelling that makes assumptions and expectations about the number of factors and which factor theories or models best suit prior theory.[53–56 97] EFA relied mainly on outer loading; however, factor loadings and fitness indices are now considered. Researchers must confirm that both folds meet standards. CFA also lets academics test financial literacy indicators and measurement models. Thus, a proper measuring model helps researchers interpret their data.

Validity, unidimensionality and reliability were necessary for all latent construct assessment models.[53 55 56 97 122] The latent construct measurement model needed convergent, construct and discriminant validity.[53 55 56 97 122] AVE assesses convergent validity, while measurement model fitness indicators determine construct validity.[54–56] On the other hand, composite reliability (CR) was used to calculate instrument reliability since it was better than Cronbach's alpha.[54–56 133]

Figure 2 shows that Pooled-CFA validated all latent constructs in the measurement model simultaneously. These constructs were aggregated using double-headed arrows to execute a Pooled-CFA. Pooled-CFA's increased degree of freedom allows model identification even when some constructs have fewer than four components.[54–56]

Table 3 Results of the KMO and Bartlett's test of sphericity

Kaiser-Meyer-Olkin measure of sampling adequacy		0.859
Bartlett's test of sphericity	Approx. chi-square	4886.279
	df	861
	Sig.	0.000 (p<0.001)

Pooled-CFA was employed in this investigation since only one construct has two components.

Uni-dimensionality

Unidimensionality is a set of variables that can be explained by one construct.[7–9] Unidimensionality is achieved when all construct-specific measuring items have acceptable factor loading.[54–56] Remove CFA components with low factor loadings from the measurement model until fit indices are met.[53–56 97 134] Table 4 summarises the build items with factor loadings >0.6.[54–56]

Validity

Convergent validity

Convergent validity is a group of indicators that measures a construct.[54–56 97 135] It assesses the strength of correlations between items that are hypothesised to measure the same latent construct.[56 97] The average variance extracted (AVE) statistic can be used to verify the convergent validity of a construct. If the concept's AVE is more than 0.5, it possesses convergent validity.[53 56 97 136] Table 4 shows that the AVE for all structures was more than 0.5. Organisational characteristics/factors (ORG) AVE shows the highest AVE, which was 0.857, and environment component, the lowest AVE, which is 0.699. The model is, therefore, convergently valid.

Construct validity

When all model fitness indices met the criteria, construct validity was attained.[55 56 97] Construct validity was established using absolute, incremental and parsimonious fit indices.[55 56 97] Some researchers recommend using one fitness index from each model fit category.[55 56 97] This study employed RMSEA, CFI and normed chi-square (x2)/df as its main indicators. According to table 5, this

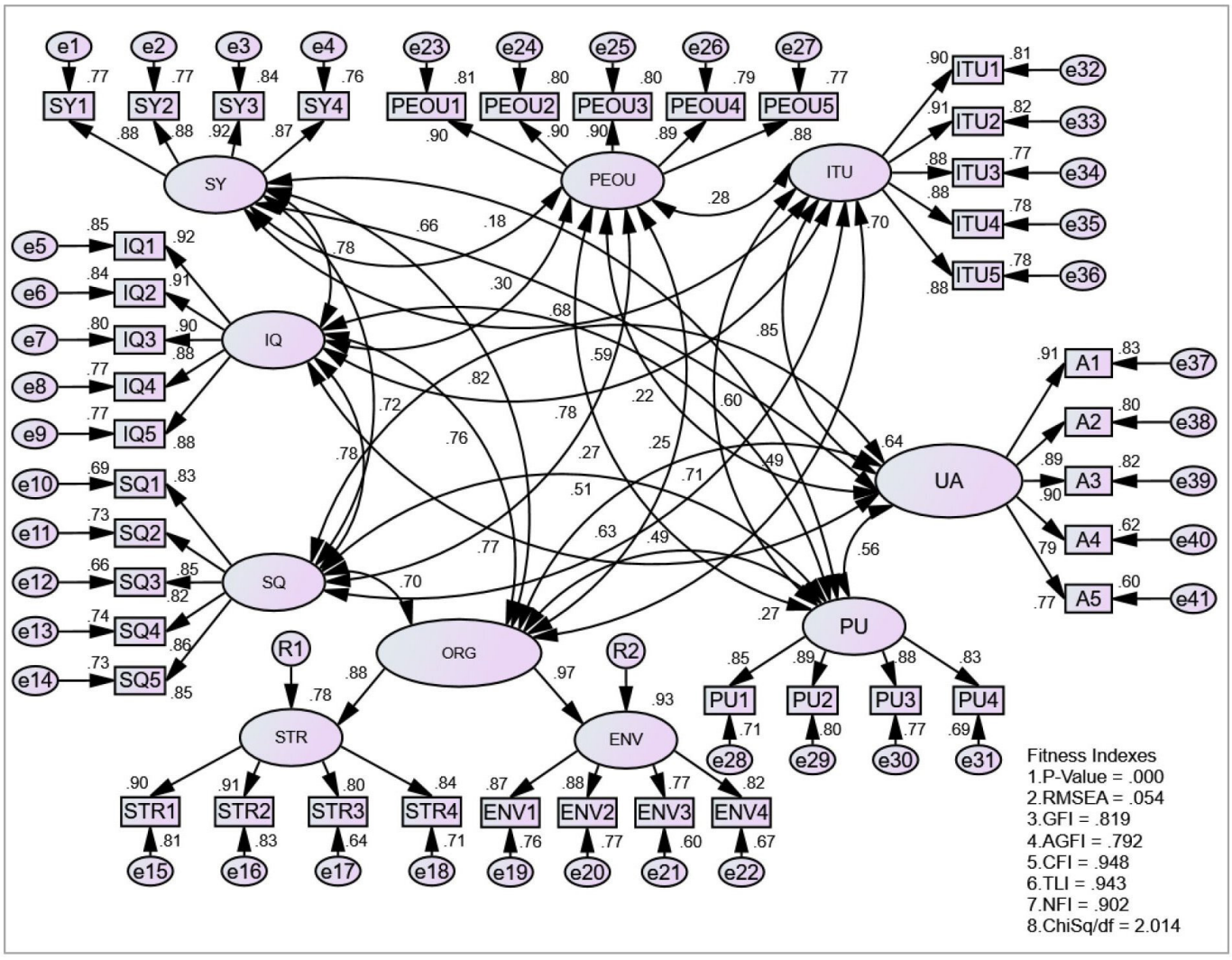

Figure 2 Result from Pooled-CFA procedure.

instrument met all three fitness indices: (1) the RMSEA value was below the threshold of 0.08 (0.054), confirming the absolute fit index; (2) the instrument achieved the incremental fit index category by obtaining a CFI value above 0.90; and (3) the parsimonious fit index, measured using Chisq/df, yielded a value of 2.014, which is below the accepted value of 3.0.[55 56 97] This study proved the instrument's construct validity.

Discriminant validity

The survey's discriminant validity was tested to ensure no redundant constructs were found in the model. The model is discriminant when the square root of the average variance extracted (AVE) for each construct is greater than its correlation value with other constructs.[55 56 136] Table 6 summarises the discriminant validity index, which showed that all constructs met the threshold.[55 56 136] The diagonal values (bold font) in this table were greater than all other values in their row and column, suggesting discriminant validity for all constructs.[55 56 136]

Composite reliability

Estimating model reliability uses composite reliability (CR).[55 56 97] CR between 0.6 and 0.7 is acceptable.[55 56 97] Table 4 above shows that the instrument's composite reliability exceeded 0.6 for all structures. The environment component had the lowest CR (0.903), while the information quality construct had the highest (0.954). Therefore, this instrument's composite reliability is accomplished.

Normality assessment

Each item evaluating the construct's distributional normality was assessed. All skewness values must be within the usual range.[56 97] Skewness between −1.5 and 1.5 is considered acceptable. All model components' skewness values are between −1.5 and 1.5, indicating their normal distribution.[56 97] The instrument's data distribution met the normality condition, as shown in table 4.

DISCUSSION

This study focused on redeveloping and validating an instrument to gauge medical doctors' intent to use and

Table 4 Factor loading of all items, composite reliability (CR) and average variant extracted (AVE) and normality testing

Construct	Component	Items	Factor loading	CR	AVE	Skewness
			(>0.6)	(>0.6)	(>0.5)	(–1.5 to 1.5)
System quality		SY1	0.876	0.936	0.787	–0.252
		SY2	0.880			–0.162
		SY3	0.917			–0.226
		SY4	0.873			–0.243
Information quality		IQ1	0.923	0.954	0.806	–0.294
		IQ2	0.914			–0.055
		IQ3	0.895			–0.138
		IQ4	0.879			–0.018
		IQ5	0.877			–0.127
Service quality		SQ1	0.829	0.925	0.710	–0.213
		SQ2	0.852			–0.233
		SQ3	0.815			–0.266
		SQ4	0.863			–0.175
		SQ5	0.852			–0.246
Organisational characteristics	Structure		0.883	0.923	0.857	
	Environment		0.967			
	Structure	STR1	0.898	0.922	0.747	–0.390
		STR2	0.912			–0.227
		STR3	0.801			–0.284
		STR4	0.842			–0.109
	Environment	ENV1	0.875	0.903	0.699	–0.184
		ENV2	0.876			–0.315
		ENV3	0.773			–0.088
		ENV4	0.816			–0.107
Perceived ease of use		PEOU1	0.901	0.951	0.796	–0.267
		PEOU2	0.896			–0.314
		PEOU3	0.896			–0.360
		PEOU4	0.889			–0.313
		PEOU5	0.879			–0.284
Perceived usefulness		PU1	0.845	0.920	0.742	–0.336
		PU2	0.893			–0.335
		PU3	0.879			–0.516
		PU4	0.828			–0.495
Intention to use		ITU1	0.899	0.951	0.794	–0.107
		ITU2	0.907			–0.209
		ITU3	0.879			–0.325
		ITU4	0.884			–0.306
		ITU5	0.885			–0.331
User Acceptance		A1	0.913	0.932	0.733	–0.532
		A2	0.894			–0.542
		A3	0.903			–0.441
		A4	0.788			–0.395
		A5	0.773			–0.413

Table 5 Fitness index summary

Fitness category	Name of the fitness index	Full name	Level of acceptance	Index value	Comment	Literature
Absolute fit	Chi-square	Discrepancy χ^2	p>0.05	<0.001	Not applicable (sample size >200)	97 163
	RMSEA	Root mean square of error approximation	<0.1 (The best <0.08)	0.054	Achieved	53 56 97
	GFI	Goodness of Fit Index	>0.85 (The best >0.9) (0.1–1.0)*	0.819	Achieved	53 56 97 163*
Incremental fit	AGFI	Adjusted goodness of fit	>0.85 (The best >0.9) (0.1–1.0)*	0.792	Achieved	53 56 97 164*
	TLI	Tucker-Lewis Index	>0.85 (The best>0.9)	0.943	Achieved	53 56 97
	CFI	Comparative Fit Index	>0.85 (The best >0.9)	0.948	Achieved	53 56 97
	NFI	Normed Fit Index	>0.85 (The best >0.9) (0.1–1.0)*	0.902	Achieved	53 56 97 165 *
Parsimonious fit	Chi-square/df	Chi-square/degree of freedom	<5.0 (The best <3.0)	2.014	Achieved	53 56 97

(level of acceptance is referred to literature with designator *

accept the Casemix system within the Total Hospital Information System (THIS) context. The EFA and CFA indicated that the instrument was well-designed and validated for assessing medical practitioners' acceptance of the Casemix system in THIS setting.[55 56 97] The acceptance of the Casemix system among medical physicians in hospital information systems was found to be influenced by various factors including system and service quality, perceived ease of use, usefulness, relevance to clinical practice, training and good organisational support, impact on efficiency and productivity, and confidence in information quality involving data accuracy and security. Healthcare organisations must address these components to gain physician acceptance.[43 44 137] They can optimise Casemix system use, improving patient care and results.[137]

Principal findings

Findings of Exploratory Factor Analysis (EFA)

The pilot test data was analysed using EFA, which helps researchers understand complex datasets and discover observed variable correlations.[55 56 97] EFA reduces variable dimensions by identifying common patterns, shaping fundamental factors that influence observable variables and grouping related variables.[122 126 138] It simplifies model design by computing factor loadings, which indicate the intensity and direction of factor-observable variable interactions. EFA also finds underlying components in a dataset, while CFA analyses and confirms an EFA-proposed factor structure.[55 56 97]

All structures underwent KMO and Bartlett's sphericity tests, with all structures having KMO values over 0.6.[55 56 105–107] The scree plot, part of EFA, was used to count components and found nine constructs on 42 items.[55 56 105–107] The study found that one construct should now have two parts, mainly due to demographic changes, particularly socioeconomic status and education. Component 1 explained 14.115% of construct variance, while component 9 explained 6.610%. All constructs had 84.07% total variance Explained (TVE), exceeding the minimum threshold of 60%.[55 56 60 112 129]

The EFA discovered nine components, including O1-O9 for organisational factors.[43 45 50 139] 41 of 42 items had factor loadings above 0.6, requiring item O1 to be

Table 6 Discriminant Validity Index

	SY	IQ	SQ	ORG	PEOU	PU	ITU	UA
System quality (SY)	**0.887**							
Information quality (IQ)	0.777	**0.898**						
Service quality (SQ)	0.725	0.780	**0.842**					
Organisational characteristics (ORG)	0.818	0.760	0.696	**0.926**				
Perceived ease of use (PEOU)	0.183	0.298	0.271	0.246	**0.892**			
Perceived usefulness (PU)	0.488	0.592	0.511	0.493	0.274	**0.861**		
Intention to use (ITU)	0.680	0.780	0.633	0.697	0.276	0.599	**0.891**	
User acceptance (UA)	0.660	0.770	0.641	0.711	0.219	0.563	0.848	**0.856**

eliminated.[53 55 56 97 122] Only organisational factors (O) had nine items reduced to eight following extraction. The remaining seven constructs had only one component and no additional components, resembling HOT-Fit and TAM framework organisational constructs.

The study stresses tool dependability and internal consistency, using markers such as Cronbach's alpha (α), person reliability, person measure and valid responses.[133 140] A Cronbach's alpha coefficient of 0.7 or above is acceptable in social science and other studies.[53 138 141 142] Internal reliability is measured by how well-selected items measure the same idea.[53–56 97 98 133 143] The researcher reordered questionnaire items for the field investigation, and CFA authenticated and confirmed all eight constructs on field data, which is elaborated further in the next Subsection 4.1.2.

Findings of Confirmatory Factor Analysis (CFA)

Once the pilot data was assessed and the EFA was commenced, the final questionnaire will be used in the quantitative field study. Eventually, another procedure will be conducted to validate the questionnaire, also known as CFA, based on the field study data. The CFA will validate the instrument's convergent, construct and discriminant validity. Unidimensionality, composite reliability and normality evaluations are also needed to reveal whether the instrument's items are valid.[53–56 97] Therefore, the findings of this study demonstrate that the quantitative instrument has been validated and proven reliable for assessing medical practitioners' intention to use and accept the Casemix system within the context of THIS. Using EFA and CFA is imperative for ensuring the instrument's validity, reliability and trustworthiness.[53–56 97]

By using EFA, the organisational factors (O) emerged into two components. The organisational factors (O) construct was renamed as organisational characteristics (ORG) in the measurement model, and the newly emerged components were named organisational structure (STR) and organisational environment (ENV). Measurement models refer to the implicit or explicit models that relate the latent variable to its indicators.[55 56 97] The organisational characteristics (ORG) construct is assessed as a second-order construct due to the emerged components. When dealing with a complex framework, researchers can choose to do the CFA individually for each second-order construct, and then followed by Pooled-CFA, through item parcelling or straight away employ Pooled-CFA.[55 56] The use of Pooled-CFA is beneficial because of its improved efficiency, effectiveness and ability to address identification difficulties.[55 56] However, although there are many constructs in this study, this measurement model only includes one second-order construct, which is the (ORG) construct with two emerged components. The other seven constructs are made up exclusively of first-order constructs, each consisting of a maximum of five items. Therefore, a direct Pooled-CFA was employed.[55 56]

This study uses CFA to validate factor loading and assessment in a theory or model.[53–56 97] CFA is a form of structural equation modelling that makes assumptions and expectations about the number of factors and which factor theories or models best suit prior theory.[53–56 97] According to Baharum *et al* in their few studies, they measured success factors in newly graduated nurses' adaptation and validation procedures.[129 144 145] Likewise, for example, CFA also allows academics to test financial literacy indicators and measurement models, ensuring that a proper measuring model helps researchers interpret their data as elaborated in a few studies.[146–148]

Validity, unidimensionality and reliability were necessary for all latent construct assessment models.[53 55 56 97 122] The latent construct measurement model needed convergent, construct and discriminant validity.[53 55 56 97 122] Convergent validity is assessed using the average variance extracted (AVE) statistic, while construct validity is determined by measurement model fitness indicators.[54–56] Composite reliability (CR) was used to calculate instrument reliability since it was better than Cronbach's alpha.[54–56 133]

Unidimensionality is a set of variables that can be explained by one construct.[7–9] Unidimensionality is achieved when all construct-specific measuring items have acceptable factor loading.[54–56] Convergent validity is a group of indicators that are considered to measure a construct.[54–56 97 135] Convergent validity is achieved when the concept's AVE is more than 0.5, and the highest AVE for all structures was 0.857.[53 56 97 136] Normality assessment was conducted on each item evaluating the construct's distributional normality, with skewness values within the usual range (−1.5 to 1.5).[56 97] The instrument's data distribution met the normality condition.

