Acceptance of Electronic Health Records in Traditional Malay Medicine: An Exploratory Prototyping Approach

Raja Rina Raja Ikram[1*], Mohd Khanapi Abd Ghani[1], Lizawati Salahuddin[1], Mohd Hariz Mohd Naim[1], Ariff Idris[1], Ngo Hea Choon[1], Kasturi Kanchymalay[1], Abd Samad Hasan Basari[2], Nadiah Ishak[3], Noor Raihan Ab Hamid[4]

[1]Fakulti Teknologi Maklumat dan Komunikasi,
 Universiti Teknikal Malaysia Melaka, MALAYSIA

[2]Fakulti Sains Komputer dan Teknologi Maklumat,
 Universiti Tun Hussein Onn Malaysia, MALAYSIA

[3]Department of Science and Technology, Faculty of Business Innovation and Technology,
 Batu 28, Kuala Sungai Baru, Melaka, MALAYSIA

[4]Asia Graduate School of Business,
UNITAR 3-01A, Level 2, Tierra Crest, Jalan SS6/3, Kelana Jaya, 47301 Petaling Jaya, Selangor Darul Ehsan, MALAYSIA

*Corresponding Author

Abstract: The usage of electronic health records is widely used today in the modern medicine field due to its immense benefits. These benefits include and are not limited to allowing physician to access a patient's chart remotely, provide alerts to a potential medication error and critical lab values. However, the usage of this technology in Traditional Malay Medicine is limited. This paper explores the acceptance usage of electronic health records in Traditional Malay Medicine in five healthcare organisations including private Traditional Malay Medicine practitioners in Malaysia. This research utilizes the exploratory prototyping approach where a prototype, MyPostnatalSys is developed and used to gain constructive feedback of the acceptance of electronic health records. MyPostnatalSys, an electronic health record prototype, was developed for integrating Traditional Malay Medicine and Modern Medicine services using an interoperability standard, HL7. The purpose of interoperability standards is to ensure patient data can be transmitted across multi-platform systems seamlessly. The results show that more than 90% respondents have shown a positive acceptance on the usage of electronic health records in Traditional Malay Medicine. However, there may exist some resistance in accepting electronic health records technology in private Traditional Malay Medicine practitioners. However Traditional Malay practitioners trained by a government led initiative for women's health, Mamacare programme, are more open to accept the implementation. This shows that upskilling programmes such as Mamacare can reduce the barriers of acceptance in electronic health records in Traditional Malay practitioners.

Keywords: Traditional Medicine, Electronic Health Records, exploratory prototyping.

1. Introduction

Traditional and Complementary Medicine (T&CM) has been gaining acknowledgement and acceptance all over the world. T&CM is an invaluable treasure and has been developed over the course of thousands of years in the quest for human wellbeing [1]. It is a form of health- related practice designed to prevent, treat, or manage illness and preserve the mental and physical well-being of individuals [2]. This practice includes traditional Malay medicine, traditional Chinese medicine, traditional Indian medicine, homeopathy and complementary therapies[3].

The important characteristics in the Malay postpartum care include the use of traditional herbs, Traditional Malay massage, exposure to hot compression, warm bath and confinement diet [4] [5]. Care of women during confinement is important for preserving the health of the women towards healing and reproductive system recovery [6]. Traditional Malay massage is part of the processes involved in Malay Confinement. Malay Confinement is essentially an all-encompassing process that aims to preserve the health and femininity of Malay women [7]. Today, many urban new mothers in the Malay community find themselves unable to fully observe the practices of the traditional Confinement, mainly because they lack the family and community support that made Malay Confinement possible. Integrated maternal and newborn postnatal care during the postnatal period should be provided as a concerted strategy to improve the survival of both the mother and newborn [8]. One effort to support integrated maternal and newborn postnatal care is via implementation of electronic health records with both domains with an integrated healthcare repository [9] [10].

The use of electronic health records (EHR) that can securely transmit patient data among physicians helps coordinate the care of patients with diverse medical conditions [11]. Appropriate medical care for patients require that physicians be able to communicate with one another about their patients. Furthermore, the poor coordination of care has been associated with poor clinical outcomes such as unnecessary hospitalization, duplicate tests, conflicting clinical advice, and adverse drug reactions [12] [13]. The electronic health records (EHR) enables clinicians treating people in a variety of settings to exchange and continuously update a patient's clinical data and then present that information in logical clinical groupings that other clinicians can access easily. The basic benefits associated with EHRs include being able to easily access computerized records and the elimination of poor coordinated patient care [14].

One of the most important barriers to the widespread adoption of EHRs are no common format or standard for recording clinical information [15]. The need for a common standard to record and transmit clinical information is widely recognized, with solutions currently being developed by both public and private entities.