Construct validity is attained when all model fitness indices meet the criteria, using absolute, incremental and parsimonious fit indices.[55 56 97] The instrument met all three fitness indices, confirming the absolute fit index with RMSEA=0.054 (aim<0.1), achieving the incremental fit index category by obtaining a CFI value above 0.90 and yielding a parsimonious fit index of 2.014 (aim<5.0).[55 56 97]

Discriminant validity was tested to ensure no redundant constructs were found in the model.[55 56 136] The model obtained discriminant validity since each construct's square root of average variance extracted (AVE) is bigger than its correlation value with other constructs.[55 56 136] The summary discriminant validity index showed all constructs met discriminant validity.

The instrument's composite reliability exceeded 0.6 for all structures, with the environment component having the lowest CR (0.903) and the information quality construct having the highest (0.954).[55 56 136] Calculating model reliability with composite reliability (CR).[55 56 97] Acceptable CR is 0.6–0.7.[55 56 97] As shown in table 1, the instrument's composite reliability exceeded 0.6 for all constructs. The environment component (ENV) had the lowest CR (0.903), while information quality had the highest (0.954). Thus, this instrument's composite reliability is achieved.

Therefore, all necessary procedures to determine validity, reliability and normalcy were conducted, and no items were excluded. As a result, the total number of items remained at 41. Construct, convergent, discriminant validities and composite reliability have all been attained. All things satisfied the criteria of normality.

Strengths and weaknesses of the study

There are various ways in which this study could benefit the medical community and policymakers.[149 150] The research assesses important success elements that affect physicians' adoption of the Casemix system in hospitals that have a THIS. Policymakers and hospital administrators may find it easier to pinpoint the critical elements influencing the Casemix system's effective deployment with the aid of the study's findings.[151] To successfully implement clinical pathway/case management programmes, policymakers may find the study to help understand the significance of ongoing clinician support and acceptance, top management leadership and support, and a committed team of case managers, nurses and paramedical professionals.[151 152] Policymakers can potentially use the findings to impact admissions decisions, thereby increasing clinical practice openness.[152–154]

Strengths and limitations exist in this research. One of the strengths of the study was that it employed a sequential explanatory mixed-method approach to investigate the CSFs and acceptance of the Casemix system among medical practitioners in THIS.[58 155 156] The findings revealed that there might be unnoticed CSFs in the quantitative phase, suggesting the need for a qualitative method to identify more CSFs, perceptions and challenges/barriers. Quantitative data support hypothesised associations, but qualitative data provide in-depth data to supplement quantitative conclusions.[157] The mixed-method approach is expected to improve research design and yield more valid results.

Additionally, another strength of this study is that it uses a strict methodological approach to instrument development and validation. It uses both EFA with pilot test data and CFA using field data, which makes the instrument used for data collection more reliable and valid. Many statistical tests were used to make sure the instrument worked well and the analysis was accurate. These included the KMO measure, Bartlett's test of sphericity, systematic deletion of items based on factor loadings, Cronbach's alpha and different validity tests such as unidimensionality, construct validity, convergent validity and discriminant validity.[55 56 105–107]

Although the study had a large sample size, it was only conducted in five selected hospitals in Malaysia. Therefore, the findings may not accurately represent all THIS hospitals in the country or other healthcare systems. Other professional positions, including paramedics, medical record officers, information technology officers and finance officers, are not included in this study since their involvement and level of understanding in the Casemix system are not similar to that of medical practitioners, despite being relatively involved in the Casemix system. Hence, this may limit the generalisability of the findings could be a potential weakness of the study. The study's findings are likely to be distinctive/unique to the healthcare setting in Malaysia and may or may not be directly transferable to other nations or healthcare systems that have distinct sociocultural, organisational or technological characteristics. While this study's findings are rooted in Malaysia's healthcare setting, where the Casemix system and THIS are prevalent, their applicability to other countries or healthcare systems with different sociocultural, organisational or technological characteristics should be carefully considered. Despite this, there are potential avenues through which the insights gained from this research could benefit other nations or healthcare systems. For example, the principles of efficiency and effectiveness in healthcare management highlighted in this study could be adapted and implemented in various settings. Additionally, the lessons learnt from the challenges faced in Malaysia's healthcare system could serve as valuable guidance for other countries looking to improve their systems.

Strengths and weaknesses concerning other studies

Compared with previous studies, this research contributes to the field by providing a validated instrument tailored to assess the acceptance of the Casemix system within the THIS environment. Prior literature has examined various aspects of Casemix implementation in Malaysia as well as in other countries. However, no one has investigated Casemix in THIS or even in HIS. Thus, this study offers a comprehensive evaluation tool that addresses critical success factors influencing medical doctors' acceptance, filling a significant research gap. Given the absence of prior research in this area, the newly created quantitative tool would be advantageous in achieving the study objectives and serve as a point of reference for future investigations.

However, previous literature by Beth Reid describes the importance of developing Casemix-based hospital information system management.[33] The Casemix-based hospital information system is a comprehensive approach to healthcare management that involves estimating costs per diagnosis-related group (DRG), building a Casemix-based system and addressing organisational design and education issues for successful implementation.[33] It is crucial to provide Casemix reports to hospital staff and clinicians to identify errors in data. Improving the quality of data is essential for both hospitals and universities. To ensure the credibility of the HIS, it must tap into decentralised databases to ensure common input data for each patient's diseases and procedures.[33] Sharing data is beneficial for clinicians as it allows them to avoid investing time and effort in ensuring database accuracy to discover that the data used for Casemix activities, such as funding, is obtained from the medical record.[40] This approach is essential for ensuring the accuracy and efficiency of healthcare management.[33]

Additionally, a study by Saizan showed that THIS hospital showed the lowest Casemix performance in terms of accuracy of the main diagnosis, the completeness of other diagnoses, and the coding of main and other diagnoses.[16] This article outlines two themes with three subthemes, each theme based on why the performance is the lowest. These two themes are the poor commitment of clinicians and obstacles in the work process. Furthermore, another study revealed that one THIS hospital in Malaysia had the lowest Casemix performance in terms of main diagnosis accuracy, other diagnosis completeness, and main diagnosis and other diagnostic coding accuracy.[16] This article presents two overarching themes, each consisting of three subthemes based on the qualitative, in-depth interview findings. These themes are centred around the underlying reasons behind the lowest Casemix performance. The two main themes identified are the lack of dedication among professionals and the challenges encountered in the workflow.

Meaning of the study: possible explanations and implications

The validated and reliable instrument developed in this study holds implications for clinicians, policymakers and healthcare organisations aiming to optimise Casemix system implementation within HIS. Identifying critical factors influencing acceptance, such as system, information and service quality, is imperative to meet study objectives. Organisational characteristics such as environment and structure, as well as human factors such as perceived ease of use and perceived usefulness, the findings offer actionable insights for enhancing system adoption, utilisation and success. Policymakers and hospital administrators can use these findings to streamline Casemix deployment strategies, improving patient care outcomes and operational efficiency within the THIS.

First, while the specific details of the findings may not directly translate to other contexts, the underlying principles and methodologies employed in this study can serve as a valuable template for researchers in different settings. By adapting and contextualising the research methods and instruments used in this study, researchers in other countries can conduct similar investigations tailored to their healthcare environments.[158 159]

Second, the identification and evaluation of critical success factors for implementing healthcare information systems, such as the Casemix system, are universal challenges healthcare organisations face worldwide.[33 158 160] Because of this, the conceptual framework and analytical methods created in this study can help us understand what makes people accept and use these kinds of systems in different situations. Researchers and policymakers in other countries can leverage these insights to inform their strategies for implementing and optimising healthcare information systems.

Additionally, while the contexts and details of the Casemix system and THIS may vary across different countries, the broader goals of improving resource allocation, clinical decision-making and quality of care are shared objectives across healthcare systems globally. Therefore, the findings of this study, particularly regarding the factors influencing system acceptance and success, have the potential to resonate with stakeholders in other countries who are working towards similar goals.[151 161 162]

Overall, while recognising the contextual specificity of the study's findings, there is potential for the insights generated to contribute to the broader body of knowledge on healthcare information systems and inform practices in other countries or healthcare settings with distinct characteristics. Through collaboration and adaptation, the lessons learnt from this research can be extrapolated and applied to diverse healthcare contexts, ultimately contributing to advancing healthcare delivery worldwide.[33 158 160] By sharing best practices and lessons learnt, healthcare systems around the world can benefit from the findings of this study and improve their information systems. This collaborative approach can lead to more efficient and effective healthcare delivery on a global scale.

Unanswered questions and future research

The current study proposes employing this instrument in future research, broadening the target population to include more professional occupations and increasing the sample size for more robust results. The novelty of this research lies in its comprehensive analysis of the direct and indirect effects of these parameters on user acceptance of implementing Casemix within THIS environment. SEM was employed to investigate the proposed model. Apart from that, mediating effects have been examined in this study involving a few critical constructs, such as PEOU, PU and ITU, using similar analysis methods. Additionally, more information on moderating characteristics, including age, gender, professional positions, degree of education, years of experience in MOH Malaysia and current THIS hospital and Casemix system knowledge, could improve the instrument. These moderating effects were examined using SEM as well.

The innovation of this study is that it examines the CSFs that influence the acceptance of the Casemix system in the THIS environment, specifically in MOH hospitals in Malaysia. The immediate findings have clear significance for healthcare organisations and policymakers in Malaysia, and even globally. However, the more significant implications for readers in other countries are also relevant. First and foremost, recognising CSF in implementing the Casemix system provides valuable information that can be applied to healthcare systems, especially those equipped with THIS facility universally. Gaining insight into these aspects can provide valuable strategic decision-making guidance in other nations seeking to implement or improve similar systems within their healthcare infrastructure.

Furthermore, the study uses a methodological approach that involves the use of a mixed-methods approach. The quantitative phase, elaborated on in this article, employs a reliable quantitative instrument that validates exploratory

and confirmatory factor analyses and reliability testing. Moreover, semi-structured, in-depth interviews were conducted with the Deputy Directors representing the top management and the CSCs of 5 participating hospitals. Hence, these mixed-methods studies provide a strong foundation for evaluating the adoption of the Casemix system within healthcare information systems. Readers from different countries might use and modify these approaches to conduct comparable investigations in their specific circumstances, enhancing the comprehension of healthcare informatics worldwide.

Moreover, the study highlights the significance of interdisciplinary collaboration among healthcare practitioners, technology specialists and policymakers in facilitating the practical application of the Casemix system as one of the clinical and costing modules essential in healthcare settings, especially in facilities equipped with HIS. This interdisciplinary approach to tackling issues in healthcare informatics is generally applicable and can be implemented in various countries and healthcare systems.

To summarise, this study's immediate findings may address the CSF of the Casemix system implementation within THIS of the healthcare system in Malaysia. However, its broader significance lies in providing valuable insights, methodological frameworks and interdisciplinary approaches that can be applied globally to adopt the Casemix system within the realm of the HIS in other countries, and it is not only applicable locally in the Malaysian setting.

CONCLUSION

In summary, this research has comprehensively evaluated the fundamental principles outlined in the conceptual framework. Various methodological approaches, including content validity, criterion validity, translation, pre-testing for face validity, pilot testing using EFA and field study employing CFA, have been employed to assess the validity of the items.[12 43 44 50 61] The EFA analysis computed KMO, Bartlett's test for sphericity and Cronbach's alpha values, all meeting the criteria for sample adequacy, sphericity and internal reliability.[53–56 97] Additionally, the CFA analysis tested for unidimensionality, construct validity, convergent validity, discriminant validity, composite reliability and normality, further confirming the validity and reliability of the instrument used to evaluate critical success factors and the acceptance of the Casemix system within the THIS context.[53–56 97]

Consequently, this validated instrument holds promise for future quantitative analyses, including covariance-based structural equation modeling (CB-SEM) or variance-based structural equation modeling (VB-SEM). In this study, CB-SEM, in conjunction with SPSS-AMOS V.24.0, was used to explore the direct, indirect, mediating and moderating effects among the constructs outlined in the conceptual framework. The findings from these quantitative analyses will be presented in forthcoming articles, providing further insights into the Casemix system's applicability within the current healthcare landscape. Moreover, the instrument's demonstrated statistical reliability and validity position is a valuable tool for future research endeavours concerning the Casemix system in the THIS context, addressing an existing research gap. With the establishment of the instrument's normality, validity and reliability, it can now be considered operational and validated for use in subsequent studies. This research holds the potential to enhance our understanding of the critical success factors and acceptance of the Casemix system, thereby facilitating its improved implementation within the THIS setting. Moving forward, the instrument will be instrumental in conducting further research initiatives to assess the adoption and effectiveness of the Casemix system in THIS environment, addressing a current scarcity of literature.

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The National University of Malaysia

CENTER FOR RESEARCH AND INSTRUMENTATION MANAGEMENT CENTER FOR RESEARCH AND INSTRUMENTATION MANAGEMENT

Reference: UKM PPI/111/8/JEP-2022-777

Date: January 13, 2023

Associate Major (PA) Dr. Roszita Ibrahim
Department of Community
Health Chancellor Tuanku Muhriz
Hospital UKM Medical Center

Y. Bhg. Professor/Datuk/Dato'/Datin/Sir/Madam,

ETHICS APPROVAL OF CONDUCTING RESEARCH AT UKM

Tajuk Penyelidikan : *Critical Success Factors And The Acceptance Of Casemix System Implementation In Total Hospital Information System Of The Ministry Of Health Malaysia*

The above is referred to.

2. Pleased to be informed, the UKM Research Ethics Committee approved the research application of Y. Bhg. Professor/Datuk/Dato'/Datin/Sir/Madam for the title above. The research approval period is from January 12, 2023 to January 11, 2025. Please submit any Side Effects Report, Progress Report Every 6 Months and Final Report as soon as the research is finished to the UKM Research Ethics Committee.

3. Please be reminded that this research project can only be carried out after receiving a letter of approval to carry out research from the Faculty's Deputy Dean of Research or Center/Institute Director.

Thank you.

Yours sincerely,

[redacted]

Chairman
of the Research Ethics Committee of
the National University of Malaysia

s.k.
- Director of
the Center for Research Management and Instrumentation (CRIM)
of Universiti Kebangsaan Malaysia
- Director
Tuanku Muhriz Chancellor Hospital,
UKM Medical Center
- Deputy Dean (Research & Innovation)
Secretariat of Medical Research & Innovation
Chancellor Tuanku Muhriz
Hospital UKM Medical Center

Universiti Kebangsaan Malaysia Research Ethics Secretariat 1st
Floor, Tuanku Muhriz Chancellor Hospital Clinical Block, UKM Medical Center, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras Kuala Lumpur.
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The National University of Malaysia

PUSAT PENGURUSAN PENYELIDIKAN DAN INSTRUMENTASI • *CENTRE FOR RESEARCH AND INSTRUMENTATION MANAGEMENT*

- **Ketua Jabatan Kesihatan Masyarakat**
  Hospital Canselor Tuanku Muhriz
  Pusat Perubatan UKM

- **Profesor Dato' Dr. Syed Mohamed Aljuni Syed Junid**
  Senior Public Health Medicine Consultant
  Professor of Health Economics
  Policy and Management Founding Chair Department of Health Policy and Management
  Faculty of Public Health
  Kuwait University

- **Profesor Madya Dr. Azimatun Noor Aizuddin**
- **Dr. Noor Khairiyah Mustafa (P115190 – Calon PhD)**
  Jabatan Kesihatan Masyarakat
  Hospital Canselor Tuanku Muhriz
  Pusat Perubatan UKM

- Fail Surat Kelulusan 2022

FI/FMZ

Sekretariat Etika Penyelidikan Universiti Kebangsaan Malaysia
Tingkat 1, Blok Klinikal, Hospital Canselor Tuanku Muhriz,Pusat Perubatan UKM, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras Kuala Lumpur.
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UNIVERSITI KEBANGSAAN MALAYSIA
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PUSAT PENGURUSAN PENYELIDIKAN DAN INSTRUMENTASI • *CENTRE FOR RESEARCH AND INSTRUMENTATION MANAGEMENT*

NAME OF ETHICS COMMITTEE/IRB: Research Ethics Committee, The National University of Malaysia	**ETHICS COMMITTEE/IRB REF NO :** **UKM PPI/111/8/JEP-2022-777**
PROTOCOL TITLE: Critical Success Factors And The Acceptance Of Casemix System Implementation In Total Hospital Information System Of The Ministry Of Health Malaysia	
PRINCIPAL INVESTIGATOR: Mejar Bersekutu (PA) Dr. Roszita Ibrahim Department of Community Heatlh Hospital Canselor Tuanku Muhriz UKM Medical Centre	

The following items [X] have been received and reviewed in connection with the above study to be conducted by the above investigator.

Documents

[X] Research Application Form
[X] Research Proposal / Protocol
[ ] Publication Policy
[X] Non-Disclosure Agreement
Information Sheet:-
[X] Malay [X] English
Consent Form:-
[X] Malay [X] English
Questionnaire:-
[X] Malay [X] English
Curriculum Vitae of Researcher:-
[X] Principal [X] Co-researcher [X] Student
[X] Good Clinical Practice Certificate (GCP)
[ ] Project Agreement

The Research Ethics Committee, The National University of Malaysia operates in accordance to the International Conference of Harmonization Good Clinical Practice Guidelines.

Comments (if any): Associate Professor Dr. Azimatun Noor Aizuddin is the co-investigator for this study and also member of Research Ethics Committee. She strictly was not involved in the decision of Research Ethics Committee to approve this study.

Date of Approval: 12 January 2023

[redacted]

Chairman
Research Ethics Committee
The National University of Malaysia

Sekretariat Etika Penyelidikan Universiti Kebangsaan Malaysia
Tingkat 1, Blok Klinikal, Hospital Canselor Tuanku Muhriz,Pusat Perubatan UKM, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras Kuala Lumpur.
Telefon: +603-9145 5046 / 5048
Email: sepukm@ukm.edu.my Web: http://research.ukm.my/jepukm/

MEDICAL RESEARCH & ETHICS COMMITTEE MINISTRY OF HEALTH
MALAYSIA MINISTRY OF HEALTH MALAYSIA National
Institute of Health Complex (NIH) No. 1, Jalan Setia Murni U13/52,
Section U13 Bandar Setia Alam, 40170 Shah Alam, Selangor.

Tel.: +(6)03-33628888/ 33628205

Ruj. Kamil Ref: 22-02621-DKX Date/ Date: 2-02-2023

NOOR KHAIRIYAH BINTI MUSTAFA PUTRAJAYA HOSPITAL

Dato'/ Dr/ Sir/Madam,

ETHICS APPROVAL LETTER/LETTER OF ETHICAL APPROVAL:

NMRR ID-22-02621-DKX (IIR)
CRITICAL SUCCESS FACTORS AND THE ACCEPTANCE OF CASEMIX SYSTEM IMPLEMENTATION IN TOTAL HOSPITAL INFORMATION SYSTEM OF THE MINISTRY OF HEALTH MALAYSIA

With respect the above is referred.

This letter is made in reference to the matter above.

2. Along with this letter is attached the letter of scientific and ethical approval for this project. All records and subject data are CONFIDENTIAL and only used for research purposes and all issues and procedures regarding data confidentiality must be followed. Permission from the Director of the Hospital / Institution where the study will be conducted must be obtained first before the study is conducted. Dato'/Mrs/Mrs need to agree and comply with the decision and other related laws.

*The Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia (MOH) has provided ethical approval for this study. Please take note that all records and data are to be kept strictly **CONFIDENTIAL** and can only be used for the purpose of this study. All precautions are be taken to maintain data confidentiality. Permission from the District Health Officer / Hospital Administrator/ Hospital Director and all relevant heads of departments /units where the study will be carried out must be obtained prior to the study. You are required to follow and comply with their decision and all other relevant regulations.*

3. Researchers and research locations involved are:

The investigators and sites involved in this study are:

Putrajaya Hospital
Noor Khairiyah Binti Mustafa (Principal Investigator)

Sultanah Bahiyah Hospital, Alor Setar
Noor Khairiyah Binti Mustafa (Principal Investigator)

Sultan Ismail Hospital
Noor Khairiyah Binti Mustafa (Principal Investigator)

.../4-

Ref. Us/ Ref: 22-02621-DKX

Sultanah Nur Zahirah Hospital, Kuala Terengganu Noor Khairiyah
Binti Mustafa (Principal Investigator)

Sarawak Heart Center Noor
Khairiyah Binti Mustafa (Principal Investigator)

4. The following study documents have been received and reviewed with reference to the above study:

The following study documents have been received and reviewed with reference to the above study:

Documents received and reviewed with reference to the above study: Documents received and reviewed with reference to the above study:

1. Cover letter to JEPP Cover letter to MREC (Version 1, dated 12-30-2022)
2. Declaration of Conflict of Interest Declaration of Conflict of Interest (COI) (Version 1, dated 12-30-2022)
3. Protocol Protocol (Version 1, dated 12-30-2022)
4. English Version: Patient Information Sheet & Informed Consent Form (Versi/ Version 1, dated 12-30-2022)
5. Malay Version: Patient Information Sheet & Informed Consent Form (Versi/ Version 1, dated 12-30-2022)
6. Data Collection Form Data Collection Form (Version 1, dated 12-30-2022)
7. English Version: Questionnaire (Version 1, dated 12-30-2022)
8. Malay Version: Questionnaire (Version 1, dated 12-30-2022)
9. Interview Guideline (Version 1, dated 12-30-2022)

Ref. Us/ Ref: 22-02621-DKX

10. Gantt Chart Gantt Chart (Version 1, dated 12-30-2022)

11. IA-HOD-IA, CV & GCP certificate/ certificate of GCP: Noor
    - Khairiyah Binti Mustafa

8. Be informed that this approval is valid until 01-02-2024. You need to send the following documents after getting ethical approval. The relevant forms can be downloaded from the National Medical Research Registry (NMRR) website.

*Please note that the approval is valid until **01-02-2024**.The following are to be reported upon receiving ethical approval. Required forms can be obtained from the National Medical Research Registry (NMRR) website.*

i. Continuing Review Form at the latest within 2 months (60 days) before the end of this approval period to renew ethics approval.

***Continuing Review Form** has to be submitted to MREC within 2 months (60 days) prior to the expiry of ethical approval.*

i. Study Final Report at the end of the study to JEPP.

***Study Final Report** upon study completion to the MREC.*

iii. Obtain ethical approval if there are amendments to any study document/study location/researcher. The JEPP has the right to withdraw ethical approval in the event of unannounced changes to study documents.

*Ethical approval is required in the case of **amendments/ changes** to the **study documents/ study sites/ study team**. MREC reserves the right to withdraw ethical approval if changes to study documents are not completely declared.*

iv. Clinical intervention studies only: Reports on all Serious Adverse Events (SAEs), Suspected Unexpected Serious Adverse Reactions (SUSARs) and Protocol Deviation/Violation at the study site approved by JEPP if applicable. SAE must be reported within 15 calendar days from the awareness of the event by the researcher. The initial SUSAR report must be submitted as early as possible but not later than 7 calendar days from the researcher's awareness of the incident, followed by a complete report within an additional 8 calendar days.

***Applicable for Clinical interventional Studies only:** Report occurrences of **all Serious Adverse Events (SAEs), Suspected Unexpected Serious Adverse Reaction (SUSARs)** and **Protocol Deviation/Violation** at all MREC approved sites to MREC. SAEs are to be reported within 15 calendar days from awareness of event by investigator. Initial report of SUSARs are to be reported as soon as possible but not later than 7 calendar days from awareness of event by investigator, followed by a complete report within 8 additional calendar days.*

9. The number of subjects/patients/respondents who will be involved in this study in Malaysia is 452 people.

*There will be **452 subjects/ patients/ respondents** involved in this study within Malaysia.*

Ref. Us/ Ref: 22-02621-DKX

10. Please be aware that any correspondence related to this research should mention the reference number of this letter to smooth related matters.

Please take note that the reference number of this letter must be stated in all future correspondence related to this study to facilitate the administrative processes.

The Medical Ethics & Research Committee, Ministry of Health Malaysia, operates according to the Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH). Any JEPP member involved in the evaluated study/project will not participate in the approval of the study/project.

The Medical Research & Ethics Committee, Ministry of Health Malaysia, operates in accordance to the International Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH). Any member of the MREC who is involved in the study/ project under review will not participate in the approval of the study/ project.

Study location/ Project Sites:
PUTRAJAYA HOSPITAL SULTANAH
BAHIYAH HOSPITAL, ALOR SETAR SULTAN ISMAIL
HOSPITAL
SULTANAH NUR ZAHIRAH HOSPITAL, KUALA TERENGGANU, SARAWAK
HEART CENTER

Decision by Medical Research & Ethics Committee: (√) Approved

() Did not pass/ Disapproved

Date of Ethical Approval: 02-02-2023

Thank you. Thank you.

I run the trust,

.....
Chairperson
of the Medical Research &
Ethics Committee of the Ministry of Health Malaysia

MREC_Share\Approval 2023\Expedited by Primary Reviewer\February 2023\22-02621-DKX

QUESTIONNAIRE
(BORANG KAJI SELIDIK)

Title: Critical Success Factors and the Acceptance of Casemix System Implementation in Total Hospital Information System of The Ministry of Health Malaysia

Tajuk: Faktor Kejayaan Kritikal Dan Penerimaan Bagi Pelaksanaan Sistem Casemix di Sistem Maklumat Hospital Menyeluruh Di Kementerian Kesihatan Malaysia

INSTRUCTIONS
ARAHAN

This questionnaire is divided into three sections which consists of **i) Personal Details, ii) The Critical Success Factors of Casemix Implementation in THIS and iii) Outcome of the study which is the Acceptance Level towards Casemix System implementation in THIS setting.** The purpose of this study is to examine the critical success factors and the acceptance of casemix System implementation in THIS facilities of the Ministry of Health (MoH) Malaysia among medical doctors in the hospital levels including the top management (medical doctors) as well as the clinicians.

*Borang soalselidik ini terbahagi kepada tiga bahagian, iaitu **i) Maklumat Peribadi, ii) Faktor Kejayaan Kritikal bagi Pelaksanaan Sistem Casemix di hospital yang dilengkapi fasiliti THIS dan iii) Hasil kajian iaitu Tahap Penerimaan terhadap Pelaksanaan Sistem Casemix di hospital yang dilengkapi fasiliti THIS.** Tujuan kajian ini adalah untuk mengkaji faktor-faktor kejayaan kritikal serta tahap penerimaan bagi Pelaksanaan Sistem Casemix di hospital-hospital Kementerian Kesihatan Malaysia yang dilengkapi fasiliti THIS di kalangan para doctor di peringkat hospital yang terdiri daripada pengurusan tertinggi (dari kalangan doctor perubatan) serta para doktor klinikal.*

Please indicate your most appropriate response. All information and your chosen answers will be kept confidential. This study has also received ethical approval from the Medical Research Ethics Committee from the Ministry of Health Malaysia (NMRR-ID-22-02621-DKX) and from Universiti Kebangsaan Malaysia (JEP-2022- 777). For more information or clarification, do not hesitate to contact the Principal Researcher via her email address: p115190@siswa.ukm.edu.my or you can contact her via WhatsApp at 012-6161342.

*Sila tandakan jawapan pilihan anda. Semua maklumat dan jawapan pilihan anda akan dirahsiakan. Kajian ini juga telah mendapat kelulusan etika daripada Jawatankuasa Etika Penyelidikan Perubatan dari Kementerian Kesihatan Malaysia **(NMRR-ID-22-02621-DKX)** dan dari Universiti Kebangsaan Malaysia **(JEP-2022-777)**. Untuk maklumat lanjut atau penjelasan, jangan teragak-agak untuk menghubungi Penyelidik Utama melalui alamat e-mel beliau: **p115190@siswa.ukm.edu.my** atau anda boleh menghubunginya melalui WhatsApp di **012-6161342.***

DEFINITIONS OF TERMS AND ACRONYM
DEFINISI BAGI TERMA DAN AKRONIM

Here are some definitions of terms and acronyms that will be used in this questionnaire: *Berikut ialah beberapa definisi istilah dan akronim yang akan digunakan dalam soal selidik ini:*

1) Casemix System: A system that **provides the healthcare industry with a consistent method of classifying types of patients, their treatment and associated costs**. It involves developing and implementing a patient classification system that groups patients according to their clinical conditions.
1) Sistem Casemix: *Sistem yang **menyediakan industri penjagaan kesihatan dengan kaedah yang konsisten bagi mengklasifikasikan jenis pesakit, rawatan mereka dan kos yang berkaitan**. Ia melibatkan pembangunan dan pelaksanaan sistem klasifikasi pesakit yang mengumpulkan pesakit mengikut keadaan klinikal mereka.*

2) **Total Hospital Information System (THIS):** It is a project by the Ministry of Health (MOH) with the objective to provide a **complete ICT system** in establishing a **paperless** hospital environment in order to offer quality health services to the public- **an integration of clinical, administrative and financial systems.**
2) Total Hospital Information System (THIS*): Ia adalah projek Kementerian Kesihatan (KKM) dengan objektif untuk menyediakan **sistem ICT yang lengkap** dalam mewujudkan **persekitaran hospital tanpa kertas** untuk*

*menawarkan perkhidmatan kesihatan yang berkualiti kepada orang ramai—**satu integrasi sistem klinikal, pentadbiran dan kewangan**.*

3) **MalaysianDRG Casemix System: A comprehensive system that records casemix data** (i.e demographic profiles, patient's encounter on arrival and admissions of patients, diagnosis, treatment, investigations and procedures, discharge numbers, patients' bed days) **from the hospitals to flow into the MOH data pool.**
3) MalaysianDRG Casemix System: Sistem komprehensif yang merekodkan data casemix *(iaitu **data demografik pesakit, data kedatangan dan kemasukan pesakit,** diagnosis, rawatan, penyiasatan dan prosedur, nombor pelepasan, hari tidur pesakit)* ***dari hospital untuk mengalir ke kumpulan data KKM*.**

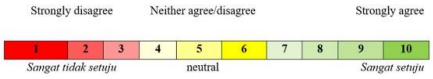
4) **Sistem Maklumat Rawatan Pesakit (SMRP): A comprehensive medical treatment report system linking all hospitals in the country.** The required data is entered manually (manual/ some BHIS/IHIS hospitals) or through integration from HIS (most THIS) and will be then integrated into MalaysianDRG Casemix System.
4) Sistem Maklumat Rawatan Pesakit (SMRP): Sistem laporan rawatan perubatan yang komprehensif menghubungkan semua hospital di negara ini*. Data yang diperlukan dimasukkan secara manual (manual/ beberapa hospital BHIS/IHIS) atau melalui integrasi daripada HIS (kebanyakan hospital THIS) dan kemudiannya akan disepadukan ke dalam Sistem MalaysianDRG Casemix*

Thank you for your cooperation.
Terima kasih atas kerjasama yang telah diberikan.