2. Methodology

An electronic health record prototype for Traditional Malay Medicine was developed, referred to as MyPostnatalSys, and used in this study to investigate the acceptance of electronic health records in Traditional Malay Medicine. The prototype was demonstrated to the participants and a structured interview was conducted using the set of questions in Table 2. Every participant was required to answer all the questions. The demonstration of prototype was conducted in groups and individual settings, depending on the availability of the participants.

2.1 Exploratory Prototyping

In exploratory prototyping, the healthcare organization representatives involved were asked to evaluate the prototype and answer a set of structured questions. The set of structured questions used in this research can be found in Table 2. The objective of these questions are to evaluate the perception and acceptance of users of MyPostnatalSys [16].

Fig. 1 - MyPostnatalSys user interface

The user interface of MyPostnatalSys can be referred to in Figure 1. There are three main modules in MyPostnatalSys which are the Traditional Malay Medicine Module, Modern Medicine Module and the Profile Management Module. The Modern Medicine Module consists of the hospital discharge and Modern Medicine doctor patient consultation. The modern medicine practitioner will be able to update and maintain electronic health records for this module. For the Traditional Malay Medicine Module, doctor patient consultation information shall be updated and maintained via electronic health records. As for the profile management module, it shall consist of registration of practitioners and management of user profile. The registration module shall register accredited practitioners and allow them to edit their profile.

When the patient seeks TMM postnatal treatment, the TMM practitioner shall check the previous medical record of the patient via MyPostnatalSys and also assess if the patient is suitable for treatment. If suitable, the TMM postnatal treatment shall be executed. Else, the patient shall be referred to the hospital for emergency cases or discharged with bed rest. All this information will also be updated in MyPostnatalSys. The workflow for PostnatalSys is shown in Figure 2.
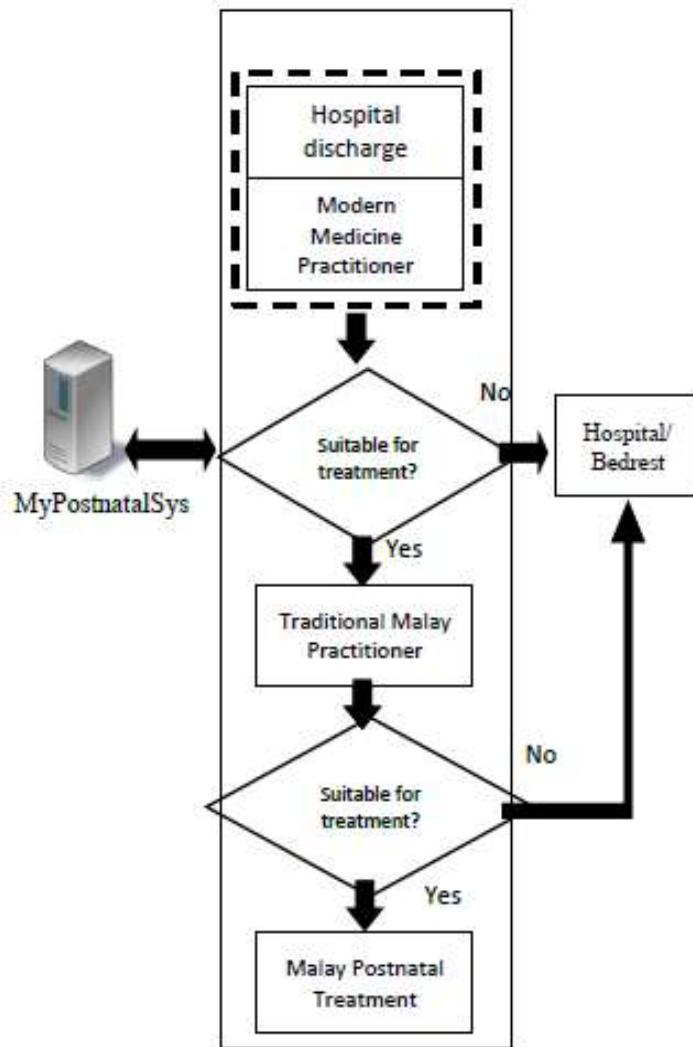
Fig. 2 - Workflow for MyPostnatalSys