SECTIONS		
SECTION 1A **Demographic Profile and Duration of Service** ***Profil Demografi dan Pengalaman Bekerja***		Please fill in/tick (√) your response in the appropriate boxes. *Sila isikan/tandakan √ pada kotak jawapan pilihan anda.*
1	Gender *Jantina*	□ Male (Lelaki) □ Female (Wanita)
2	Age (in years) *Umur (dalam tahun)*	____years (tahun)
3	Hospital *Hospital*	□Hospital Putrajaya, WP Putrajaya □Hospital Sultanah Nur Zahirah, Kuala Terengganu, Terengganu □Hospital Sultan Ismail, Johor Bahru, Johor □Sultanah Bahiyah, Alor Setar, Kedah □Pusat Jantung Sarawak, Kota Samarahan, Sarawak
4	Professional Role or Position *Peranan/Jawatan*	□ Hospital Director (Pengarah Hospital) □ Deputy Director (Timbalan Pengarah) □Consultant Specialist/Specialist (Pakar Perunding/Pakar) □Medical Officer (Pegawai Perubatan) □House Officer (Pegawai Perubatan Siswazah)
5	Education Background *Latar Belakang Pendidikan Tertinggi*	□Post-Doctorate (Pasca- Doktor Falsafah) □Philosophy Doctor (PhD)/Ijazah Doktor Falsafah □Sub-Specialty (Sub-Kepakaran) □Master's Degree (Ijazah Sarjana) □Bachelor's Degree (Ijazah Sarjana Muda)
6	Duration of years working in Ministry of Health Malaysia (in years) *Tempoh perkhidmatan dalam Kementerian Kesihatan Malaysia (dalam tahun)*	____years (tahun) ____
7	Duration of service at current hospital (in years) *Tempoh perkhidmatan di hospital ini (dalam tahun)*	_____years (tahun)
8	Have you ever undergone training related to the Casemix system during your service at the Ministry of Health?	□ Yes (Ya) □No (Tidak)

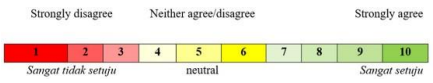
	Pernahkah anda menjalani latihan berkaitan sistem Casemix sepanjang perkhidmatan anda di Kementerian Kesihatan?									
	SECTION 1B **Knowledge on Casemix (Pengetahuan mengenai Casemix)**	Please indicate your responses based on the scale from 1-10, with 1 being 'no knowledge, and 10 being 'Excellent Knowledge' *Sila tandakan jawapan pilihan anda mengikut skala dari 1-10, di mana 1 adalah 'tiada pengetahuan', dan 10 adalah 'pengetahuan yang sangat baik* 									
1	Casemix system is one of the MOH's strategy to improve quality of health care in medical and health facilities in Malaysia. *Sistem Casemix merupakan salah satu strategi KKM untuk menambahbaik kualiti penjagaan kesihatan difasiliti perubatan dan kesihatan di Malaysia.*	1	2	3	4	5	6	7	8	9	10
2	The MalaysianDRG casemix system was introduced by the Ministry of Health (MOH) in October 2010 and subsequently implemented throughout the entire country. *Sistem casemix MalaysianDRG telah diperkenalkan oleh Kementerian Kesihatan (KKM) pada Oktober 2010dan seterusnya dilaksanakan di seluruh negara.*	1	2	3	4	5	6	7	8	9	10
3	The main objective of Casemix System is meant for estimating the costs which has been spent for each Diagnosis Related Group (DRG) or Main diagnosis Category (MDC). *Objektif utama pelaksanaan Sistem Casemix adalah untuk menganggar kos rawatan yang dibelanjakan keatas sesuatu Diagnosis Related Group (DRG) or Main diagnosis Category (MDC).*	1	2	3	4	5	6	7	8	9	10
4	Casemix System is involving and evaluating both clinical and costing data. *Sistem Casemix melibatkan dan menilai kedua-dua data klinikal dan kewangan.*	1	2	3	4	5	6	7	8	9	10
5	Casemix System is involving healthcare workers from various positions and disciplines. *Sistem Casemix melibatkan kakitangan kesihatan daripada pelbagai jawatan dan disiplin.*	1	2	3	4	5	6	7	8	9	10
6	The implementation of the Casemix system that contains clinical data will involve demographic profiles, patient's encounter on arrivaland admissions of patients, diagnosis, treatment, investigations and procedures.	1	2	3	4	5	6	7	8	9	10

	Pelaksanaan Sistem Casemix yang mengandungi data klinikal akan melibatkan data demografik pesakit,data kedatangan dan kemasukan pesakit, diagnosis,rawatan, ujian-ujian dan prosedur.										
7	The implementation of the Casemix system that contains financial data will involve discharge numbers, patients' bed days, encounter/workload for inpatient, percentage of time spent, hospital expenditure, building value, land value, outpatient and daycare, space areas, annual emolument, assets purchased, medical/health/dental supplies, out-of-pockets and medical aid supports. *Pelaksanaan sistem Casemix yang mengandungi data kewangan akan melibatkan nombor discaj, hari tidur pesakit, pertemuan/beban kerja untuk pesakitdalam, peratusan masa yang dihabiskan, perbelanjaan hospital, nilai bangunan, nilai tanah, pesakit luar dan jagaan harian, kawasan ruang, emolumen tahunan, aset yang dibeli, bekalan perubatan/kesihatan/pergigian, perbelanjaan luar poket dan sokongan bantuan perubatan.*	1	2	3	4	5	6	7	8	9	10
8	The implementation of the Casemix System requires healthcare staff to provide accurate primary diagnosis, complete secondary diagnosis and accurate main procedures, and a complete list of other procedures/ treatment/ investigations. *Pelaksanaan Sistem Casemix memerlukan kakitangan penjagaan kesihatan untuk menyediakan diagnosis utama yang tepat, diagnosis lain yanglengkap dan prosedur utama yang tepat, dan senarai lengkap prosedur/rawatan/penyiasatan lain.*	1	2	3	4	5	6	7	8	9	10
9	Implementing Casemix System in Total Hospital Information System (THIS) will integrate all required data into the Sistem Maklumat Rawatan Pesakit (SMRP), the MalaysianDRG Casemix System, and finally into Executive Information System. *Dengan pelaksanaan Sistem Casemix dalam Sistem Maklumat Hospital Jumlah (THIS), semua data yang diperlukan akan disepadukan ke dalam Sistem MaklumatRawatan Pesakit (SMRP), Sistem Casemix MalaysianDRG dan akhirnya ke dalam Executive Information System.*	1	2	3	4	5	6	7	8	9	10
10	Monitoring and evaluation is done through indicators that have been specially prepared for the Casemix System by the Malaysian Ministry of Health through the MalaysianDRG Casemix System application, as well as monitors through the audit function in the system as well as through audit documentation and codes on Per-PD 301. *Pemantauan dan penilaian dilakukan melalui indikator-indikator yang telah disediakan khas untuk Sistem Casemix oleh pihak KementerianKesihatanMalaysia melalui aplikasi*	1	2	3	4	5	6	7	8	9	10

	MalaysianDRG Casemix System, serta pemantaun melalui fungsi audit dalam sistem serta melalui audit dokumentasi dan kod pada Per-PD 301										
SECTION 2 **Critical Success Factors (Faktor-faktor Kejayaan Kritikal)**		Please indicate your responses based on the scale from 1-10, with 1 being 'strongly disagree', *and 10 being 'strongly agree'* *Sila tandakan jawapan pilihan anda mengikut skala dari 1-10, di mana 1 adalah 'sangat tidak setuju', dan 10 adalah 'sangat setuju'* 									
PE1	It is easy to find the information I needed from THIS and/or MalaysianDRG Casemix System. *Mudah untuk mencari maklumat yang saya perlukan daripada THIS dan/atau MalaysianDRG Casemix System.*	1	2	3	4	5	6	7	8	9	10
PE2	Using Casemix System with THIS is easy in all its steps. *Menggunakan dan mengadaptasi Sistem Casemix dengan THIS adalah mudah dalam semua langkahnya.*	1	2	3	4	5	6	7	8	9	10
PE3	I find it easy and flexible to get the THIS to do what I want for Casemix purposes. *Saya rasa mudah dan fleksibel untuk THIS melakukan apa yang saya kehendaki bagi tujuan Casemix.*	1	2	3	4	5	6	7	8	9	10
PE4	It is easy to learn Casemix documentation with THIS support available. *Sangat mudah untuk mempelajari penulisan dokumentasi klinikal Casemix dengan sokongan perkhidmatan THIS yang tersedia.*	1	2	3	4	5	6	7	8	9	10
PE5	My performance at work has improved as I am using THIS and the Casemix System. *Prestasi saya di tempat kerja telah bertambah baik kerana saya menggunakan THIS dan mengadaptasi Sistem Casemix.*	1	2	3	4	5	6	7	8	9	10
PU1	I am satisfied with the implementation of the Casemix System in THIS environment. *Saya berpuas hati dengan pelaksanaan Sistem Casemix dalam persekitaran THIS.*	1	2	3	4	5	6	7	8	9	10
PU2	The use of the Casemix System in THIS environment has facilitated my job operations. *Penggunaan Sistem Casemix dalam persekitaran THIS telah memudahkan operasi kerja saya.*	1	2	3	4	5	6	7	8	9	10
PU3	Casemix System adoption in THIS context results in more success in achieving job objectives.	1	2	3	4	5	6	7	8	9	10

	Penerimaan Sistem Casemix dalam konteks THIS menghasilkan lebih banyak kejayaan dalam mencapai objektif pekerjaan.										
PU4	I find the integration of THIS and/or SMRP and/or MalaysianDRG Casemix System useful in my job. *Saya mendapati integrasi THIS dan/atau SMRP dan/atau MalaysianDRG Casemix System berguna dalam tugas saya.*	1	2	3	4	5	6	7	8	9	10
O1	Organizational competency to provide the resources for the implementation of the Casemix System is required in THIS setting. *Kecekapan organisasi untuk menyediakan sumber untuk pelaksanaan Sistem Casemix diperlukan dalam tetapan THIS*	1	2	3	4	5	6	7	8	9	10
O2	My employer and my head of department is supportive to me for my work involving THIS and Casemix. *Majikan dan ketua jabatan saya menyokong saya menyokong saya untuk kerja saya yang melibatkan THIS dan Casemix.*	1	2	3	4	5	6	7	8	9	10
O3	Casemix System adoption in THIS settings is supported by Ministry of Health, State Health Department and the hospital top management. *Pelaksanaan Sistem Casemix dalam tetapan THIS disokong oleh Kementerian Kesihatan Malaysia, Jabatan Kesihatan Negeri dan pengurusan tertinggi hospital.*	1	2	3	4	5	6	7	8	9	10
O4	Hospital top management is responsible to provide training for Casemix and THIS. *Pengurusan tertinggi hospital bertanggungjawab menyediakan latihan untuk Sistem Casemix dan THIS.*	1	2	3	4	5	6	7	8	9	10
O5	Series of training on the clinical documentation and costing module according to the stipulated guidelines prepared by the Ministry of Health Malaysia are adequate. *Siri latihan dokumentasi klinikal dan modul kewangan mengikut garis panduan yang ditetapkan yang disediakan oleh Kementerian Kesihatan Malaysia adalah mencukupi.*	1	2	3	4	5	6	7	8	9	10
O6	Organizational competency leads to the easiness of Casemix System adoption in THIS context. *Kecekapan organisasi membawa kepada kemudahan penggunaan Sistem Casemix dalam konteks THIS.*	1	2	3	4	5	6	7	8	9	10
O7	Organizational competency leads to the usefulness of Casemix System adoption in THIS context. *Kecekapan organisasi membawa kepada kegunaan penggunaan Sistem Casemix dalam konteks THIS.*	1	2	3	4	5	6	7	8	9	10
O8	The service providers of THIS and/or MalaysianDRG Casemix System adequately provide training to the users.	1	2	3	4	5	6	7	8	9	10

	Pembekal perkhidmatan THIS dan/atau MalaysianDRG Casemix System menyediakan latihan secukupnya kepada pengguna.										
O9	Adequate technical/application support is provided for Casemix System implementation in THIS context. *Sokongan teknikal/aplikasi yang mencukupi disediakan untuk pelaksanaan Sistem Casemix dalam konteks THIS.*	1	2	3	4	5	6	7	8	9	10
SQ1	The THIS and/or MalaysianDRG Casemix System are always available. *THIS dan/atau MalaysianDRG Casemix System sentiasa tersedia.*	1	2	3	4	5	6	7	8	9	10
SQ2	The THIS and/or MalaysianDRG Casemix System are user-friendly. *THIS dan/atau MalaysianDRG Casemix System adalah mesra pengguna.*	1	2	3	4	5	6	7	8	9	10
SQ3	The THIS and/or MalaysianDRG Casemix System provide interaction between users and the system. *THIS dan/atau MalaysianDRG Casemix System menyediakan interaksi antara pengguna dan sistem.*	1	2	3	4	5	6	7	8	9	10
SQ4	The THIS and/or MalaysianDRG Casemix System provide high-speed information access. *THIS dan/atau MalaysianDRG Casemix System menyediakan akses maklumat berkelajuan tinggi.*	1	2	3	4	5	6	7	8	9	10
IQ1	The information required for the Casemix system generated by THIS is accurate and correct. *Maklumat yang diperlukan untuk Sistem Casemix dijana oleh THIS adalah tepat dan betul.*	1	2	3	4	5	6	7	8	9	10
IQ2	The information generated by the THIS is useful for Casemix purposes by providing complete information. *Maklumat yang dijana oleh THIS berguna untuk tujuan Casemix dengan menyediakan maklumat lengkap*	1	2	3	4	5	6	7	8	9	10
IQ3	The THIS generates information for Casemix purposes in a timely manner. *THIS menjana maklumat untuk tujuan Casemix tepat pada masanya.*	1	2	3	4	5	6	7	8	9	10
IQ4	The information needed for Casemix is available all the time with THIS. *Maklumat yang diperlukan untuk Casemix tersedia sepanjang masa dengan THIS.*	1	2	3	4	5	6	7	8	9	10
IQ5	I trust the information output of the THIS and/or MalaysianDRG Casemix System. *Saya mempercayai output maklumat bagi Sistem THIS dan/atau Casemix.*	1	2	3	4	5	6	7	8	9	10

SE1	The THIS can be relied on to provide information as and when needed for Casemix purposes. *THIS boleh dipercayai untuk memberikan maklumat apabila diperlukan untuk tujuan Casemix.*	1	2	3	4	5	6	7	8	9	10
SE2	The vendor support services of the THIS and/or SMRP and/or MalaysianDRG Casemix System provide sufficient technical assistance. *Penyedia Sistem Casemix THIS dan/atau SMRP dan/atau MalaysianDRG menyediakan bantuan teknikal yang mencukupi.*	1	2	3	4	5	6	7	8	9	10
SE3	If those vendor support services promise to do something by a specific time, they will. *Jika perkhidmatan sokongan berjanji untuk melakukan sesuatu pada masa tertentu, mereka akan melakukannya*.	1	2	3	4	5	6	7	8	9	10
SE4	The output from the integration of THIS and/or SMRP and/or MalaysianDRG Casemix system completes the Casemix workflow. *Output daripada integrasi THIS dan/atau SMRP dan/atau MalaysianDRG Casemix System* melengkapkan proses kerja Casemix.	1	2	3	4	5	6	7	8	9	10
SE5	The overall infrastructure in place is adequate to support THIS services and the Casemix System. *Infrastruktur keseluruhan yang disediakan adalah mencukupi untuk menyokong THIS dan Sistem Casemix.*	1	2	3	4	5	6	7	8	9	10
	SECTION 3 **(Intention to Use and User Acceptance)**	Please indicate your responses based on the scale from 1-10, with 1 being 'strongly disagree', *and 10 being 'strongly agree'* *Sila tandakan jawapan pilihan anda mengikut skala dari 1-10, di mana 1 adalah 'sangat tidak setuju', dan 10 adalah 'sangat setuju'* 									
ITU1	I enjoy and motivated to work in a THIS hospital where the Casemix System is being implemented. *Saya suka dan bermotivasi untuk bekerja di hospital yang dilengkapi dengan THIS di mana Sistem Casemix sedang dilaksanakan.*	1	2	3	4	5	6	7	8	9	10
ITU2	I think the implementation of the Casemix System with THIS-provided services is a good idea. *Saya merasakan pelaksanaan Sistem Casemix dengan perkhidmatan yang disediakan THIS adalah idea yang baik.*	1	2	3	4	5	6	7	8	9	10
ITU3	I believe the hospital staff is receptive to the implementation of the Casemix system.	1	2	3	4	5	6	7	8	9	10