MyPostnatalSys Technology Integration components consist of two major modules as referred to in Figure 3: (1) the Traditional Medicine Module and (2) Modern Medicine module. Both modules contain the submodule for doctor patient consultation which contains the Subject Objective Assessment and Plan (SOAP) data [16,17]. During doctor patient consultation, electronic health records are retrieved and maintained in the EHR repository via the defined critical data attributes. Objective information for patients such as vital signs (i.e. blood pressure, pulse) and other patient information can be extracted from the integrated electronic health records repository to assist patient diagnosis. The application of electronic health record standards format and coding in the modern medicine module are extended to the Traditional Medicine EHR Repository for standardization. Multiple EHR repositories from different healthcare providers in Traditional Medicine and Modern Medicine can also be utilized and access from the modules. In addition, the critical data attributes have been defined and the application of standard clinical codings such as HL7 and ICD10 has been extended to be used in Traditional Malay Medicine.
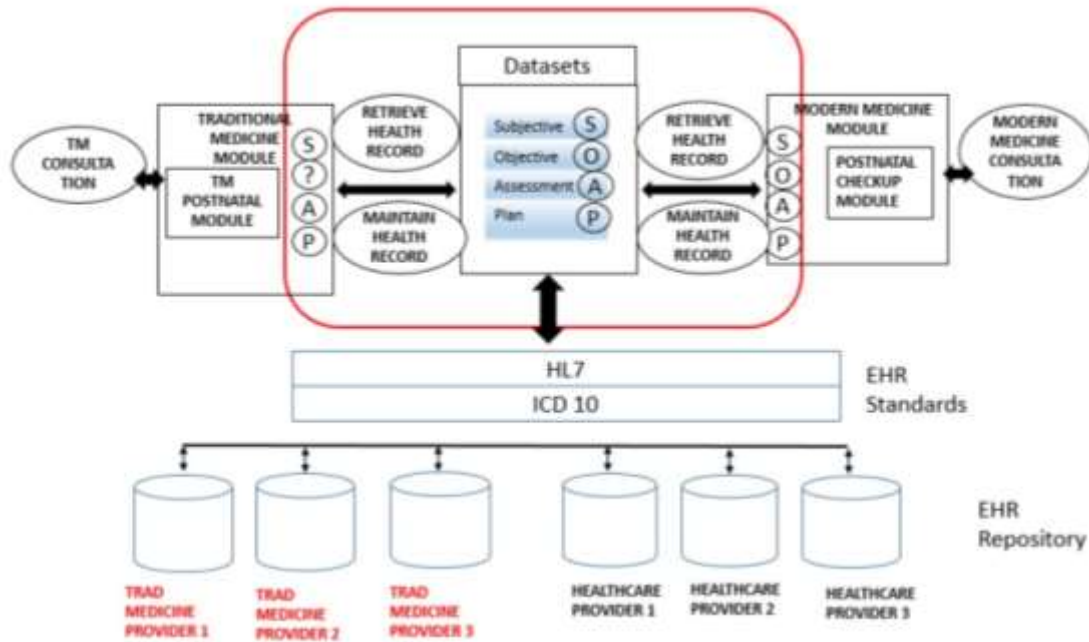
Fig. 3 - **MyPostnatalSys Technology Integration Component**

The core clinical data information used for the technology integration component is presented in Table 1. The core clinical indicators consist of delivery type, date of delivery, previous pregnancy information, treatment information, complications information, vital signs and delivery related procedures [17]. These data can also be divided into Subjective, Objective Assessment and Plan categories as depicted in Figure 3. The data was the converted to HL7 standard and applied in the MyPostnatalSys prototype.

Table 1 - Core clinical data for traditional malay medicine postnatal treatment [17]

Indicators	Definition	Data Type	Length	Format
Delivery Type	Type of delivery of baby 01 Operation Delivery 02 Cervical delivery 03 Elective caesarean 04 Emergency caesarean	Numeric	2	01,02,03,04
Date of delivery	The start of the baby perinatal period DD/MM/YYYY	Date format	8	30/12/2014
Previous pregnancy information	Number of previous pregnancy NN	Num	2	01,02,03..99
	Previous delivery methods 01 Operation Delivery 02 Cervical delivery 03 Elective caesarean 04 Emergency caesarean	Num	2	01,02,03,04
	Pregnancy delivery date DD/MM/YYYY	Date format	8	30/12/2014
	Previous delivery complications *ICD-10 Section XVI Certain conditions originating in the perinatal period* P00-P96 *ICD-10 Section XV Pregnancy, childbirth and the puerperium* O00-O99	String	3	O00...O99, P00…P99
Treatment assessment	What kind of treatment should be given to the patient? 01 Suitable for treatment 02 Not suitable for treatment 03 Treatment with precaution 04 Emergency referral	Numeric	NN	01,02,03

Treatment plan	What follow up treatment should be given to the patient? 01 Postnatal massage 02 Body wrap 03 Hot compress 04 Postpartum diet 05 Herbal bath 06 Others	Numeric	2	01,02..07
	Frequency during postnatal period NN	Numeric	2	01,02..NN
Previous treatment history	Previous treatment 01 Postnatal massage 02 Body wrap 03 Hot compress 04 Postpartum diet 05 Herbal bath 06 Others 07 None	Numeric	2	01,02…07
	Date of previous treatment history DD/MM/YYYY	Date format	8	30/12/2014
Complication treatment history	Complications during previous TMM postnatal care treatment *ICD-10 Section XVI Certain conditions originating in the perinatal period* P00-P99	String	3	P00..P99
Mother physical condition	Condition of mother following birth PP Primary Postnatal Care SC Secondary / Tertiary Care MD Maternal Death	Char	2	PP, SC, MD
Vital signs	01 Blood Pressure 02 Pulse rate 03 Temperature	Numeric	2	01,02,03
Allergy	Code representing allergy of patient *ICD 10 section: Allergic conditions: ICD10 codes*	String	4	NNNNN
Breastfeeding status	Y Breastfeeding at discharge N Not breastfeeding	String	1	Y,N
Referral reason -	Code representing referral reason of current pregnancy *ICD-10 Section XV Pregnancy, childbirth and the puerperium* O00-O99	String	3	O00..O99
Referral description	Description of the referral reason	String	256	Freestyle
Severity	Severity adjunct of the referral reason 01 Mild 02 Moderate 03 Severe	Num	2	01,02,03
Referral date	Date the referral was made DD/MM/YYYY	Date format	8	30/11/2014
Delivery related procedures	Assisted delivery 01 Vacuum 02 Forceps 03 None	Numeric	2	01,02,03
	Other Labour procedures Induction Flag – Yes, No Episiotomy Flag – Yes, No Manual Placenta Removal Flag – Yes, No Epidural usage Flag – Yes, No Degree of tear – Yes, No Episiotomy – Yes, No Surgical repair for tear – Yes, No	Char	1	Y, N
Visit date	Postnatal treatment visit date DD/MM/YYYY	Date format	8	30/11/2014

A demonstration of MyPostnatalSys was presented the participants before they proceed to evaluate the prototype based on the set of structured questions in Table 2. The questions are based on a Likert scale of 1 to 5 where a scale of 5 indicates a Strong Agreement and a scale of 1 indicates a Strong Disagreement. Amongst the questions asked were their perception on whether MyPostnatalSys can assist healthcare providers (i.e. TMM practitioner and modern medicine practitioner) to understand the patients' overall postnatal health status. This question is essential as it demonstrates the integration of modern and traditional Malay medicine in postnatal care via technology or electronic health records. The objective is to provide patient with a seamless healthcare service, where patient information can be sought from the system even though they had received treatment from different healthcare providers. The structured set

of questions also evaluated the perception of participants on whether MyPostnatalSys can assist modern medicine and TMM practitioners to evaluate the suitability of patient seeking TMM postnatal treatment.

Table 2 - Set of structured questions

Q1. MyPostnatalSys can assist healthcare providers (i.e. TMM practitioner and modern medicine practitioner) to understand the patients overall postnatal health status.
Q2. MyPostnatalSys can assist modern medicine and TMM practitioners to evaluate the suitability of patient seeking TMM postnatal treatment.
Q3. MyPostnatalSys is relevant or has potential to be implemented in the national health system.
Q4. MyPostnatalSys is easy to use.
Q5. MyPostnatalSys user interface is simple and easy to understand.

The prototype developed in this research is for exploration, where the emphasis is to clarify requirements and desirable features of the target system and where alternative possibilities for solution are discussed (Budde et al. 1984). This approach focuses on communicating application features between prospective users and software developers where a practical demonstration of possible system functions is able to stimulate good ideas and promote alternative solutions (Budde et al. 1984). Exploratory prototyping serves to enhance the early phases of software development: requirements and functional analyses and may aid to establish the features the proposed system should offer (Budde et al. 1984).

2.2 Healthcare Organisations Involved in the Study

Five healthcare organisations were involved in the study, particularly Hospital M, Hospital L, Hospital P, Hospital S and Private Traditional Malay Medicine Practitioners. Hospital M is a government healthcare centre with modern medicine practitioners and use paper-based patient health records. Hospital L is a private healthcare centre with both modern and traditional practitioners with no health record for Traditional Medicine services. Hospital P is a government hospital that practices modern and traditional medicine with paper based records in the traditional medicine unit. Hospital S is a private clinic with modern medicine practitioner and uses paper based patient health records. Private Traditional Malay practitioner is a freelance practitioner that uses no health records when treating patients.

Postnatal home visits or check ups are based on an established schedule and recorded in manual health records in Hospital P, M and S. No health records are recorded by Hospital L and private TMM practitioners. The current issue is the current system has resulted in isolated patient health records. Traditional Medicine patient health records are also paper based. There is lack of availability of critical data attributes in Traditional Malay Medicine. Application of electronic health records standards (i.e. HL7, ICD10) and standard clinical diagnosis coding are only applicable in the modern medicine domain. Patient objective information is not available for proper diagnosis.