	Saya percaya kakitangan hospital menerima pelaksanaan Sistem Casemix.										
ITU4	I agree with the idea of implementing Casemix System and extending it to other THIS hospital. *Saya bersetuju dengan idea untuk melaksanakan Sistem Casemix dan memanjangkannya ke hospital yang dilengkapi dengan THIS yang lain*	1	2	3	4	5	6	7	8	9	10
ITU5	I recommend using THIS to support Casemix System implementation. *Saya mengesyorkan penggunaan THIS bagi menyokong pelaksanaan Sistem Casemix.*	1	2	3	4	5	6	7	8	9	10
A1	Casemix System implementation with THIS setting facilitates easy access to patient information. *Pelaksanaan Sistem Casemix dengan tetapan THIS memudahkan akses mudah kepada maklumat pesakit.*	1	2	3	4	5	6	7	8	9	10
A2	Casemix System adoption with THIS provided service enables me to accomplish tasks more efficiently and increase my quality of work. *Pelaksanaan Sistem Casemix dalam tetapan THIS membolehkan saya menyelesaikan tugas dengan lebih cekap dan meningkatkan kualiti kerja saya.*	1	2	3	4	5	6	7	8	9	10
A3	The implementation of the Casemix system in THIS setting contributes to more accurate and complete diagnosis and procedures. Pelaksanaan Sistem Casemix dalam tetapan THIS menyumbang kepada diagnosis dan prosedur yang lebih tepat dan lengkap.	1	2	3	4	5	6	7	8	9	10
A4	The integration of Casemix System and THIS will help overcome the limitations of the paper-based system. *Penyepaduan/Integrasi MalaysianDRG Casemix System dan/atau THIS akan membantu mengatasi batasan sistem berasaskan kertas.*	1	2	3	4	5	6	7	8	9	10
A5	Overall, I am satisfied with the Casemix System implementation in THIS setting. *Secara keseluruhannya, saya berpuas hati dengan pelaksanaan Sistem Casemix dalam tetapan THIS.*	1	2	3	4	5	6	7	8	9	10

Supplementary File 4

Supplementary File 4a**:** The number of experts and its implication on the acceptable cut-off score of CVI

Number of experts	Acceptable CVI values	Source of recommendation
Two experts	At least 0.80	(Davis 1992)
Three to five experts	Should be 1	(Polit et al. 2007; Polit & Beck 2006)
At least six experts	At least 0.83	(Polit et al. 2007; Polit & Beck 2006)
Six to eight experts	At least 0.83	(Lynn M. R. 1986)
At least nine experts	At least 0.78	(Lynn M. R. 1986)

Resource: (Yusoff 2019)

Supplementary File 4b: The definition and formula of I-CVI, S-CVI/Ave, and S-CVI/UA

CVI indices	Definition	Formula
I-CVI (item-level content validity index)	The proportion of content experts giving the item a relevance rating of 3 or 4	I-CVI = (agreed item)/ (number of experts)
S-CVI/Ave (scale-level content validity index based	The average of the I-CVI scores for all items on the scale or the average of proportion relevance judged by all experts. The proportion relevant is the average relevance rating by individual experts.	S-CVI/Ave = (sum of I-CVI scores)/(number of item) S-CVI/Ave = (sum of proportion relevance rating)/ (number of experts)
S-CVI/UA (scale-level content validity index based on the universal agreement method)	The proportion of items on the scale that achieve a relevance scale of 3 or 4 by all experts. Universal agreement (UA) score is given as 1 when the item achieved 100% experts in agreement, otherwise, the UA score is given as 0.	S-CVI/UA = (sum of UA scores)/(number of item)

Note: The definition and formula were based on the recommendations by (Davis 1992; Lynn M. R. 1986; Polit et al. 2007; Polit & Beck 2006) in Multimedia Appendix 2a.
Resource: (Yusoff 2019)

Supplementary File 4c: The relevance ratings on the item scale by two experts

Item code	Item No.	Expert 1	Expert 2	Experts in Agreement	I-CVI	UA
Gender	**1.1.1**	1	1	2	1	1
Age	**1.1.2**	1	1	2	1	1
Hospital's Name	**1.1.3**	1	1	2	1	1
Professional Roles	**1.1.4**	1	1	2	1	1
Educational Background	**1.1.5**	1	1	2	1	1
Tenure at MOH	**1.1.6**	1	1	2	1	1
Tenure at Current Hospital	**1.1.7**	1	1	2	1	1
Casemix Training	**1.1.8**	1	1	2	1	1
K1	**1.2.1**	1	1	2	1	1
K2	**1.2.2**	1	1	2	1	1
K3	**1.2.3**	1	1	2	1	1
K4	**1.2.4**	1	1	2	1	1
K5	**1.2.5**	1	1	2	1	1
K6	**1.2.6**	1	1	2	1	1
K7	**1.2.7**	1	1	2	1	1
K8	**1.2.8**	1	1	2	1	1
K9	**1.2.9**	1	1	2	1	1
K10	**1.2.10**	1	1	2	1	1
PEOU1	**2.1.1**	1	1	2	1	1
PEOU2	**2.1.2**	1	1	2	1	1
PEOU3	**2.1.3**	1	1	2	1	1
PEOU4	**2.1.4**	1	1	2	1	1
PEOU5	**2.1.5**	1	1	2	1	1
PU1	**2.2.1**	1	1	2	1	1
PU2	**2.2.2**	1	1	2	1	1
PU3	**2.2.3**	1	1	2	1	1
PU4	**2.2.4**	1	1	2	1	1
O1	**2.3.1**	1	1	2	1	1
O2	**2.3.2**	1	1	2	1	1
O3	**2.3.3**	1	1	2	1	1
O4	**2.3.4**	1	1	2	1	1
O5	**2.3.5**	1	1	2	1	1
O6	**2.3.6**	1	1	2	1	1
O7	**2.3.7**	1	1	2	1	1
O8	**2.3.8**	1	1	2	1	1
O9	**2.3.9**	1	1	2	1	1
SY1	**2.4.1**	1	1	2	1	1
SY2	**2.4.2**	1	1	2	1	1

SY3	**2.4.3**	1	1	2	1	1
SY4	**2.4.4**	1	1	2	1	1
IQ1	**2.5.1**	1	1	2	1	1
IQ2	**2.5.2**	1	1	2	1	1
IQ3	**2.5.3**	1	1	2	1	1
IQ4	**2.5.4**	1	1	2	1	1
IQ5	**2.5.5**	1	1	2	1	1
SQ1	**2.6.1**	1	1	2	1	1
SQ2	**2.6.2**	1	1	2	1	1
SQ3	**2.6.3**	1	1	2	1	1
SQ4	**2.6.4**	1	1	2	1	1
SQ5	**2.6.5**	1	1	2	1	1
ITU1	**2.7.1**	1	1	2	1	1
ITU2	**2.7.2**	1	1	2	1	1
ITU3	**2.7.3**	1	1	2	1	1
ITU4	**2.7.4**	1	1	2	1	1
ITU5	**2.7.5**	1	1	2	1	1
UA1	**3.1**	1	1	2	1	1
UA2	**3.2**	1	1	2	1	1
UA3	**3.3**	1	1	2	1	1
UA4	**3.4**	1	1	2	1	1
UA5	**3.5**	1	1	2	1	1
				S-CVI/Ave	**1.00**	
Proportion Relevance		1	1	**S-CVI/UA**		**1.00**

The average proportion of items judged as relevant across the two experts	**1.00**

UNIVERSITI KEBANGSAAN MALAYSIA
The National University of Malaysia
JABATAN KESIHATAN MASYARAKAT • *DEPARTMENT OF COMMUNITY HEALTH*

UKM.FPR JKM.600-4/4/8
5 Januari 2023

PROF. DR. [redacted]
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Universiti Sultan Zainal Abidin
21300 Kuala Nerus
Terengganu

YBhg. Prof,

PERMOHONAN PERKHIDMATAN SEBAGAI PAKAR PENILAIAN SOAL SELIDIK PENYELIDIKAN TESIS PhD

Dengan segala hormatnya izinkan saya merujuk kepada perkara di atas.

2. Sukacita dimaklumkan bahawa Dr. Noor Khairiyah binti Mustafa (P115190) merupakan seorang pelajar Doktor Falsafah (Kesihatan Masyarakat), Jabatan Kesihatan Masyarakat, Fakulti Perubatan, Universiti Kebangsaan Malaysia di bawah penyelian saya. Beliau sedang menjalankan kajian bertajuk **"Critical Success Factors and The Acceptance of Casemix System Implementation in Total Hospital Information System of Ministry of Health Malaysia".**

3. Sehubungan itu, pihak fakulti berbesar hati melantik YBhg. Prof sebagai pakar menilai soal selidik bagi menentukan kesahan dan kebolehpercayaan data kuantitatif yang akan digunakan dalam penyelidikan beliau. Bersama-sama ini, dilampirkan borang soal selidik dan maklumbalas penilaian soal selidik penyelidikan tesis PhD untuk tujuan rujukan YBhg. Prof.

Saya amat berharap agar permohonan ini mendapat maklum balas yang positif dari YBhg. Prof. Perhatian dan pertimbangan dari pihak YBhg. Prof amat saya hargai.

Sekian, terima kasih.

Saya yang menjalankan amanah,

MEJ. BERSEKUTU (PA) DR. ROSZITA IBRAHIM
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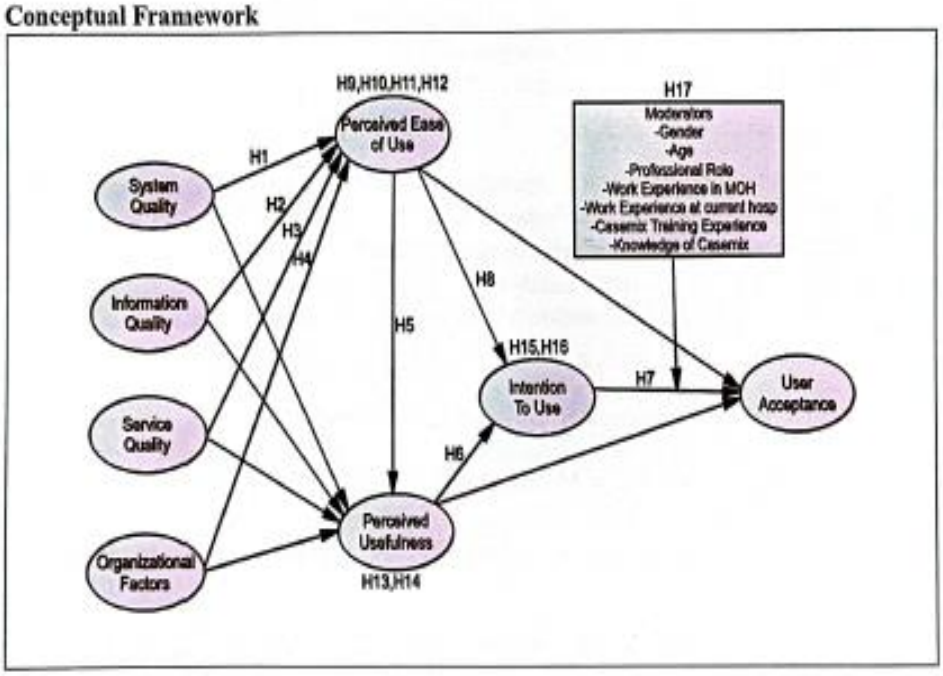
Questionnaire Criterion Validation	
Title	Critical Success Factors and The Acceptance of Casemix System Implementation in Total Hospital Information System of The Ministry of Health Malaysia
Ph.D. Student	Dr. Noor Khairiyah binti Mustafa
Main Supervisor	Mejar Bersekutu (PA) Dr. Roszita binti Ibrahim
Co-Supervisors	1. Prof. Dato' Dr. Syed Mohamed Al-Junid bin Syed Junid 2. Prof Madya Dr. Azimatun Noor binti Aizuddin

Conceptual Framework



CRITERION VALIDATION OF THE QUESTIONNAIRE

Dear Experts,

This questionnaire contains eight (8) main constructs/domains with a total of 60 items. We need your judgment on the degree of match of each item. Your review should be based on the definitions, and relevant terminologies that are provided in the questionnaire. Please be as objective and constructive as possible in your review and please use the following rating scale:

Degree of Match:

Perfect Match - maintain the item as it is
Moderate Match - maintain the item but needs some refining
Poor Match - remove the item

QUESTIONNAIRE
(BORANG KAJI SELIDIK)

Title: Critical Success Factors and the Acceptance of Casemix System Implementation in Total HospitalInformation System of the Ministry of Health Malaysia

Tajuk: Faktor Kejayaan Kritikal Dan Penerimaan Bagi Pelaksanaan Sistem Casemix di Sistem Maklumat Hospital Menyeluruh Di Kementerian Kesihatan Malaysia

INSTRUCTIONS
ARAHAN

This questionnaire is divided into three sections which consist of **i) Personal Details, ii) The Critical Success Factors of Casemix Implementation in THIS, and iii) Outcome of the study which is the Acceptance Leveltowards Casemix System implementation in THIS setting.** The purpose of this study is to examine the critical success factors and the acceptance of Casemix System implementation in THIS facilities of the Ministryof Health (MOH) Malaysia.

*Borang soalselidik ini terbahagi kepada tiga bahagian, iaitu **i) Maklumat Peribadi, ii) Faktor Kejayaan Kritikalbagi Pelaksanaan Sistem Casemix di hospital yang dilengkapi fasiliti THIS dan iii) Hasil kajian iaitu Tahap Penerimaan terhadap Pelaksanaan Sistem Casemix di hospital yang dilengkapi fasiliti THIS.** Tujuan kajian ini adalah untuk mengkaji faktor-faktor kejayaan kritikal serta tahap penerimaan bagi Pelaksanaan Sistem Casemixdi hospital-hospital Kementerian Kesihatan Malaysia yang dilengkapi fasiliti THIS.*

Please indicate your most appropriate response. All information and your chosen answers will be kept confidential. This study has also received ethical approval from the Medical Research Ethics Committee from the Ministry of Health Malaysia **(NMRR-ID-22-02621-DKX),** and from Universiti Kebangsaan Malaysia **(JEP-2022- 777).** For more information or clarification, do not hesitate to contact the Principal Researcher via her email address: p115190@siswa.ukm.edu.my or you can contact her via WhatsApp at 012-6161342.

*Sila tandakan jawapan pilihan anda. Semua maklumat dan jawapan pilihan anda akan dirahsiakan. Kajian ini juga telah mendapat kelulusan etika daripada Jawatankuasa Etika Penyelidikan Perubatan dari Kementerian Kesihatan Malaysia **(NMRR-ID-22-02621-DKX)** dan dari Universiti Kebangsaan Malaysia **(JEP-2022-777)**. Untuk maklumat lanjut atau penjelasan, jangan teragak-agak untuk menghubungi Penyelidik Utama melalui alamat e-mel beliau: **p115190@siswa.ukm.edu.my** atau anda boleh menghubunginya melalui WhatsApp di **012-6161342.***

DEFINITIONS OF TERMS AND ACRONYM
DEFINISI BAGI TERMA DAN AKRONIM

Here are some definitions of terms and acronyms that will be used in this questionnaire:
Berikut ialah beberapa definisi istilah dan akronim yang akan digunakan dalam soal selidik ini:

1) Casemix System: A system that **provides the healthcare industry with a consistent method of classifying types of patients, their treatment and associated costs**. It involves developing and implementing a patient classification system that groups patients according to their clinical conditions.
***1) Sistem Casemix:** Sistem yang **menyediakan industri penjagaan kesihatan dengan kaedah yang konsisten bagi mengklasifikasikan jenis pesakit, rawatan mereka dan kos yang berkaitan**. Ia melibatkan*

pembangunan dan pelaksanaan sistem klasifikasi pesakit yang mengumpulkan pesakit mengikut keadaan klinikal mereka.

2) **Total Hospital Information System (THIS):** It is a project by the Ministry of Health (MOH) to provide a **complete ICT system** in establishing a **paperless** hospital environment to offer quality health services to the public- **an integration of clinical, administrative, and financial systems.**

2) Total Hospital Information System (THIS)*: Ia adalah projek Kementerian Kesihatan (KKM) dengan objektifuntuk menyediakan* ***sistem ICT yang lengkap*** *dalam mewujudkan* ***persekitaran hospital tanpa kertas*** *untuk*

*menawarkan perkhidmatan kesihatan yang berkualiti kepada orang ramai—****satu integrasi sistem klinikal, pentadbiran dan kewangan****.*

3) **MalaysianDRG Casemix System: A comprehensive system that records casemix data** (i.e demographic profiles, patient's encounter on arrival and admissions of patients, diagnosis, treatment, investigations and procedures, discharge numbers, patients' bed days) **from the hospitals to flow into the MOH data pool.**

3) MalaysianDRG Casemix System: ***Sistem komprehensif yang merekodkan data casemix*** *(iaitu* ***data demografik pesakit, data kedatangan dan kemasukan pesakit,*** *diagnosis, rawatan, penyiasatan dan prosedur, nombor pelepasan, hari tidur pesakit)* ***dari hospital untuk mengalir ke kumpulan data KKM.***

4) **Sistem Maklumat Rawatan Pesakit (SMRP): A comprehensive medical treatment report system linkingall hospitals in the country.** The required data is entered manually (manual/ some BHIS/IHIS hospitals) or through integration from HIS (most THIS) and will be then integrated into MalaysianDRG Casemix System.