3. Results

A total of 29 respondents participated in this study. Majority of modern and traditional practitioners that participated agree that MyPostnatalSys can assist healthcare providers to understand the overall postnatal health status of a patient as per Figure 4. A total of 92.9% agreed (rating 4 and above) that MyPostnatalSys can assist healthcare providers to understand the patients overall postnatal health status.
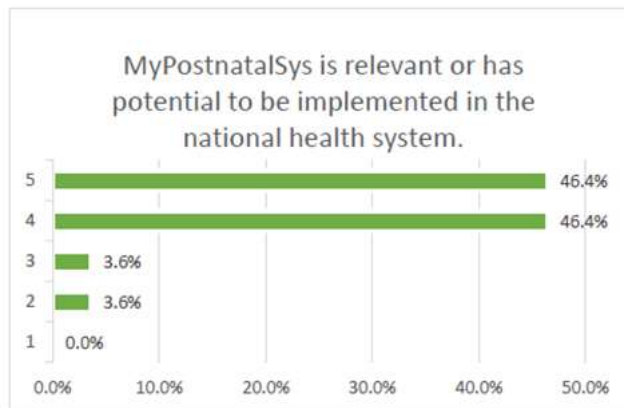

Fig. 4 - Results of respondents for Question 1

A total of 89.3% of respondents agreed that MyPostnatalSys can assist practitioners to evaluate the suitability of patient seeking TMM postnatal treatment as exhibited in Figure 5.
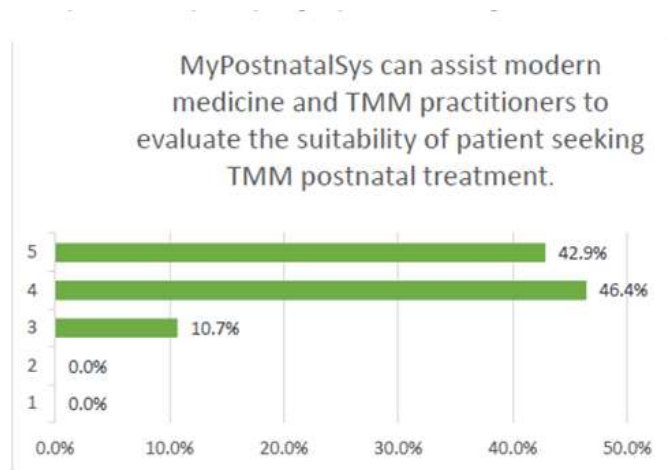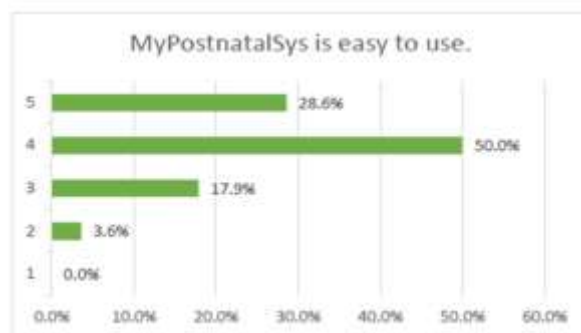
A total of 46.4% had rated 4 (Agree) and 42.9% rated 5 (Strongly Agree) for this question. One of the practitioners that provided a rating of 3 (Neutral) responded that the current postnatal treatment provided by the healthcare system and healthcare services index and mother's health have already improved. MyPostnatalSys may slightly assist this improvement.

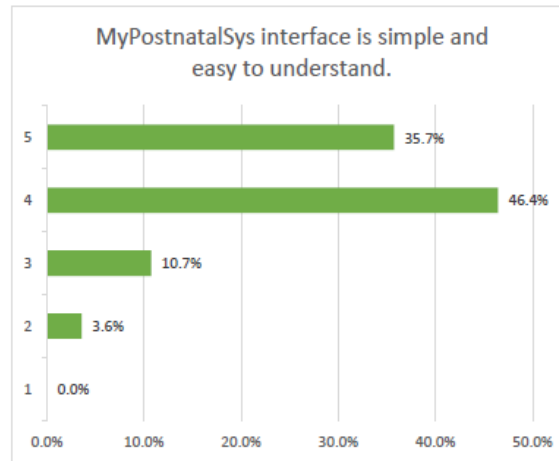**Fig. 6 - Results of respondents for Question 3**

A total of 92.8% of respondents agreed that MyPostnatalSys is relevant to be implemented in the national health system according to Figure 6. A total of 46.4% had rated 4 (Agree) and 46.4% rated 5 (Strongly Agree) for this question.

Fig. 7 - Results of respondents for Question 4

A total of 82.1% of respondents agreed that MyPostnatalSys interface is simple and easy to understand according to Figure 7. A total of 46.4% had rated 4 (Agree) and 35.7% rated 5 (Strongly Agree) for this question.

Fig. 8 - Results of respondents for Question 5

A total of 82.1% of respondents agreed that MyPostnatalSys interface is simple and easy to understand as per Figure 8. A total of 46.4% had rated 4 (Agree) and 35.7% rated 5 (Strongly Agree) for this question.

In overall, at least 75% of respondents support the implementation of electronic health records to integrate electronic health records in traditional and modern medicine.

4. Discussion

This section shall discuss in depth the analysis of case studies results from the participants in this study. A summary of healthcare organisations involved in this study can be found in Table 3. The representatives of organisations involved consists of nurses, medical officers, Obstetrics & Gynaecology Specialist, and Traditional Malay Medicine practitioners. Nurses involved in this study are well trained in the field of maternity care. Modern medicine practitioners' respondents consists of nurses specialising in Midwifery care. Medical officers selected in this study consists of mothers who are experienced in implementing Malay postnatal practices during their self-confinement period. Traditional Malay Medicine practitioners involved all have a minimum of ten years of experience in Malay postnatal care services. TMM practitioners respondents selected have been trained and underwent a rigorous interview process before selected by Lembaga Penduduk dan Pembangunan Keluarga Negara (LPPKN) (National Association for Residents and Family Development) to provide postnatal care services on behalf of their organisation.

Table 3 - Summary of participants from case study healthcare organisation

Case Study Organisation	Hospital M	Hospital L	Hospital P	Hospital S	Private TMM
Characteristics					
Government healthcare centre	/		/		
Private healthcare centre		/		/	
Freelance practitioner					/
Modern Medicine practitioner	/	/	/	/	
Traditional Medicine practitioner		/	/		/
Computerised Health Record System					
Paper based Health Record	/		/	/	
No health record		/			/
Total participants	**17**	**8**	**2**	**1**	**1**

One of the TMM practitioner involved works in traditional and complementary unit in Hospital P. Thus, all TMM practitioners respondents involved in this study are well sought to provide postnatal care services in their respective residence communities.

4.1 Hospital P

Hospital P has a separate unit for Traditional and Complementary Medicine (T&CM) and Obstetrics & Gynecology (O&G) Services. The O&G unit is hospital P is fully computerised and produces a black and white referral letter to the Traditional and Complementary Medicine (T&CM) unit for patients who request to seek services there. The T&CM unit appointment management is computerised. However, patient assessment such as vital signs and treatment history are still recorded manually on paper. A total of two subject matter experts participated in this study.

The first three questions of the prototype validation were given a full score of 5 by both participants, indicating they strongly agree that MyPostnatalSys can assist healthcare providers to understand the patient's overall health status, evaluate suitability of seeking treatment and has relevant to be implemented in the national health system. A modern medicine practitioner in Hospital P responded that new generation houseman or doctors work better with templates ready for them i.e. checklists, or information technology-based systems as similar to MyPostnatalSys. These results show that the selected case study is supportive towards implementation of electronic health records in the TMM postnatal care domain to integrate its healthcare services with modern medicine. Majority of the subthemes identified are also acknowledged by the participants of the case study that represents highly regarded subject matter experts in the field of study.

4.2 Hospital L

Hospital L is a government agency which provides women healthcare services to the public at a subsidized cost and organizes a Mamacare programme. Practitioners selected from this Mamacare program are subject matter experts in the field of Traditional Malay Medicine with some exposure in modern medicine. These practitioners often visit the home of customers or provide treatment in the centre once a week according to their rotation schedule. Appointment process with practitioners involve a telephone call and the researcher also observed that no health records of patients were recorded when treatment was provided at the patient's home. Patient details are briefly recorded in the centres with information regarding treatment and treatment duration. Other information regarding patient's health requirement are not recorded.

The first three questions of the prototype validation were given a minimum of 4 (agree) by a minimum of 75% of participants, indicating they agree that MyPostnatalSys can assist healthcare providers to understand the patients overall health status, evaluate suitability of seeking treatment and has relevance to be implemented in the national healthcare system. Only 1 or 2 (13% and 25%) participants rated 3 (neutral for all 3 questions). However, there were diverse answers for question 3 and 4 when rating the easiness of the system and interface, implying that there is issue of technical competency when using electronic health records by TMM practitioners.

4.3 Hospital M

Hospital M is one of the renowned public hospitals with modern healthcare facilities in Melaka. Hospital M provides general and specialised healthcare services including obstetrician and gynaecology services with experienced practitioners. The researcher observed that the appointment process for patients are written on yellow cards. During registration, a computerised calling system is used. Patient health information are written on a dedicated file during doctor patient consultation with a computerised label sticker generated for each patient file. A total of 17 practitioners from Hospital M participated in this study.