4) Sistem Maklumat Rawatan Pesakit (SMRP): ***Sistem laporan rawatan perubatan yang komprehensif menghubungkan semua hospital di negara ini****. Data yang diperlukan dimasukkan secara manual (manual/ beberapa hospital BHIS/IHIS) atau melalui integrasi daripada HIS (kebanyakan hospital THIS) dan kemudiannya akan disepadukan ke dalam Sistem MalaysianDRG Casemix*

Thank you for your cooperation.
Terima kasih atas kerjasama yang telah diberikan.

Section 1 (*Bahagian 1*):

A. Demographic Profile and Duration of Service
Profil Demografi dan Pengalaman Bekerja

Please tick (√) your response in the appropriate boxes and fill in the blank.
Sila tandakan √ pada kotak jawapan pilihan anda dan isi petak kosong.

1.1.1 Gender [*Jantina*]: □ Male [*Lelaki*]
□ Female [*Perempuan*] ✓

1.1.2 Age [*Umur*]:____year(s) [*tahun*] ✓

1.1.3 Name of Hospital [*Nama Hospital*]:

□Hospital Putrajaya
□Hospital Sultanah Nur Zahirah, Kuala Terengganu ✓
□Hospital Sultan Ismail, Johor Bahru
□Hospital Sultanah Bahiyah, Alor Setar
□Pusat Jantung Sarawak

1.1.4 Role or Position [*Peranan atau Jawatan*]:

□Hospital Director (Pengarah Hospital)
□Deputy Director (Timbalan Pengarah) ✓
□Consultant Specialist/Specialist (Pakar Perunding/Pakar)
□Medical Officer (Pegawai Perubatan)
□House Officer (Pegawai Perubatan Siswazah)

1.1.5 Education Background [*Latar belakang Pendidikan*]:

□Post-Doctorate (Pasca-Kedoktoran) ✓
□Philosphy Doctor, PhD (Ijazah Kedoktoran)
□Sub-Specialty (Sub-Kepakaran)
□Master's Degree (Ijazah Sarjana)
□Bachelor's Degree (Ijazah Sarjana Muda)

1.1.6 Duration of years in Malaysian Ministry of Health
[*Tempoh perkhidmatan dalam Kementerian Kesihatan*]

_____year(s) [*tahun*]

1.1.7 Duration of service in Casemix-THIS hospital
**[*Tempoh perkhidmatan di Hospital Casemix-THIS]*

_____year(s) [*tahun*]

1.1.8 Have you ever undergone training related to the Casemix system during your service at the Ministry of Health?

[*Pernahkah anda menjalani latihan berkaitan Sistem Casemix sepanjang perkhidmatan anda di Kementerian Kesihatan?*]:

□ Yes (Ya)
□No (Tidak)

Comments from Validation Experts for Section 1A:

The demographic information are used for testing the moderation effect.

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B. Knowledge about Casemix System

Pengetahuan mengenai Sistem Casemix

Please indicate your responses based on the scale from 1-10, with 1 being 'no knowledge, 5 as 'fair knowledge' and 10 being 'Good Knowledge'.
[Sila tandakan jawapan pilihan anda mengikut skala dari 1-10, di mana 1 adalah 'tiada pengetahuan', 5 adalah 'pengetahuan yang sederhana' dan 10 adalah 'pengetahuan yang baik':

No knowledge — Fair knowledge — Good knowledge

1	2	3	4	5	6	7	8	9	10

Tiada Pengetahuan — *Pengetahuan yang sederhana* — *Pengetahuan yang baik*

Item No.	Item Details	Relevance			Comments
	Knowledge about Casemix System ***Pengetahuan mengenai Sistem Casemix***	**Perfect Match (maintain item as it is)**	**Moderate Match (maintain item but needs some refining)**	**Poor Match (remove item)**	
1.2.1	Casemix system is one of the MOH's strategy to improve quality of health care in medical and health facilities in Malaysia. *Sistem Casemix merupakan salah satu strategi KKM untuk menambahbaik kualiti penjagaan kesihatan di fasiliti perubatan dan kesihatan di Malaysia.*	✓			change the score to interval scale.
1.2.2	The main objective of Casemix System is meant for calculating the costs which has been spent for each Diagnosis Related Group (DRG) or Main diagnosis Category (MDC). *Objektif utama pelaksanaan Sistem Casemix adalah untuk mengira kos yang dibelanjakan ke atas satu satu Diagnosis Related Group (DRG) or Main diagnosis Category (MDC)*	✓			"

The score "true" and "false" is not preffered to measure the extent of knowledge.

[redacted]
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1.2.3	Casemix System is involving and evaluating both clinical and costing data. *Sistem Casemix melibatkan dan menilai kedua-dua data klinikal dan kewangan.*	✓			score change to interval scale.
1.2.4	The Casemix System is involving healthcare workers from various positions and disciplines. *Sistem Casemix melibatkan kakitangan kesihatan daripada pelbagai jawatan dan disiplin*	✓			"
1.2.5	The implementation of the Casemix system that contains clinical data will involve demographic profiles, diagnosis, treatment, investigations and procedures. *Pelaksanaan Sistem Casemix yang mengandungi data klinikal akan melibatkan data demografik pesakit, diagnosis, rawatan, ujian-ujian dan prosedur*	✓			"
1.2.6	The implementation of the Casemix system that contains financial data will involve space areas, annual emolument, assets, medical/health/dental supplies and medical aid supports. *Pelaksanaan Sistem Casemix yang mengandungi data kewangan pula akan melibatkan data keluasan kawasan, emolumen (gaji) tahunan aset, bekalan pergigian/kesihatan/perubatan dan sokongan bantuan perubatan.*	✓			"
1.2.7	The implementation of Casemix System takes into account the demand and level of user's satisfaction with the health services/systems provided. *Pelaksanaan Sistem Casemix mengambil kira keperluan, kehendak dan tahap kepuasan pengguna dengan perkhidmatan/sistem kesihatan yang disediakan*	✓			"
1.2.8	The implementation of the Casemix System means that healthcare staff provide accurate primary diagnosis, complete secondary diagnosis and complete list of procedures/ treatment/ investigations. *Pelaksanaan Sistem Casemix bermaksud kakitangan kesihatan menyediakan diagnosis utama yang tepat, diagnosis-diagnosis lain yang lengkap dan prosedur/rawatan/ujian yang lengkap.*	✓			"
1.2.9	With the implementation of Casemix System in Total Hospital Information System (THIS), each doctor, paramedics and allied health professional is responsible for preparing accurate and complete diagnosis and procedures for acute cases, chronic cases, cases of pregnant women, and children in an integrated manner/system.	✓			"

Guna skala 1 — 10 untuk ukur
sejauh mana dia tahu atau tidak
tahu tentang sesuatu atau boleh ukur
sejauh mana dia setuju atau tidak setuju.

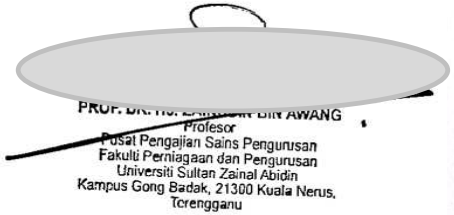
	Dengan Pelaksanaan Sistem Casemix di Total Hospital Information System (THIS)m, setiap doktor, paramedik dan kakitangan sokongan klinikal bertanggungjawab untuk menyediakan diagnosis dan prosedur/rawatan/ujian yang tepat dan lengkap bagi kes akut, kronik, kes ibu mengandung dan kanak-kanak dalam sistem bersepadu				
1.2.10	Monitoring and evaluation are done through indicators specially prepared for Casemix system set by the Ministry of Health Malaysia through the application of MalaysianDRG Casemix System. *Pemantauan dan penilaian dilakukan melalui indikator-indikator yang telah disediakan khas untuk Sistem Casemix oleh pihak Kementerian Kesihatan Malaysia melalui aplikasi MalaysianDRG Casemix System.*	✓			

Other Comments from Validation Experts for Section 1B:

For measuring knowledge, it is not proper to use True or false. Need to measure how much the respondents know in a scale between 1 to 10.

So, they can assess their knowledge on subject matter based on how much they agree or disagree with the given statement.

⇒ Knowledge can also be measured based on how much they know in a scale between 1 (zero knowledge) to 10 (perfect knowledge). The score in between reflect how much the respondents know about the issue at hand.



PROF. DR. [redacted] BIN AWANG
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Section 2: Critical Success Factors of Casemix System Implementation in THIS Setting

[Bahagian 2: Faktor Kejayaan Kritikal yang menyumbang kepada Implementasi Sistem Casemix dalam THIS]

This section will be divided into three sub-sections to assess the critical success factors of Casemix System Implementation in Total Hospital Information System (HIS) Setting comprising of Human, Organizational and Technological Factors in your hospital.
[Bahagian ini akan dibahagikan kepada tiga sub-bahagian untuk menilai faktor kejayaan kritikal Pelaksanaan Sistem Casemix dalam Total Hospital Information System (HIS)].

Please indicate your responses based on the scale from 1-10, with 1 being 'strongly disagree', 5 as 'neither disagree or agree'(neutral) and 10 being 'strongly agree'.
[Sila tandakan jawapan pilihan anda mengikut skala dari 1-10, di mana 1 adalah 'sangat tidak setuju', 5 adalah 'neutral' dan 10 adalah 'sangat setuju']:

Strongly disagree — Neither agree/disagree — Strongly agree

1	2	3	4	5	6	7	8	9	10
Sangat tidak setuju				neutral					*Sangat setuju*

Factor/ Construct *Faktor Konstruk*	Item No. No. Item	Item Details *Butiran Item*	Relevance			Comments
			Perfect Match (maintain Item as it is)	Moderate Match (maintain item but needs some refining)	Poor Match (remove item)	
Perceived Ease of Use ***Dirasakan Mudah untuk Digunakan***	2.1.1	It is easy to find the information I needed from THIS and/or MalaysianDRG Casemix System. *Mudah untuk mencari maklumat yang saya perlukan daripada THIS dan/atau MalaysianDRGCasemix System.*	✓			
	2.1.2	Using Casemix System with THIS is easy in all itssteps. *Menggunakan dan mengadaptasi Sistem Casemix dengan THIS adalah mudah dalam semua langkahnya.*	✓			
	2.1.3	I find it easy and flexible to get the THIS to do whatI want for Casemix purposes. *Saya rasa mudah dan fleksibel untuk THISmelakukan apa yang saya kehendaki bagi tujuan Casemix.*	✓			
	2.1.4	It is easy to learn Casemix documentation with THIS support available.	✓			

		Sangat mudah untuk mempelajari penulisan dokumentasi klinikal Casemix dengan sokongan perkhidmatan THIS yang tersedia.				
	2.1.5	My performance at work has improved as I amusing THIS and the Casemix System. *Prestasi saya di tempat kerja telah bertambah baik kerana saya menggunakan THIS dan mengadaptasi Sistem Casemix.*	✓			
Perceived Usefulness ***Dirasakan Berguna***	2.2.1	I am satisfied with the implementation of theCasemix System in THIS environment. *Saya berpuas hati dengan pelaksanaan SistemCasemix dalam persekitaran THIS.*	✓			
	2.2.2	The use of the Casemix System in THISenvironment has facilitated my job operations. Penggunaan Sistem Casemix dalam persekitaranTHIS telah memudahkan operasi kerja saya.	✓			
	2.2.3	Casemix System adoption in THIS context results in more success in achieving job objectives. *Penerimaan Sistem Casemix dalam konteks THIS menghasilkan lebih banyak kejayaan dalam mencapai objektif pekerjaan.*	✓			
	2.2.4	I find the integration of THIS and/or SMRP and/or MalaysianDRG Casemix System useful in my job. *Saya mendapati integrasi THIS dan/atau SMRP dan/atau MalaysianDRG Casemix System bergunadalam tugas saya.*	✓			
Organizational Factors	2.3.1	Organizational competency to provide the resources for the implementation of the Casemix System is required in THIS setting. *Kecekapan organisasi untuk menyediakan sumber untuk pelaksanaan Sistem Casemix diperlukan dalam tetapan THIS*	✓			
	2.3.2	My employer and my head of department is supportive to me for my work involving THIS andCasemix. Majikan dan ketua jabatan saya menyokong saya menyokong saya untuk kerja saya yang melibatkanTHIS dan Casemix.	✓			
	2.3.3	Casemix System adoption in THIS settings is supported by Ministry of Health, State Health Department and the hospital top management. *Pelaksanaan Sistem Casemix dalam tetapan THISdisokong*	✓			

		oleh Kementerian Kesihatan Malaysia, Jabatan Kesihatan Negeri dan pengurusantertinggi hospital.				
	2.3.4	Hospital top management is responsible to providetraining for Casemix and THIS. *Pengurusan tertinggi hospital bertanggungjawab menyediakan latihan untuk Sistem Casemix dan THIS.*	✓			
	2.3.5	Series of training on the clinical documentation and costing module according to the stipulatedguidelines prepared by the Ministry of Health Malaysia are adequate. *Siri latihan dokumentasi klinikal dan modulkewangan mengikut garis panduan yangditetapkan yang disediakan oleh Kementerian Kesihatan Malaysia adalah mencukupi.*	✓			
	2.3.6	Organizational competency leads to the easiness ofCasemix System adoption in THIS context. *Kecekapan organisasi membawa kepada kemudahan penggunaan Sistem Casemix dalam konteks THIS.*	✓			
	2.3.7	Organizational competency leads to the usefulnessof Casemix System adoption in THIS context. *Kecekapan organisasi membawa kepada kegunaan penggunaan Sistem Casemix dalam konteks THIS.*	✓			
	2.3.8	The service providers of THIS and/or MalaysianDRG Casemix System adequately provide training to the users. Pembekal perkhidmatan THIS dan/atau MalaysianDRG Casemix System menyediakanlatihan secukupnya kepada pengguna.	✓			
	2.3.9	Adequate technical/application support is providedfor Casemix System implementation in THIS context. *Sokongan teknikal/aplikasi yang mencukupi disediakan untuk pelaksanaan Sistem Casemix dalam konteks THIS.*	✓			
System Quality ***Kualiti Sistem***	2.4.1	The THIS and/or MalaysianDRG Casemix Systemare always available. *THIS dan/atau MalaysianDRG Casemix Systemsentiasa tersedia.*	✓			
	2.4.2	The THIS and/or MalaysianDRG Casemix Systemare user-friendly. *THIS dan/atau MalaysianDRG Casemix Systemadalah mesra pengguna.*	✓			

	2.4.3	interaction between users and the system. *THIS dan/atau MalaysianDRG Casemix Systemmenyediakan interaksi antara pengguna dan sistem.*	✓				
	2.4.4	The THIS and/or MalaysianDRG Casemix Systemprovide high-speed information access. *THIS dan/atau MalaysianDRG Casemix System menyediakan akses maklumat berkelajuan tinggi.*	✓				
Information Quality ***Kualiti Maklumat***	2.5.1	The information required for the Casemix systemgenerated by THIS is accurate and correct. *Maklumat yang diperlukan untuk Sistem Casemixdijana oleh THIS adalah tepat dan betul.*	✓				
	2.5.2	The information generated by the THIS is useful for Casemix purposes by providing complete information. *Maklumat yang dijana oleh THIS berguna untuk tujuan Casemix dengan menyediakan maklumatlengkap*	✓				
	2.5.3	The THIS generates information for Casemixpurposes in a timely manner. *THIS menjana maklumat untuk tujuan Casemixtepat pada masanya.*	✓				
	2.5.4	The information needed for Casemix is availableall the time with THIS. *Maklumat yang diperlukan untuk Casemix tersediasepanjang masa dengan THIS.*	✓				
	2.5.5	I trust the information output of the THIS and/or MalaysianDRG Casemix System. *Saya mempercayai output maklumat bagi SistemTHIS dan/atau Casemix.*	✓				
Service Quality ***Kualiti Perkhidmatan***	2.6.1	The THIS can be relied on to provide information as and when needed for Casemix purposes. *THIS boleh dipercayai untuk memberikan maklumat apabila diperlukan untuk tujuanCasemix.*	✓				
	2.6.2	The vendor support services of the THIS and/or SMRP and/or MalaysianDRG Casemix System provide sufficient technical assistance. *Penyedia Sistem Casemix THIS dan/atau SMRP dan/atau MalaysianDRG menyediakan bantuan teknikal yang mencukupi.*	✓				