The first three questions of the prototype validation was given a full score of 4 (Agree) or 5 (Strongly Agree) by all participants, indicating they agree that MyPostnatalSys can assist healthcare providers to understand the patients overall health status, evaluate suitability of seeking treatment and has relevance to be implemented in the national health system. These results show that the selected case study is supportive towards implementation of electronic health records in the TMM postnatal care domain to integrate its healthcare services with modern medicine. Question 4 and 5 also received a rating of 4 and 5 from 94% of the participants except 1 participant (6%) when asked about the easiness or the system and interface. This indicates that there is a high technical competency in the practitioners in Hospital M.

4.4 Hospital S

Hospital S is a private clinic in Sungai Udang, Melaka with two modern medicine practitioners and three clinic assistants. One of the modern medicine practitioners in Hospital S participated in this study. The researcher observed that the registration and queue process for patients are using a computerised calling system. However, patient health records during doctor patient consultation are still paper based.

The first and third questions of the prototype validation was given a score of 4 (Agree) by the practitioner, indicating they agree that MyPostnatalSys can assist healthcare providers to understand the patients overall health status, and has relevance to be implemented in the national health system. However, the practitioner in this case study was neutral (rating 3) when asked whether MyPostnatalSys can assist to evaluate suitability of patients seeking treatment as she feels that the current healthcare system is sufficient and electronic health records can minimally

improve a doctors diagnosis. Question 4 and 5 also received a rating of 4 and 5, indicating that the technical competency for the practitioner is quite high.

4.5 Private Traditional Malay Practitioner

Private TMM practitioners are freelance practitioners that provide TMM services to the home of patients. One private TMM practitioner was involved in this study. The researcher observed that the appointment process involves a telephone or short message service to the practitioner to check the session availability. During the treatment, the practitioner would ask the patients labour experience and suggest appropriate treatment based on the patient's request. No patient health record was observed written or noted by the private TMM practitioner.

The first and second questions of the prototype validation was given a score of 4 (Agree) by the practitioner, indicating she agrees that MyPostnatalSys can assist healthcare providers to understand the patient's overall health status, and assist the practitioner to evaluate suitability of patients seeking treatment. However, she rated 2 (Disagree) when asked whether the system has relevance to be implemented in the national health system. This indicates that the practitioner acknowledges the benefit of EHR systems. However, they may be personally resistant to implement the technology. Question 4 and 5 also received a rating of 3 (Neutral) for both questions, indicating that the technical competency for the practitioner may be an issue for private TMM practitioners. The private Traditional Malay Medicine practitioner selected was quite resistant towards electronic health records and rejected the idea of its usage in her daily work. Based on this observation, there is a tendency that TMM practitioners who are not exposed to modern medicine and technology may feel self-sufficient with their knowledge and look high upon the services they provide. These factors may result an individual to not wish to upgrade their skills. However, this conclusion cannot be generalized from one private Traditional Malay Medicine practitioner response. Thus this is one of the study's limitation.

5. Conclusion

Modern and traditional medicine will be required to organize and make transportable basic patient information, consisting of the most relevant and timely facts about a patient's condition available real time. Acquiring complete lifetime patient records [18,19] is crucial as information about patients' past treatments (and past healthcare providers), allergies, basic information (e.g. blood type and inherited diseases) will determine how accurate doctors/physicians can diagnose certain disease before suitable type of treatments and prescriptions can be recommended. This may contribute to a more high-quality, efficient patient care [20]. Thus, acceptance and resistance factors towards this technology must be managed to increase adoption.

Overall, the participants in the case study have shown positive acceptance towards electronic health records except for the private Traditional Malay practitioner. However, Traditional Malay practitioners under the Mamacare programme in Hospital L shows more promising acceptance towards electronic health records technology. This shows that upskilling programmes can assist in improving the acceptance towards new technology and reduce resistance. However, the usage of a new system may require technical competency and high support in the early stage. Other factors to be considered are clear job roles and responsibilities may become an issue when implementing electronic health records in both traditional and modern medicine domain as there may be conflicting or overlapping authorities and job scope if not properly defined.

Acknowledgement

References

[1]   Steel, A., W. Peng, A. Gray & J. Adams, (2019). The Role and Influence of Traditional and Scientific Knowledge in Naturopathic Education: A Qualitative Study. Journal of Alternative and Complementary Medicine, 25(2), 196–201

[2]   Bjering, H., A. Ginige, A. Maeder, A. Bensoussan, X. Zhu & C. Lattuca, (2011). Electronic medical record information system for patient consultations in Chinese medicine. Studies in Health Technology and Informatics, 168, 10–5

[3]   Raja Ikram, R.R., Raja Ikram, Raja Rina (2017) Integrated Health Information Systems Framework In Post Natal Care For Modern And Traditional Malay Medicine, Universiti Teknikal Malaysia Melaka, (2017)

[4]   Yuniantini, U., (2020). Postpartum Care Impact on Malayan Mothers in Pontianak, Indonesia. Journal of Scientific Research in Medical and Biological Sciences, 1(1), 47–52

[5]   Raja Ikram, R.R., L. Salahuddin, M.H. Mohd Naim, A. Idris, N.A. Zainal Abidin, N. Ishak & N.R. Ab Hamid, (2019). A conceptual integrated health information systems framework in postnatal care for modern and traditional Malay medicine. Indonesian Journal of Electrical Engineering and Computer Science, 17(3), 1531–1539

[6]   Nik Yusof Fuad, N.F., S.M. Ching, D.H. Awg Dzulkarnain, A.T. Cheong & Z.A. Zakaria, (2020).Complementary alternative medicine use among postpartum mothers in a primary care setting: a cross-sectional study in Malaysia. BMC Complementary Medicine and Therapies, 20(1), 197

[7]   Abd Jalil, M.A., A.N. Shuid & N. Muhammad, (2012). Role of medicinal plants and natural products on osteoporotic fracture healing. Evidence-Based Complementary and Alternative Medicine : ECAM, 2012, 1–7

[8]   Yang, L., Y.M. Di, J.L. Shergis, Y. Li, A.L. Zhang, C. Lu, X. Guo & C.C. Xue, (2018). A systematic review of acupuncture and Chinese herbal medicine for postpartum depression. Complementary Therapies in Clinical Practice, 33, 85–92

[9]   Marques, I.C.P. & J.J.M. Ferreira, (2020). Digital transformation in the area of health: systematic review of 45 years of evolution. Health and Technology, 10(3), 575–586

[10]   Raja Ikram, R.R., M.K. Abd Ghani, N.R. Ab Hamid & L. Salahuddin, (2018). Enabling Ehealth In Traditional Medicine: A Systematic Review Of Information Systems Integration Requirements. Journal of Engineering Science and Technology, 13(12), 4193–4205

[11]   Shen, B., J. Guo & Y. Yang, (2019). MedChain: Efficient healthcare data sharing via blockchain. Applied Sciences (Switzerland), 9(6),

[12]   Abushaar, L.A. & A. Ismail, (2018). Acceptance of Tele-Consultation and its Determinant Factors among Doctors in Outpatient Clinics in the Hospital of Conselor Tuanku Muhriz, Kuala Lumpur, Malaysia

[13]   Raja Ikram, R.R. & M.K. Abd Ghani, (2015). An Overview of Traditional Malay Medicine in the Malaysian Healthcare System. Journal of Applied Sciences, 15(5), 723–727

[14]   Salahuddin, L., Z. Ismail, U.R. Hashim, N.H. Ismail, R.R. Raja Ikram, F. Abdul Rahim & N.H. Hassan, (2019). Healthcare practitioner behaviours that influence unsafe use of hospital information systems. Health Informatics Journal, 146045821983309

[15]   Fernández-Alemán, J.L., I.C. Señor, P.Á.O. Lozoya & A. Toval, (2013). Security and privacy in electronic health records: A systematic literature review. Journal of Biomedical Informatics, 46(3), 541–562

[16]   Ikram, R.R.R., M.K. Abd Ghani & U.M. Hambaran, (2015). Integrated modern and traditional malay medicine healthcare services in postnatal care - An evaluation of mypostnatalsys. ARPN Journal of Engineering and Applied Sciences, 10(19),

[17]   Abd Ghani, M.K. & R.R. Raja Ikram, (2015). Development of clinical minimum dataset for postnatal treatment in traditional Malay medicine. ARPN Journal of Engineering and Applied Sciences, 10(19), 9032–9037

[18]   Ghani, M.K.A., R.K. Bali, R.N.G. Naguib, I.M. Marshall & N.S. Wickramasinghe, (2010). Critical analysis of the usage of patient demographic and clinical records during doctor-patient consultations: a Malaysian perspective. International Journal of Healthcare Technology and Management, 11(1/2), 113

[19]   Hambaran, O.M., M. Khanapi, A. Ghani, R. Rina, R. Ikram & B.M. Aboobaider, (2015). Implementation Of Hybrid Software Architecture Framework In Clinical Information System : A Case Study Of A Malaysian Clinic. ARPN Journal of Engineering and Applied Sciences, 10(20), 9891–9895

[20]   Ikram, R.R.R., M.K.A. Ghani & N. Abdullah, (2015). An analysis of application of health informatics in Traditional Medicine: A review of four Traditional Medicine Systems. International Journal of Medical Informatics, 84(11), 988–996