	2.6.3	by a specific time, they will. *Jika perkhidmatan sokongan berjanji untukmelakukan sesuatu pada masa tertentu, mereka akan melakukannya.*	✓			
	2.6.4	The output from the integration of THIS and/or SMRP and/or MalaysianDRG Casemix system completes the Casemix workflow. *Output daripada integrasi THIS dan/atau SMRP dan/atau MalaysianDRG Casemix System* melengkapkan proses kerja Casemix.	✓			
	2.6.5	The overall infrastructure in place is adequate tosupport THIS services and Casemix System. *Infrastruktur keseluruhan yang disediakan adalahmencukupi untuk menyokong THIS dan Sistem Casemix.*	✓			
Intention to Use ***Niat untuk Menggunakan***	2.7.1	I enjoy and motivated working in a THIS hospitalwhere the Casemix System is being implemented. *Saya suka dan bermotivasi untuk bekerja di hospital yang dilengkapi dengan THIS di manaSistem Casemix sedang dilaksanakan.*	✓			
	2.7.2	I think Casemix System with THIS providedservice implementation is a good idea. *Saya rasa pelaksanaan Sistem Casemix dengan perkhidmatan yang disediakan THIS adalah idea yang baik.*	✓			
	2.7.3	I believe the hospital staff is receptive to theimplementation of the Casemix system. *Saya percaya kakitangan hospital menerimapelaksanaan Sistem Casemix.*	✓			
	2.7.4	I agree with the idea of implementing Casemix System and extending it to other THIS hospitals. *Saya bersetuju dengan idea untuk melaksanakanSistem Casemix dan memanjangkannya ke hospital yang dilengkapi dengan THIS yang lain*	✓			
	2.7.5	I recommend using THIS to support CasemixSystem implementation. *Saya mengesyorkan penggunaan THIS bagimenyokong pelaksanaan Sistem Casemix.*	✓			

Other Comments from Validation Experts for Section 2:

The item statements are simple and easy to understand by the respondents.

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Section 3 Outcome
[Bahagian 3: Hasil]

Please indicate your responses based on the scale from 1-10, with 1 being 'strongly disagree', 5 as 'neither disagree or agree'(neutral) and 10 being 'strongly agree'.
[Sila tandakan jawapan pilihan anda mengikut skala dari 1-10, di mana 1 adalah 'sangat tidak setuju', 5 adalah 'neutral' dan 10 adalah 'sangat setuju']:

Strongly disagree Neither agree/disagree Strongly agree

1	2	3	4	5	6	7	8	9	10
Sangat tidak setuju				neutral					*Sangat setuju*

Factor/ Construct *Faktor Konstruk*	Item No. *No. Item*	Item Details *Butiran Item*	Relevance			Comments
			Perfect Match (maintain item as it is)	Moderate Match (maintain item but needs some refining)	Poor Match (remove item)	
USER ACCEPTANCE ***PENERIMAAN PENGGUNA***	3.1	Casemix System implementation with THIS setting facilitates easy access to patient information. *Pelaksanaan Sistem Casemix dengan tetapanTHIS memudahkan akses mudah kepada maklumat pesakit.*	✓			
	3.2	Casemix System adoption with THIS providedservice enables me to accomplish tasks more efficiently and increase my quality of work. *Pelaksanaan Sistem Casemix dalam tetapan THISmembolehkan saya menyelesaikan tugas dengan lebih cekap dan meningkatkan kualiti kerja saya.*	✓			
	3.3	The implementation of the Casemix system inTHIS setting contributes to more accurate andcomplete diagnosis and procedures. Pelaksanaan Sistem Casemix dalam tetapan	✓			

		THISmenyumbang kepada diagnosis dan prosedur yanglebih tepat dan lengkap.				
	3.4	The integration of Casemix System and THIS willhelp overcome the limitations of the paper-based system. *Penyepaduan/Integrasi MalaysianDRG Casemix System dan/atau THIS akan membantu mengatasibatasan sistem berasaskan kertas.*	✓			
	3.5	Overall, I am satisfied with the Casemix Systemimplementation in THIS setting. *Secara keseluruhannya, saya berpuas hati denganpelaksanaan Sistem Casemix dalam tetapan THIS.*	✓			

Other Comments from Validation Experts for Section 3:

The item statements are straight forward and easy to understand. No ambiguous statement or misleading statement.

Language used	English Correct
	Bahasa Melayu Correct
Comprehensibility	✓
Appropriateness	✓

Validator's name:	[redacted]
Contact Number:	[redacted]
E-mail Address:	[redacted]
Validator's signature and stamp:	Date: [redacted]

[redacted]

Profesor
Pusat Pengajian Sains Pengurusan
Fakulti Perniagaan dan Pengurusan
Universiti Sultan Zainal Abidin
Kampus Gong Badak, 21300 Kuala Nerus,
Terengganu

PRE-TESTING OF QUESTIONNAIRE FOR CSF AND THE ACCEPTANCE OF CASEMIX SYSTEM WITHIN THIS IN MALAYSIA

Timestamp	Email Address *Alamat Emel*	Language Bahasa	Do you agree to participate in this study? *Adakah anda bersetuju untuk menyertai kajian ini?*	1.1.1 Gender *Jantina*	1.1.2 Age (in years) *Umur (tahun)*	1.1.3 Hospital	1.1.4 Professional Role or Position *Jawatan*	1.1.5 Education Background *Latarbelakang Pendidikan*	1.1.6 Duration of years working in Ministry of Health Malaysia (in years)	1.1.7 Duration of service in current hospital (in years)	1.1.8 Have you ever undergone training related to the Casemix system during your service at the Ministry of Health?	The language that has been used (i.e simple, easy to understand, hard to understand, too much medical jargon etc). *Penggunaan bahasa yang telah digunakan dalam soal selidik (contoh: mudah, mudah difahami, sukar difahami, terlalu banyak jargon perubatan dll)*	Comprehensibility of instructions, questions and answer choices. *Kefahaman terhadap arahan, soalan dan pilihan jawapan*	Appropriateness of instructions, questions and answer choices *Kesesuaian arahan, soalan dan pilihan jawapan*	Overall comment (if any) *Ulasan keseluruhan (jika ada)*
3/9/2023 2:47:07 PM	hh.buhari@gmail	Bahasa Melayu	Saya bersetuju.	Perempuan	23	Hospital Putrajaya	Pegawai Perubatan Siswazah	Ijazah Sarjana Muda	1	1	Ya	mudah difahami	Arahan, soalan dan pilihan jawapan mudah difahami. Arahan dan Soalan yang jelas untuk difahamkan. Pilihan jawapan yang banyak dan mudah untuk dipilih. Soalan yang disempaikan menepati objektif tajuk.	Arahan, soalan dan pilihan jawapan yang sesuai mengikut tajuk perbincangan.	Secara keseluruhan questionnaire sangat berkesan dan mudah difahami. Objektif yg ingin disrangkan juga dapat difahami dengan jelas.
3/10/2023 9:28:08 PM	ku.fatimah@yal	English	Yes, I agree.	Female	34	Hospital Putrajaya	Medical Officer	Bachelor's Degree	6	1	No	Simple and easy to understand	Overall it is comprehensive. Using the scale scoring to rate answers is really helpful.	Yes, appropriate. The questions are related to the study topic	This is a good study to reveal acceptance towards casemix and factors that can contribute to its success
3/13/2023 10:27:40 AM	effendi@hpj.gov	Bahasa Melayu	Saya bersetuju.	Lelaki	33	Hospital Putrajaya	Pegawai Perubatan	Ijazah Sarjana Muda	6	3	Ya	Bahasa mudah difahami, terdapat sedikit penggunaan perkataan jargon perubatan	Faham seluruhnya	Sesuai dengan soalan	Kaji selidik yang bagus dan mudah difahami serta mencapai objektif
3/13/2023 10:34:16 AM	shakzad@gmail.c	English	Yes, I agree.	Male	31	Hospital Putrajaya	Medical Officer	Bachelor's Degree	5	5	Yes	English is easy to understand	Good	Good	Ok. A good study to investigate something that is rarely being investigated
3/15/2023 10:35:52 AM	anum60@gmail.	Bahasa Melayu	Saya bersetuju.	Perempuan	43	Hospital Putrajaya	Pakar	Ijazah Sarjana	17	3	Ya	Penggunaan Bahasa Melayu yang mudah difahami	Mudah memami setiap arahan, soalan dan pilihan jawapan	Sesuai	Tiada
3/18/2023 9:24:16 AM	ozzun@hpj.gov.r	English	Yes, I agree.	Male	36	Hospital Putrajaya	Medical Officer	Bachelor's Degree	10	5	No	Understand well	Well organized	Clear	Good initiative
3/18/2023 10:34:47 AM	amar_pj@yahoo	English	Yes, I agree.	Male	43	Hospital Putrajaya	Medical Officer	Master's Degree or equivalent	16	1	Yes	Slightly difficult especially the technical jargons	No major issues	No major issues	Easy to comprehend
3/20/2023 11:06:47 AM	dpeople13@gm	English	Yes, I agree.	Female	34	Hospital Putrajaya	Medical Officer	Master's Degree or equivalent	10	5	Yes	Yes, there are some language which are lengthy and I have sent the feedback to the investigator	Easy to understand, some minor grammatical error which has been sent a feedback to the investigator	Very appropriate	A very well done questionnaire, just needs some changes in language grammar and length.. Feedback sent to the PI
3/20/2023 8:25:47 PM	nisafarina@hpj.	English	Yes, I agree.	Female	26	Hospital Putrajaya	House Officer	Bachelor's Degree	1	1	Yes	Understand well and the language used easy to understand	It is comprehensive. I am able to understand the instructions, questions and answer choices well	the instructions, questions and answer choices are appropriate	Well done and all the best to the investigators
3/21/2023 10:29:19 AM	shana@hpj.gov.	English	Yes, I agree.	Female	44	Hospital Putrajaya	Specialist	Master's Degree or equivalent	19	10	Yes	Simple and the language is easy to understand	Comprehensive	Appropriate	Well-prepared questionnaire and study
3/21/2023 12:24:08 AM	shairol@hpj.gov	Bahasa Melayu	Saya bersetuju.	Lelaki	37	Hospital Putrajaya	Timbalan Pengarah	Ijazah Sarjana	12	12	Ya	Bahasa yang mudah difahami. Tiada isu	Mudah difahami kehendak soalan, arahan	Sesuai	Sebuah kaji selidik dan kajian yang sangat bagus.

PARTICIPANT INFORMATION SHEET FORM
(QUESTIONNAIRE)
(for adult subjects)

1. **Title of study**:
   Critical Success Factors and The Acceptance of Casemix System Implementation in Total Hospital Information System of The Ministry of Health Malaysia

2. **Name of investigator and institution:**
   Dr. Noor Khairiyah binti Mustafa– Universiti Kebangsaan Malaysia, Kementerian Kesihatan Malaysia

3. **Name of sponsor**:
   All will be self-funded by the principal investigator. This study does not receive sponsorship/funds from outside parties.

4. **Introduction:**
   It is important that you understand why the research is being done and what it will involve. Please take your time to read through and consider this information carefully before you decide if you are willing to participate. Ask the study staff if anything is unclear or if you would like more information. After you are properly satisfied that you understand this study, and that you wish to participate, you must sign this informed consent form.

   Your participation in this study is voluntary. You do not have to be in this study if you do not want to. You may also refuse to answer any questions you do not want to answer. If you volunteer to be in this study, you may withdraw from it at any time. If you withdraw, any data collected from you up to your withdrawal will still be used for the study. Your refusal to participate or withdrawal will not affect any medical or health benefits to which you are otherwise entitled.

   This study was approved by both the Medical Research Ethics Committee from the Ministry of Health and the Faculty of Medicine, The National University Malaysia with the reference number: **NMRR ID-22-02621-DKX** and **JEP-2022-777** respectively.

5. **What is the purpose of the study?**
   The purpose of this study is to evaluate the critical success factors and the acceptance of Casemix System implementation in Total Hospital Information System of the Ministry of Health Malaysia.

   This research will be conducted for duration of 42 months from October 2021 till May 2025. But the data collection period for the questionnaire might be done around April 2023 till June 2023 once the ethics approval from MREC is obtained. The expected number of participants is 300 individuals.

6. What are my responsibilities when taking part in this study?

It is important that you answer all the questions asked through the online questionnaire which is distributed by the study staff honestly and completely which will take about 10-15 minutes of your time.

If you decide to withdraw from the study midway, you could exit the Google Form freely and no measures will be used to preserve the data you have filled in, thus all data will be destroyed.

7. What are the potential risks and side effects of being in this study?

Participation to this study will not affect your treatment, and the risk is minimal. You are free to decline to answer any of the questions that you feel uncomfortable with.

8. What are the benefits of being in this study?

There may or may not be any benefits to you. Information obtained from this study will help provides a foundation for Casemix System implementation and data integration in THIS hospitals. Moreover, the outcomes of this study can guide the stakeholders on how to adapt or improve Casemix system implementation in current contexts, as well as how to incorporate the Casemix system in various settings.

9. Who is funding the research?

All research funding will be borne by the main research student Dr Noor Khairiyah Mustafa. You will also not be paid to participate in this study.

10. Will my medical information be kept private?

All your information obtained in this study will be kept and handled in a confidential manner, in accordance with applicable laws and/or regulations. When publishing or presenting the study results, your identity will not be revealed without your expressed consent. Individuals involved in this study, qualified monitors, and auditors, and governmental or regulatory authorities may inspect the study data, where appropriate and necessary.

11. Who should I call if I have questions?

If you have any questions about the study or want information about this study, please contact:

Principal Investigator
Dr. Noor Khairiyah binti Mustafa
Jabatan Perubatan Kesihatan Awam
Universiti Kebangsaan Malaysia
Tel: 012-6161342
Email: P115190@siswa.ukm.edu.my

For enquiries regarding the rights of the subject

Jawatankuasa Etika & Penyelidikan Perubatan
(Medical Research & Ethics Committee)
Kementerian Kesihatan Malaysia
Kompleks Institut Kesihatan Negara (NIH),

No.1, Jalan Setia Murni U13/52,
Seksyen U13 Bandar Setia Alam,
40170 Shah Alam, Selangor.
No.Tel: 03-33628407/33628205/ 33628888

Jawatankuasa Etika Penyelidikan Perubatan UKM
Sekretariat Etika Penyelidikan Universiti Kebangsaan Malaysia,
Tingkat 1, Blok Klinikal,
Hospital Canselor Tuanku Muhriz,
Pusat Perubatan UKM,
Jalan Yaacob Latif,
Bandar Tun Razak,
56000 Cheras Kuala Lumpur.
Tel: +603-9145 5046 / 9145 5048
E-mail: sepukm@ukm.edu.my

RISALAH MAKLUMAT PESERTA
(BORANG KAJI SELIDIK)
(untuk subjek dewasa)

1. **Tajuk Penyelidikan :**
   Critical Success Factors and The Acceptance of Casemix System Implementation in Total Hospital Information System of The Ministry of Health Malaysia
   (Faktor Kejayaan Kritikal Dan Penerimaan Bagi Pelaksanaan Sistem Casemix di Sistem Maklumat Hospital Menyeluruh Di Kementerian Kesihatan Malaysia)

2. **Nama Institusi and nama penyelidik:**
   Dr. Noor Khairiyah binti Mustafa – Universiti Kebangsaan Malaysia, Kementerian Kesihatan Malaysia

3. **Nama penaja:**
   Semua pembiayaan kos kajian ditanggung oleh Penyelidik Utama. Kajian ini tidak menerima penajaan/dana dari pihak luar.

4. **Pengenalan:**
   Risalah ini menjelaskan hal-hal berkenaan penyelidikan tersebut dengan lebih mendalam dan terperinci. Amat penting anda memahami mengapa penyelidikan ini dilakukan dan apa yang dilakukan dalam penyelidikan ini. Sila ambil masa yang secukupnya untuk membaca dan mempertimbangkan dengan teliti penerangan yang diberi sebelum anda bersetuju untuk menyertai penyelidikan ini. Jika ada sebarang kemusykilan ataupun maklumat lanjut yang anda ingin tahu, anda boleh bertanya dengan mana-mana kakitangan yang terlibat dalam penyelidikan ini. Setelah anda berpuas hati bahawa anda memahami penyelidikan ini, dan anda berminat untuk turut serta, anda dikehendaki untuk menandatangani Borang Persetujuan atau Keizinan Peserta, pada muka surat akhir risalah ini.

   Penyertaan anda dalam penyelidikan ini adalah secara sukarela. Anda tidak perlu menyertai penyelidikan ini jika anda tidak mahu. Anda juga mempunyai hak untuk tidak menjawab mana-mana soalan yang anda tidak mahu jawab. Anda juga boleh menarik diri daripada penyelidikan ini pada bila-bila masa sahaja. Jika anda menarik diri, segala maklumat yang telah diperolehi sebelum anda menarik diri tetap akan digunakan dalam penyelidikan ini. Jika anda tidak mahu menyertai ataupun menarik diri dari penyelidikan ini, tindakan anda tidak akan menjejaskan segala hak dan keistimewaan perubatan kesihatan yang selayaknya anda terima.

   Kajian ini telah diluluskan oleh kedua-dua Jawatankuasa Etika Penyelidikan Perubatan dari Kementerian Kesihatan dan Fakulti Perubatan, Universiti Kebangsaan Malaysia dengan nombor rujukan: **NMRR ID-22-02621-DKX** dan **JEP-2022-777** masing-masing.

5. **Apakah tujuan penyelidikan ini dilakukan?**
   Tujuan penyelidikan ini dilakukan adalah untuk mengenalpasti faktor-faktor kejayaan kritikal dan penerimaan bagi pelaksanaan Sistem Casemix dalam Sistem Maklumat Hospital Menyeluruh di Kementerian Kesihatan Malaysia.

   Penyelidikan ini akan berlangsung selama 42 bulan dari Oktober 2021 hingga Mei 2025. Namun, proses pengumpulan data untuk fasa kuantitatif melalui borang kaji selidik

dijangka bermula dari April 2023 hingga Jun 2023 selepas permohonan etika dan penyelidikan perubatan daripada MREC diperoleh. Dijangka bahawa 300 individu akan mengambil bahagian dalam kajian ini.

6. Apakah tanggungjawab saya sewaktu menyertai penyelidikan ini?

Amat penting anda menjawab kesemua soalan dalam borang kaji selidik dalam talian ini yang dikemukakan oleh kakitangan penyelidikan dengan jujur dan lengkap yang akan mengambil masa selama 10-15 minit.

Jika anda memutuskan untuk menarik diri daripada kajian di tengah-tengah, anda boleh keluar dari Google Form ini dengan bebas dan tiada langkah akan digunakan untuk mengekalkan data yang telah anda isi, justeru semua data akan dimusnahkan.

7. Apakah risiko dan kesan-kesan sampingan menyertai penyelidikan ini?

Risiko untuk penyertaan penyelidikan ini yang adalah minima. Anda berhak untuk tidak menjawab jika rasa tidak selesa dengan mana-mana soalan kajian.

8. Apakah manfaatnya saya menyertai kajian ini?

Penyelidikan ini mungkin akan mendatangkan manfaat ataupun langsung tiada memberi apa-apa manfaat kepada anda. Segala maklumat yang diperolehi daripada penyelidikan ini akan dapat membantu dalam mengenalpasti faktor-faktor kejayaan kritikal dan penerimaan bagi pelaksanaan Sistem Casemix dalam Sistem Maklumat Hospital Menyeluruh di Kementerian Kesihatan Malaysia.

9. Siapakah yang membiayai penyelidikan ini?

Segala pembiayaan penyelidikan akan ditanggung oleh pelajar penyelidik utama Dr Noor Khairiyah Mustafa. Anda juga tidak akan dibayar untuk menyertai kajian ini.

10. Adakah maklumat saya akan dirahsiakan?

Segala maklumat anda yang diperolehi dalam penyelidikan ini akan disimpan dan dikendalikan secara sulit, bersesuaian dengan peraturan-peraturan dan/ atau undang-undang yang berkenaan. Sekiranya hasil penyelidikan ini diterbitkan atau dibentangkan kepada orang ramai, identiti anda tidak akan didedahkan tanpa kebenaran anda terlebih dahulu.

Pihak-pihak tertentu seperti individu yang terlibat dalam penyelidikan ini, juruaudit dan jurupantau yang terlatih, pihak berkuasa kerajaan atau undang-undang, boleh memeriksa maklumat atau data kajian jika diperlukan.

11. Siapakah yang perlu saya hubungi sekiranya saya mempunyai sebarang pertanyaan?

Anda boleh menghubungi Penyelidik Utama kajian ini sekiranya anda mempunyai sebarang pertanyaan mengenai penyelidikan ini:

Penyelidik Utama
Dr. Noor Khairiyah binti Mustafa
Jabatan Perubatan Kesihatan Awam
Universiti Kebangsaan Malaysia
Tel: 012-6161342
Email: P115190@siswa.ukm.edu.my

Jika anda mempunyai sebarang pertanyaan berkaitan dengan hak-hak anda sebagai peserta dalam penyelidikan ini, sila hubungi:

Jawatankuasa Etika & Penyelidikan Perubatan
(Medical Research & Ethics Committee)
Kementerian Kesihatan Malaysia
Kompleks Institut Kesihatan Negara (NIH),
No.1, Jalan Setia Murni U13/52,
Seksyen U13 Bandar Setia Alam,
40170 Shah Alam, Selangor.
No.Tel: 03-33628407/33628205/ 33628888

Jawatankuasa Etika Penyelidikan Perubatan UKM
Sekretariat Etika Penyelidikan Universiti Kebangsaan Malaysia,
Tingkat 1, Blok Klinikal,
Hospital Canselor Tuanku Muhriz,
Pusat Perubatan UKM,
Jalan Yaacob Latif,
Bandar Tun Razak,
56000 Cheras Kuala Lumpur.
Tel: +603-9145 5046 / 9145 5048
E-mel: sepukm@ukm.edu.my

INFORMED CONSENT FORM
(QUESTIONNAIRE)

Title of Study: Critical Success Factors and The Acceptance of Casemix System in the Total Hospital Information System of the Ministry of Health Malaysia

By signing below, I confirm the following:

- I have been given oral and written information for the above study and have read and understood the information given.
- I have had sufficient time to consider participation in the study and have had the opportunity to ask questions and all my questions have been answered satisfactorily.
- I understand that my participation is voluntary and I can at any time free withdraw from the study without giving a reason and this will in no way affect my future treatment. I am not taking part in any other research study at this time. I understand the risks and benefits, and I freely give my informed consent to participate under the conditions stated.
- I understand that if I decide to withdraw from the study midway, I could exit the site freely and no measures will be used to preserve the data I have filled in, thus all data will be destroyed.
- I understand that I must follow the study investigator's instructions related to my participation in the study.
- I understand that study staff, qualified monitors and auditors, the sponsor or its affiliates, and governmental or regulatory authorities, have direct access to my medical record in order to make sure that the study is conducted correctly and the data are recorded correctly. All personal details will be treated as **STRICTLY CONFIDENTIAL.**
- I consent to provide my personal details and that the information will be managed ethically according to the terms of the Malaysian Personal Data Protection Act 2010 (PDPA).
- I will receive a copy of this subject information/informed consent form via e-mail.
- I understand that anonymity and confidentiality will be maintained throughout the duration of the study. It is not possible to identify me in any publication.
- I understand that the outcome of the study may be published in a journal and/or as an internal report for stakeholders. I can have access to these publications or reports.
- I understand that the data will be kept by the researcher securely for the duration of the study and deleted by 31st May 2028.
- I agree/disagree* to participate in this study. *(*delete which is not applicable)*

Subject:

Signature:	I/C number:
Name:	Date:

Investigator conducting informed consent:

Signature:	I/C number:
Name:	Date:

If you have any questions about the study or want information about this study, please contact:

Principal Investigator
Dr. Noor Khairiyah binti Mustafa
Jabatan Perubatan Kesihatan Awam
Universiti Kebangsaan Malaysia
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Email: P115190@siswa.ukm.edu.my

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56000 Cheras Kuala Lumpur.
Tel: +603-9145 5046 / 9145 5048
E-mail: sepukm@ukm.edu.my

BORANG PERSETUJUAN/ KEIZINAN PESERTA
(BORANG KAJI SELIDIK)

Tajuk Penyelidikan : *Critical Success Factors and The Acceptance of Casemix System Implementation in Total Hospital Information System of The Ministry of Health Malaysia* (Faktor Kejayaan Kritikal Dan Penerimaan Bagi Pelaksanaan Sistem Casemix di Sistem Maklumat Hospital Bersepadu Di Kementerian Kesihatan Malaysia)

Dengan menandatangani di bawah, saya mengesahkan bahawa:

- Saya telah diberi maklumat tentang penyelidikan di atas secara lisan dan bertulis and saya telah membaca & memahami segala maklumat yang diberikan dalam risalah ini.
- Saya telah diberikan masa yang secukupnya untuk mempertimbangkan penyertaan saya dalam penyelidikan ini dan telah diberi peluang untuk bertanyakan soalan dan semua persoalan saya telah dijawab dengan sempurna dan memuaskan.
- Saya juga faham bahawa penyertaan saya adalah secara sukarela dan pada bila-bila masa saya bebas menarik diri daripada penyelidikan ini tanpa harus memberi sebarang alasan dan ianya sama sekali tidak akan menjejaskan perkhidmatan saya
- Saya tidak mengambil bahagian dalam mana-mana penyelidikan lain pada masa ini. Saya juga memahami tentang risiko dan manfaat penyelidikan ini dan saya secara sukarela memberi persetujuan untuk menyertai penyelidikan ini di bawah syarat-syarat yang telah dinyatakan di atas.
- Saya faham bahawa jika saya memutuskan untuk menarik diri daripada kajian di tengah-tengah, saya boleh keluar dari lokasi temuramah dengan bebas dan tiada langkah akan digunakan untuk mengekalkan data yang telah saya isi, justeru semua data akan dimusnahkan.
- Saya faham saya harus mematuhi nasihat dan arahan yang berkaitan dengan penyertaan saya dalam penyelidikan ini daripada doktor penyelidikan (penyelidik).
- Saya faham bahawa kakitangan penyelidikan, pemantau dan juruaudit terlatih, dan pihak berkuasa kerajaan atau undang-undang, mempunyai akses langsung dan boleh menyemak data peribadi saya bagi memastikan penyelidikan ini dijalankan dengan betul dan data direkodkan dengan betul. Segala maklumat dan data peribadi akan dianggap sebagai **SULIT.**
- Saya bersetuju untuk memberikan butiran peribadi saya dan maklumat tersebut akan diuruskan secara beretika mengikut terma Akta Perlindungan Data Peribadi Malaysia 2010 (PDPA).)
- Saya akan menerima satu salinan 'Risalah Maklumat Pesakit dan Borang Persetujuan atau Keizinan Pesakit' yang telah lengkap melalui e-mel.
- Saya faham bahawa kerahsiaan dan kerahsiaan akan dikekalkan sepanjang tempoh kajian. Tidak mungkin untuk mengenal pasti saya dalam mana-mana penerbitan.)
- Saya faham bahawa hasil kajian mungkin diterbitkan dalam jurnal dan/atau sebagai laporan dalaman untuk pihak berkepentingan. Saya boleh mempunyai akses kepada penerbitan atau laporan ini.)
- Saya faham bahawa data akan disimpan oleh penyelidik dengan selamat sepanjang tempoh kajian dan dipadamkan selewat-lewatnya pada 31 Mei 2028.)
- Saya bersetuju/ tidak bersetuju* untuk menyertai penyelidikan ini. (*Potong mana yang tidak berkenaan)

Subjek :

Tandatangan:	Nombor K/P:
Nama:	Tarikh :

Penyelidik yang mengendalikan proses menandatangani borang keizinan:

Tandatangan:	Nombor K/P:
Nama:	Tarikh :

Anda boleh menghubungi Penyelidik Utama kajian ini sekiranya anda mempunyai sebarang pertanyaan mengenai penyelidikan ini:

Penyelidik Utama

Dr. Noor Khairiyah binti Mustafa
Jabatan Perubatan Kesihatan Awam
Universiti Kebangsaan Malaysia
Tel: 012-6161342
Email: P115190@siswa.ukm.edu.my

Jika anda mempunyai sebarang pertanyaan berkaitan dengan hak-hak anda sebagai peserta dalam penyelidikan ini, sila hubungi:

Jawatankuasa Etika & Penyelidikan Perubatan
(Medical Research & Ethics Committee)
Kementerian Kesihatan Malaysia
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Jalan Yaacob Latif,
Bandar Tun Razak,
56000 Cheras Kuala Lumpur.
Tel: +603-9145 5046 / 9145 5048
E-mel: sepukm@ukm.edu.my

Supplementary 9:

Table I: The number of components formed and the amount of variance for every component

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.939	33.187	33.187	5.945	14.155	14.155
2	6.159	14.665	47.852	4.477	10.660	24.815
3	4.475	10.656	58.507	4.213	10.030	34.845
4	3.046	7.252	65.760	4.029	9.594	44.438
5	2.351	5.597	71.357	3.834	9.129	53.568
6	1.635	3.893	75.250	3.384	8.058	61.626
7	1.513	3.603	78.853	3.336	7.943	69.569
8	1.184	2.820	81.673	3.314	7.892	77.460
9	1.007	2.398	84.070	2.776	6.610	84.070
Extraction Method: Principal Component Analysis						

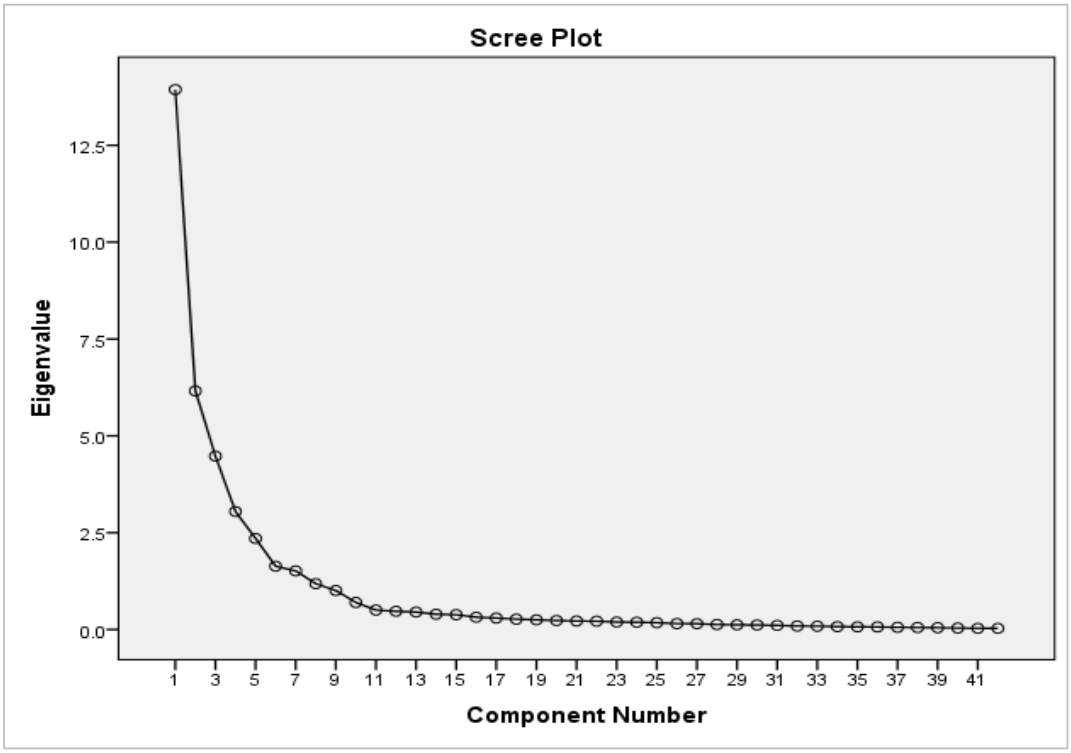

Figure I: The scree-plot indicates nine components emerged for the constructs